

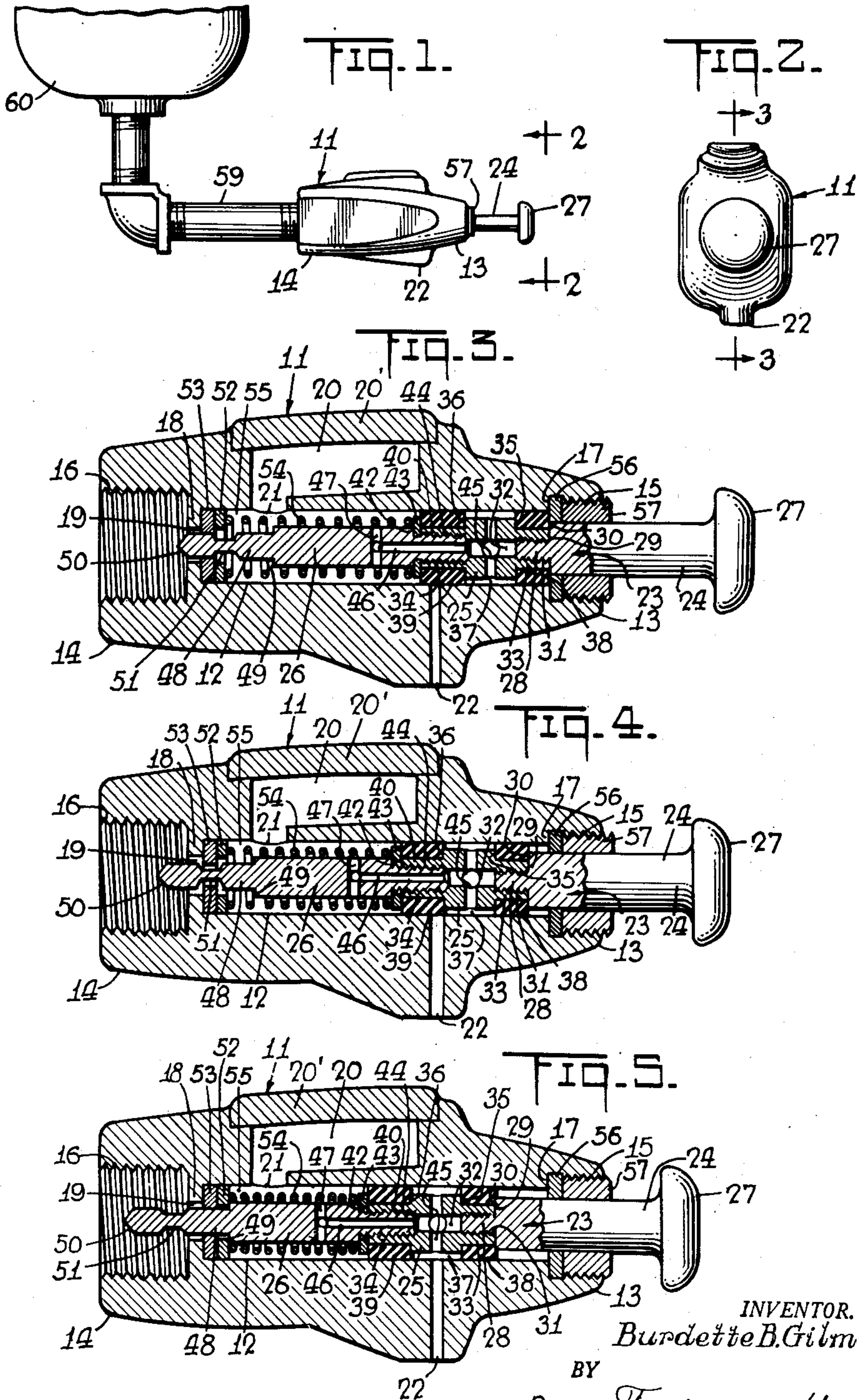
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VALVE ASSEMBLY

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## VALVE ASSEMBLY

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1

This invention relates to valve assemblies and more particularly to a valve assembly for dispensing measured quantities of liquid, whether free-flowing such as liquid soap or more viscous such as oils.

It is among the objects of this invention to provide a valve assembly that is neat, compact, pleasing in appearance, efficient in operation and does not readily become out of order, that is simple and inexpensive to construct, that contains few parts and lends itself easily to quantity production, that will dispense measured quantities of liquid without waste or leakage and that may conveniently be disassembled for cleaning and servicing.

