Nov. 8, 1966 J. J. RODRIGUES, JR 3,283,727

LIQUID DISPENSER WITH AUTOMATIC AIR PURGE

Filed Nov. 2, 1964

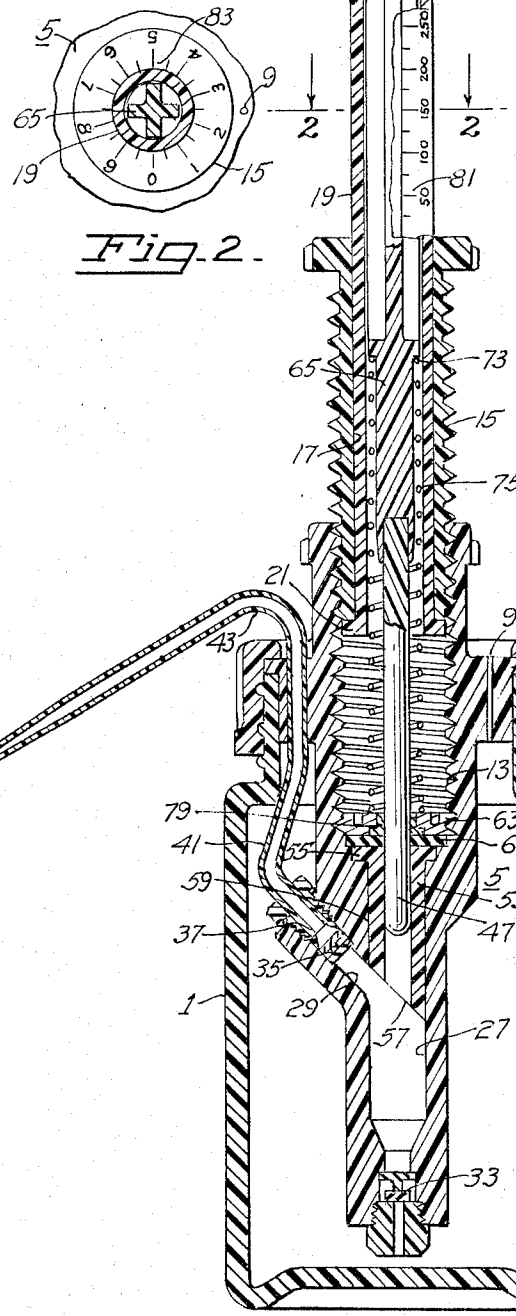


Fig. 2.

Fig. 1.

INVENTOR.
JOHN J. RODRIGUES, Jr.

BY
Bruce & Brosler

HIS ATTORNEYS

United States Patent Office

3,283,727

Patented Nov. 8, 1966

3,283,727

LIQUID DISPENSER WITH AUTOMATIC AIR PURGE

John J. Rodrigues, Jr., Orinda, Calif., assignor to Microchemical Specialties Co., Berkeley, Calif., a corporation of California

Filed Nov. 2, 1964, Ser. No. 408,153

6 Claims. (Cl. 103—203)

My invention relates generally to precision dispensing of liquid, primarily in equal volumes, and more particularly to the elimination of air or gas from such dispenser which might otherwise produce erratic results.

In liquid dispensers, where accuracy is not a factor, the presence of trapped air or gas is not of particular concern, but in dispensers designed for the accurate dispensing of liquid and particularly equal volumes of liquid per stroke of the dispenser, air or gas trapped in the pump chamber of such device, will introduce variances in the volumes of liquid discharged, which errors will vary with the ratio of the volume of trapped gas to the volume of liquid in the pump at the time.

This source of error is of particular concern in dispensers designed for operation in the ultra-micro range where the volume of liquid to be dispensed per stroke of the pump, may be less than a drop, and errors, however slight, could become material factors.

Entrapment of air or gases becomes a particular problem in dispensers utilizing free pistons, that is, pistons in the form of cylindrical rods of smaller diameters than the cylindrical wall of the pump barrel in which they move, and which operate solely on the basis of variable volume displacement of liquid in the pump barrel, as the piston moves in such region. The present invention is particularly concerned with this type of dispenser.

Among the objects of my invention are:

(1) To provide a novel and improved liquid dispenser of the type utilizing free pistons;

(2) To provide a novel and improved liquid dispenser utilizing a free piston, and designed to dispense equal volumes in the ultra-micro range, wherein the volumes dispensed may run less than a drop per stroke of such piston;

(3) To provide a novel and improved liquid dispenser utilizing a free piston, which dispenser is adapted to automatically purge itself of air or other gases tending to collect therein.

Additional objects of my invention will be brought out in the following description of a preferred embodiment of the same, taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a view in section through a dispenser embodying the air purging feature of the present invention;

FIGURE 2 is a view in section taken in the plane 2—2 of FIGURE 1.

Referring to the drawing for details of my invention in its preferred form, liquid may be dispensed from a jar or container 1, provided with a removable cap ring 3 secured as by threads to the neck of the container.

Projecting downwardly into the container is a pump assembly including a pump body 5 with a radial supporting shoulder flange 7 clamped to the top of the jar 1 by the cap ring 3, and provided with a vent 9 exposing the interior of the jar to the atmosphere. The upper end of the pump body is enlarged and provided with an internally threaded recess 13 to accommodate a coaxial bushing 15 having a central bore 17 to slidably receive a hollow plunger 19.

The lower end of the plunger terminates in a radial flange 21 adapted to abut the lower end of the bushing,

which functions as a stop to movement of the plunger in that direction.

The lower portion of the pump body is preferably of smaller diameter and comprises the pump barrel having a cylindrical bore 27 providing a main piston passageway. Extending from the main piston passageway is a branch passageway 29, said latter passageway being directed upwardly at an angle to the main passageway, to assure that the branch passageway will terminate at a point above the junction of the two passageways.

At the lower end of the barrel is an intake valve assembly 33 of any suitable design, while at the upper end of the branch passageway, is a discharge valve assembly 35 retained in position by a suitable plug 37 which serves as a means to anchor the inner end of a discharge tube 41. This discharge tube passes up through the body supporting flange 7 where it is maintained in a bend 43 to facilitate the handling of discharge.

For reciprocation in the main passageway of the barrel is a free piston 47, whose diameter is substantially less than that of the main passageway 27 of the pump. Where extreme accuracy in dispensing is of paramount importance, such piston will be lapped to its proper diameter.

The piston enters the pump barrel through a purging seal 53 supported by an upper flange 55 resting against the lower end of the pump body recess, and terminating at its lower end 57 at an angle, with its shortest longitudinal dimension 59 ending at the junction of the branch passageway with the main passageway. This purging seal provides a sliding fit for the free piston 47, but not necessarily a tight seal, to thereby avoid excessive friction to reciprocal movement of the piston in such seal.

Such free sliding is permitted by the provision of a piston seal at the upper end of the purging seal, in the form of a resilient sealing washer 61 of any suitable elastomer, one such elastomer being a plastic known as "KEL-F." This washer is clamped between the upper surface or flange 55 of the purging seal and a retainer 63 above, to preclude deflection of the sealing washer with movements of the free piston, to thereby minimize leakage and possible error. This retainer may be peripherally threaded, to be threaded into the recess 17 for engagement with the sealing washer 61, and to this end, the retainer may be provided with spanner wrench recesses.

The free piston 47 is normally supported in a retracted position with the lower tip thereof somewhere in the neighborhood of the junction of the branch passageway with the main passageway, the exact setting being a function of the desired stroke of the piston. Toward this end, the piston may, at its upper end, be secured in a handle 65 of a length such as to extend up into the plunger 19, where it is formed to provide a shoulder 73.

A compression spring 75 installed about the piston between such shoulder and the bottom of the recess, as constituted by the retainer, is capable of elevating the plunger and piston to the point of bringing the plunger flange 21 into abutting engagement with the lower end of the bushing 15, to thus determine the prevailing upper limit of travel of the piston and prevailing normal position of the piston in the pump barrel.

The stroke of the piston is determined by the spacing between the lower surface of the plunger flange and the bottom of the recess, as determined by the retainer, and inasmuch as the bushing 15 is adjustable within the recess 17, the normal position of the piston in the main passageway may be adjusted, and thereby alter the stroke of the piston.

In preparing the device for use, the pump chamber, as determined by the exposed space between the intake and

the discharge valve assemblies **33** and **35**, is first filled by a few strokes of the piston until a discharge from the end of the discharge tube **41** becomes available. Thereafter, each stroke of the piston will discharge the same quantity of liquid each time, for on each return stroke of the piston, an amount of liquid will be drawn into the chamber equal to that discharged from the chamber, if all conditions are otherwise favorable.