According to the invention the device comprises a casing having a longitudinal bore therethrough with an inlet to a source of liquid and an outlet. A plunger assembly slidably movable in said bore controls both the inlet and outlet. The plunger assembly has a nose which coacts with the inlet to effect a seal on the innermost and outermost position of the plunger assembly, yet which affords a passageway to the source of liquid during the intermediate position of the plunger assembly. An outlet control piston is also provided, movable with the plunger assembly, a single coil spring normally retaining said plunger assembly in inlet and outlet closing position. An air chamber in the top of said casing has a port leading into said bore and a discharge chamber is also provided in said bore defined by the plunger assembly and in communication with said air chamber by way of said bore.

In the accompanying drawing in which is shown one of various possible embodiments of the several features of the invention,

Fig. 1 is a side view of the device connected to a container,

Fig. 2 is a front view of the device on a larger scale taken along line 2—2 of Fig. 1,

Fig. 3 is a cross sectional view of the device on a larger scale taken along line 3—3 of Fig. 2, and

Figs. 4 and 5 are views similar to Fig. 3 showing the device in different stages of operation.

Referring now to the drawings, the valve assembly comprises a substantially cylindrical casing 11 which is preferably cast in a unitary piece from an appropriate mold and has a bore 12 extending longitudinally therethrough. At the front end 13 and the rear end 14 of the casing 11, the bore is enlarged and internally threaded as at 15 and 16, respectively, the enlarged front end of the bore forming an annular shoulder 17 and the enlarged rear end of the bore having an

2

annular flange 18 unitary with the casing, defining the inlet 19 to the valve assembly. The top of the casing 11 has a depression therein over which a closure plate 20 is affixed preferably by soldering to the casing, to form an air chamber 20 having a port 21 at the rear thereof which leads into the bore 12, from which latter the vertical discharge outlet 22 extends downward through the bottom of the casing 11.

Slidably movable in bore 12 is a substantially cylindrical plunger assembly 23 comprising a plunger rod 24, a valve body 25 and a valve stem 26. Plunger rod 24 has an actuating head 27 at its front end and a reduced portion 28 at its root end 29 forming a shoulder 30. The reduced portion 28 is threaded into and closes the correspondingly threaded end 31 of a bore 32 extending longitudinally through valve body 25, the latter having reduced portions 33 and 34 at each end thereof, respectively, forming shoulders 35 and 36. Mounted on said reduced portions 33 and 34 and defining a discharge chamber 37 therebetween are plunger piston 38 and outlet control piston 39 respectively, of greater diameter than the diameter of the valve body and preferably made of resilient material. Plunger piston 38 is sandwiched between shoulder 35 and shoulder 30 and thereby retained securely on reduced portion 33 of the valve body. Outlet control piston 39 is retained on reduced portion 34 by valve stem 26, the latter having at one end a shoulder 42 against which is seated a metal washer 43 surrounding the externally threaded reduced portion 40. When portion 40 is threaded into the correspondingly internally threaded end 44 of bore 32 of the valve body 25, the piston 39 is sandwiched between washer 43 and shoulder 36.

Valve body 25 has a pair of bores 45 extending transversely therethrough preferably at right angles to each other and passing across bore 32 into the discharge chamber 37, while valve stem 26 has a longitudinal bore 46 at one end extending through reduced portion 40 thereof and leading into bore 32, the opposite end of bore 46 having a pair of bores 47 which are at right angles to each other and extend transversely through the valve stem across bore 46 therein. The function of bores 45 and 47 and bores 32 and 46 is to form a channel or passageway for the liquid as will hereinafter be set forth.

Valve stem 26 has a reduced nose or plunger stem 48 forming a shoulder 49. The tip 50 of the stem 26 is conical and has an annular groove 51 in juxtaposition thereto which serves to control



the inlet 19 in the manner hereinafter set forth. The tip 50 and nose 48 of the valve stem, when inserted in bore 12, extend through apertures in metal washer 52 and flexible washer 53 and through the inlet 19 of the casing beyond flange 18. As the diameter of the nose 48 of the valve stem 26 is slightly greater than the diameter of the aperture in the flexible washer 53, a tight seal will result, effectively closing the inlet 19. The aperture in the metal washer 52 is larger than the aperture in the flexible washer 53 in order to prevent undue friction or binding of the valve stem nose as it is pushed therethrough.

A coil spring 54 encompassing the valve stem 26 and pressing at one end against metal washer 52 and at its other end against metal washer 43, serves to retain flexible washer 53 which is coaxial with metal washer 52, against flange 18 and also normally holds the plunger assembly 23 in valve closing position, with the nose 48 of the valve stem 26 closing inlet 19 by reason of the hugging of flexible washer 53 against the reduced nose 48 of the valve stem, and outlet control piston 39 closing outlet 22 in the bottom of the casing. The space in bore 12 between metal washers 43 and 52 defines a supply chamber 55 as will hereinafter be described.

A metal washer 56 is seated on shoulder 17 at the front end of the casing 11 and is retained thereon by a gland or collar 57 having a threaded periphery which coacts with the internal threads 15. The gland 57 and washer 56 encompass the plunger rod 24 and washer 56 limits the longitudinal sliding movement of plunger assembly 23 when plunger piston 38 abuts thereagainst under the urging of coil spring 54, as shown in Fig. 3.

#### *Assembly and operation*

To assemble the device, the plunger assembly 23 is first put together outside the casing 11 as follows: Plunger piston 38 is placed over the reduced portion 33 of valve body 25 and then the reduced root end 28 of plunger rod 24, which had previously been passed through gland 57 and washer 56, is threaded into threaded end 31 of bore 32 of the valve body. Shoulders 30 and 35 of the plunger rod 24 and the valve body 25, respectively, thereby firmly clamp the plunger piston 38 therebetween. Outlet closure piston 39 is then placed around reduced portion 34 of the valve body and the threaded reduced end 40 of valve stem 26 with washer 43 thereon, is threaded into the bore 32 of valve body 25, the shoulder 36 of the valve body and washer 43 which abuts against shoulder 42 of the valve stem 26 firmly clamping piston 39 therebetween. Coil spring 54 is placed around valve stem 26 so that one end of the spring abuts against washer 43, and the flexible washer 53 and metal washer 52 are dropped into bore 12 against flange 18.

The plunger assembly 23 may now be inserted through end 13 of the casing into bore 12 so that the tip 50 of the valve stem 26 extends beyond flange 18 and the metal washer 52 abuts against the other end of the coil spring. Gland 57 is then threaded into threaded opening 15 at the front 13 of the casing to retain the plunger assembly in the bore 12.

To use the valve assembly, it is threaded at 16 upon a pipe 59 leading from a tank or container 60 of liquid soap which is preferably elevated to create a pressure. The valve is so installed that air chamber 20 is on top of the assembly, thereby preventing the air entrapped in the chamber

from escaping. When actuating head 27 is initially pressed, it will bring annular groove 51 on nose 48 into alignment with washers 52 and 53 and flange 18, as shown in Fig. 4 and thus open inlet 19 and permit the liquid soap which is under pressure due to the head created by the elevated container, to enter into the body of the casing. As the liquid soap is under pressure, it will fill supply chamber 55 and flow through bores 47 and 46 into bore 32 and through bore 45 in the valve body to fill the discharge chamber 37, and also flow into the air chamber 20 partially filling the latter and compressing the air therein. As in the position shown in Fig. 4, the outlet 22 is still sealed by piston 39, the contents of the discharge chamber will not be expelled.

Continued pressure on the actuating head 27 will bring the plunger assembly 23 to the end of its forward stroke, as shown in Fig. 5, as limited by the abutting of shoulder 49 at the root end of the nose 48 of the valve stem against metal washer 52. In this position, the nose 48 of the valve stem will close inlet 19 and the volume of the supply chamber 55 will be reduced by the movement of piston 39, thus further compressing the air in the air chamber 20. As the discharge chamber 37 has been brought into juxtaposition with outlet 22, the compressed air in the air chamber 20 which exerts pressure on the contents of the discharge chamber 37 through supply chamber 55, bores 47, 46, 32 and 45, will force a quantity of liquid from the discharge chamber through outlet 22.

The longer the actuating head is depressed the greater the amount of liquid will be ejected, limited however to the amount of liquid in the discharge chamber 37, bores 47, 46, 32 and 45, the supply chamber 55 and in the air chamber 20, that can be forced out by the compressed air in the air chamber 20. As the inlet 19 is sealed by nose or plunger stem 48 of the valve stem, only such liquid as is in the body of the casing can be dispensed and none escapes into pipe 59.

When the actuating head is released, the tensed coil spring 54 will return the plunger assembly to the position of Fig. 3. As the piston 39 moves to seal outlet 22, it also enlarges the supply chamber 55 and a partial vacuum is thereby created therein which will suck any liquid remaining in the discharge chamber 37 and inlet 22 back into the supply chamber 55. As piston 39 passes over outlet 22 it will quickly seal the latter, thereby preventing any liquid that should remain in the outlet 22 from leaking. Thus the annoyance and waste due to dripping between periods of use is obviated. When annular groove 51 again comes into juxtaposition with washers 52 and 53 and flange 18 and opens inlet 19, the combined action of the pressure on the liquid from container 60 and the partial vacuum in the supply chamber 55 will quickly cause a new supply of liquid to be forced into the body of the casing, thus readying the valve for the next use. At the end of the return movement of the plunger stem, it again seals the outlet 19.

It is to be noted that even if the valve should not be used for some time and the liquid soap therein should harden, it is a relatively simple matter to remove the entire valve assembly from the front of the device without the need for access to the rear of the dispenser or removal even of the valve casing 11. By simply unscrewing collar 57, the entire plunger assembly 23 may be withdrawn from bore 12, and as readily restored after cleaning or repair.



5

Although the device is especially suitable for dispensing liquid soap, it can also be used with juices, syrups, oils or any other liquids of like viscosity where it is desirable to limit the amount ejected at each use.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A valve assembly for dispensing liquids, said valve assembly comprising a casing having a longitudinal bore therethrough, said bore having an inlet to a source of liquid and an outlet, a plunger assembly slidably mounted in said bore, means on said plunger assembly to control said inlet and outlet, a spring normally retaining said plunger assembly in inlet and outlet closed position, a supply chamber in said bore defined by said plunger assembly and said inlet, an air chamber in said casing having a port leading into said supply chamber, a discharge chamber in said bore defined by said plunger assembly, means affording communication between said supply chamber and said discharge chamber, said plunger assembly being constructed and arranged to open said inlet to enable liquid to flow into said supply chamber and said discharge chamber and to compress the air in said air chamber while still retaining said outlet in closed position, and to close said inlet, open said outlet and provide access thereto from said discharge chamber, whereby the compressed air in said air chamber may forcibly eject the contents of said discharge chamber from said outlet.

2. A valve assembly for dispensing liquids, said valve assembly comprising a substantially cylindrical casing having a bore extending longitudinally therethrough with an outlet therefrom, an air chamber in said casing having a port leading into said bore, means in said bore near the rear end of said casing defining an inlet thereto, a gland removably affixed in said bore at the front end of said casing, a plunger assembly slidably mounted in said bore and extending through said gland and beyond said inlet and retained in said bore by said gland, means on said plunger assembly near the rear end thereof controlling said inlet, means on said plunger assembly near the front end thereof controlling said outlet, said control means being rigidly connected with respect to each other, a coil spring in said bore encompassing said plunger assembly and normally retaining the latter in inlet and outlet closed position, an actuating head on the front end of said plunger assembly whereby the latter may be forced into said bore against the tension of said spring successively to open said inlet, close said inlet and open said outlet.

3. The combination set forth in claim 2 in which the means in said bore defining an inlet thereto comprises an annular flange unitary with said bore, a resilient washer seated on said flange, and a rigid washer seated on said resilient washer, said spring pressing against said rigid washer and retaining the latter and said resilient washer against said flange.

4. A valve assembly for dispensing liquids, said valve assembly comprising a substantially cylindrical casing having a bore extending longitudinally therethrough with an outlet therefrom, means in said bore near the rear end of said casing defining an inlet thereto, an air chamber in said casing having a port leading into said bore, a gland removably affixed in said bore at the front end of said casing, a substantially cylindrical plunger assembly slidably mounted in said bore and retained therein by said gland, said plunger assembly comprising a valve stem extending through and beyond said inlet, having a peripheral groove therein and controlling said inlet, a valve body rigidly connected thereto and a plunger rod connected to said valve body and extending through said gland, means on said valve body to control said outlet, a coil spring in said bore encompassing said valve stem and normally retaining the latter in inlet closed position with said peripheral groove spaced from said inlet and the means on said valve body in outlet closed position, an actuating head on the front end of said plunger rod whereby said plunger assembly may be forced into said bore against the tension of said spring successively to open said inlet, compress the air in said air chamber, close said inlet and open said outlet, whereby the compressed air in said air chamber can force the liquid in the bore through the outlet.

6

5. A valve assembly for dispensing liquids, said valve assembly comprising a casing having a longitudinal bore therethrough of enlarged diameter with an outlet therefrom and threaded at both ends of the bore forming a shoulder at the front end thereof, an annular flange in said bore unitary with said casing at the rear end of said bore and defining an inlet thereto, a plunger assembly slidably mounted in said bore, said plunger assembly comprising a valve stem having a peripheral groove therein, a resilient washer seated on said flange and snugly encompassing said valve stem, a valve body connected to said valve stem at one end thereof, a piston affixed to each end of said valve body and defining a discharge chamber therebetween, a supply chamber in said bore between said resilient washer and one of said pistons, means affording communication between said discharge chamber and said supply chamber, an air chamber in said casing having a port leading into said supply chamber, a spring encompassing said valve stem and normally retaining the latter in inlet closing position and retaining said last named piston in outlet closing position, a plunger rod connected to the free end of said valve body and extending from said casing, a washer encompassing said plunger rod and seated on said shoulder, an externally threaded gland encompassing said plunger rod and coacting with the threaded front end of said bore to retain said washer on said seat, thereby to retain said plunger assembly in said bore, said last named piston and said annular groove being so spaced from each other with respect to the inlet and outlet that inward movement of said plunger rod will first bring said annular groove in juxtaposition to said annular flange and said resilient washer to open said inlet while still retaining said piston over said outlet, thereby filling the supply chamber and discharge chamber and compressing the air in said air chamber, continued movement of said plunger rod again closing said inlet and moving said piston away from said outlet, the compressed air in said air chamber thereupon ejecting the contents of said discharge chamber.

6. A valve assembly for dispensing liquids, said valve assembly comprising a casing having a longitudinal bore therethrough with an outlet therefrom, means in said bore near the rear end of said casing defining an inlet thereto, an air chamber in said casing having a port leading into said bore, a gland removably affixed in said bore at the front end of said casing, a substantially cylindrical plunger assembly slidably mounted in said bore and retained therein by said gland, said plunger assembly comprising a valve stem extending through and beyond said inlet, having a peripheral groove therein and controlling said inlet, a valve body rigidly connected thereto and a plunger rod connected to said valve body and extending through said gland, means on said valve body to control said outlet, a coil spring in said bore encompassing said valve stem and normally retaining the latter in inlet closed position with said peripheral groove spaced from said inlet and the means on said valve body in outlet closed position, an actuating head on the front end of said plunger rod whereby said plunger assembly may be forced into said bore against the tension of said spring successively to open said inlet, compress the air in said air chamber, close said inlet and open said outlet, whereby the compressed air in said air chamber can force the liquid in the bore through the outlet.



7

6. A valve assembly for dispensing liquids, said valve assembly comprising a substantially cylindrical casing having a bore extending longitudinally therethrough with an outlet therefrom, an air chamber in said casing having a part leading into said bore, an inlet in said casing near the rear end thereof, a gland removably affixed in said bore at the front end of said casing, a plunger assembly slidably movable in said bore, extending through said gland and retained in said bore by said gland, a plunger stem on said plunger assembly near the rear end thereof and extending through said inlet to control the latter, means on said plunger assembly near the front end thereof controlling said outlet, a coil spring in said bore encompassing said plunger assembly and normally retaining the latter in inlet and outlet closed position, an actuating head on the front end of said plunger assembly whereby the latter may be forced into said bore against the tension of said spring successively to open said inlet, close said inlet, and open said outlet.

7. A valve assembly for dispensing liquids, said valve assembly comprising a casing having a longitudinal bore therethrough with an outlet therefrom, an annular flange in said bore unitary with said casing at the rear end of said bore and defining an inlet thereto, a plunger assembly slidably mounted in said bore, said plunger assembly comprising a valve stem having a peripheral groove therein, a resilient washer seated on said flange and snugly encompassing said valve stem, a pair of pistons affixed on said plunger assembly and defining a discharge chamber therebetween, a supply chamber in said bore between said resilient washer and one of said pistons, means affording communication between said discharge chamber and said supply chamber, an air chamber in said casing having a port leading into said supply chamber, a spring encompassing said valve stem and normally retaining the latter in inlet closing position and said last named piston in outlet closing position, means to move said plunger assembly in said bore against the tension of said spring, said last named piston and said annular groove being so spaced from each other with respect to the inlet and outlet that inward movement of said plunger assembly will first bring said annular groove in juxtaposition to said annular flange and said resilient washer to open said inlet while still retaining said last named piston over said outlet, thereby enabling said supply chamber and said discharge chamber to fill and compressing the air in said air chamber, continued inward movement of said plunger assembly again closing said inlet and moving said last named piston away from said outlet, the compressed air in said air chamber thereupon ejecting the contents of said discharge chamber from said outlet, said last named piston upon return movement of said plunger assembly by said spring enlarging said supply chamber and creating a vacuum therein, thereby sucking the remaining contents of said outlet and said discharge chamber back into said supply chamber.

8. A valve assembly for dispensing liquids, said valve assembly comprising a substantially cylindrical casing having a bore extending longitudinally therethrough with an outlet therefrom, means in said bore near the rear end of said casing defining an inlet thereto, said means comprising an annular flange unitary with said bore, a

8

resilient washer seated on said flange, an air chamber in said casing having a port leading into said bore, a gland removably affixed in said bore at the front end of said casing, a substantially cylindrical plunger assembly slidably mounted in said bore and retained therein by said gland, said plunger assembly comprising a valve stem extending through and beyond said resilient washer and flange and having a peripheral groove therein, a valve body connected to said valve stem and a plunger rod connected to said valve body and extending through said gland, means on said valve body to control said outlet, a coil spring in said bore encompassing said valve stem, positioned between said resilient washer and the means on said valve body and normally retaining said valve stem in inlet closed position with said peripheral groove spaced from said inlet, and with the means on said valve body in outlet closed position, an actuating head on the front end of said plunger rod whereby said plunger assembly may be forced into said bore against the tension of said spring to successively bring said peripheral groove on said valve stem into alignment with said resilient washer, to open said inlet and compress the air in said air chamber, and thereupon to close said inlet and open said outlet whereby the compressed air in said air chamber may eject the liquid in the bore through said outlet.

9. A valve assembly for dispensing liquids, said valve assembly comprising a substantially tubular casing having a bore extending longitudinally therethrough with an outlet therefrom, means in said bore near the rear end of said casing defining an inlet thereto, an air chamber in said casing having a port leading into said bore, a gland removably affixed in said bore at the front end of said casing, a substantially cylindrical plunger assembly slidably mounted in said bore and retained therein by said gland, said plunger assembly comprising a valve stem extending beyond said inlet and controlling the latter, said valve stem having a peripheral groove therein, a valve body connected to said valve stem and a plunger rod connected to said valve body and extending through said gland, said valve body having reduced portions at each end thereof, an outlet control piston affixed on one of said reduced portions, a plunger piston affixed on the other of said reduced portions, said pistons being of greater diameter than said valve body and defining a discharge chamber therebetween, means affording communication between said air chamber and said discharge chamber, a coil spring in said bore encompassing said valve stem and normally retaining the latter in inlet closed position with said peripheral groove spaced from said inlet, and said outlet control piston in outlet closed position with said piston positioned over said outlet, an actuating head on the front end of said plunger rod whereby said plunger assembly may be forced into said bore against the tension of said spring successively to bring said peripheral groove into alignment with said inlet to open the latter and compress the air in said air chamber, to move said peripheral groove away from said inlet to close the latter and to move said outlet control piston away from said outlet to open the latter thereby enabling the compressed air in said air chamber to eject the contents of said discharge chamber from said outlet.

10. A valve assembly for dispensing liquids, said valve assembly comprising a substantially



9

cylindrical casing having a bore extending longitudinally therethrough with an outlet therefrom, an air chamber in said casing having a port leading into said bore, an inlet in said casing near the rear end thereof, said inlet comprising an annular flange unitary with said bore, a resilient washer seated on said flange, a gland removably affixed in said bore at the front end of said casing, a plunger assembly slidably mounted in said bore extending through said gland and retained in said bore by said gland, a plunger stem on said plunger assembly near the rear end thereof, having a peripheral groove therein and extending through said inlet to control the latter, means on said plunger assembly near the front end thereof movable over said outlet to control the latter, a coil spring in said bore encompassing said plunger assembly and normally retaining the latter in inlet and outlet closed position with said peripheral groove spaced from said inlet and said means on said plunger assembly positioned over said outlet,

10

and retaining said resilient washer against said flange, an actuating head on the front end of said plunger assembly whereby the latter may be forced into said bore against the tension of said spring successively to move said peripheral groove into alignment with said inlet to open the latter, to move said peripheral groove away from said inlet to close the latter and to move said means on said plunger assembly away from said inlet to open the latter.

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