One such condition to be considered, is the matter of trapping air or other gas in the pump chamber. In this connection, it is significant to note that the purging seal surrounding the portion of the piston normally extending into the main passageway of the barrel, not only occupies the space in the upper part of the barrel, where air or other gas if present, would normally be trapped, but by terminating the lower end of the purging seal at an angle, and positioning it with its shortest dimension at the junction of the branch passageway with the main passageway, any air entering at the intake valve assembly will automatically be forced out through the discharge valve during priming of the pump. None can be trapped in the pump itself to adversely effect its operation.

One advantage of utilizing a free piston, is that it enables one to interchange a free piston of one diameter for one of another diameter, thus enabling one to alter the calibration of the dispenser without changing its overall dimensions. With such changes, one must also change the purging seal and piston seal, to ones conforming to the particular piston installed. This presents no particular problem as the parts are readily removable and interchangeable.

A change of pistons would also necessitate a change of the retainer **63**, but for the fact that I provide a removable flanged collar **79** installed in a complementary recess in the underside of the retainer **63** and forming a functional part thereof. Such collar may be removed, and another having a bore conforming to the new piston, substituted.

It will be appreciated that were the purging seal **53** sufficiently short, it could be made to seal more closely against the piston and thus take over the function of the sealing washer **61**, which could then be dispensed with. Under these conditions, the branch passageway will be located higher up in the barrel, and, to avoid interference with the bushing recess **17**, such branch passageway could include an angle bend as it branched off from the main passageway.

The stroke adjustments could be indicated on the plunger **19**, by means of a suitable scale **81** inscribed thereon, and for micrometer adjustments, of stroke, the upper surface of the bushing **15** may be inscribed with a vernier scale **83**, all as illustrated and described in my copending application for Dispenser Adapted for Ultra-Micro Range, S.N. 151,873, filed November 13, 1961, now Patent No. 3,191,807.

From the foregoing description of my invention in its preferred form, it will be apparent that the same is subject to alteration and modification without departing from the underlying principles involved, and I accordingly do not desire to be limited in my protection to the specific details illustrated and described except as may be necessitated by the appended claims.

I claim:

1. A dispenser comprising

a barrel having a main piston passageway therein and a branch pasageway leading therefrom and terminating at a point above the junction of said branch passageway and said main passageway,

a free piston in said barrel, said free piston having a diameter less than the diameter of said main passageway and being out of contact with said main passageway throughout the functioning length of said piston,

means normally supporting said free piston in a retracted position in said main passageway,

and a purging seal lining that portion of the main passageway normally occupied by said free piston and slidably fitting said piston,

said purging seal terminating at its lower end at an angle, with its shortest longitudinal dimension at the junction of said two passageways.

2. A dispenser comprising

a barrel having a main piston passageway therein and a branch passageway leading therefrom and terminating at a point above the junction of said branch passageway and said main passageway,

a free piston in said barrel, said free piston having a diameter less than the diameter of said main passageway and being out of contact with said main passageway throughout the functioning length of said piston,

means slidably sealing said free piston at the entrance to said barrel,

means normally supporting said free piston in a retracted position in said main passageway,

and a purging seal lining that portion of the main passageway normally occupied by said free piston and slidably fitting said piston,

said purging seal terminating at its lower end at an angle, with its shortest longitudinal dimension at the junction of said two passageways.

3. A dispenser comprising

a barrel having a main piston passageway therein and a branch passageway leading therefrom and terminating at a point above the junction of said branch passageway and said main passageway,

a free piston in said barrel, said free piston having a diameter less than the diameter of said main passageway and being out of contact with said main passageway throughout the functioning length of said piston,

means normally supporting said free piston in a retracted position with the tip thereof in the neighborhood of the junction of the branch passageway with said main passageway,

and a purging seal lining that portion of the main passageway normally occupied by said free piston and slidably fitting said piston,

said purging seal terminating at its lower end at an angle, with its shortest longitudinal dimension at the junction of said two passageways.

4. A dispenser comprising

a barrel having a main piston passageway therein and a branch passageway leading therefrom at an upwardly directed angle to said main passageway and terminating at a point above the junction of said branch passageway and said main passageway,

a free piston in said barrel, said free piston having a diameter less than the diameter of said main passageway and being out of contact with said main passageway throughout the functioning length of said piston,

means normally supporting said free piston in a retracted position with the tip thereof in the neighborhood of the junction of the branch passageway with said main passageway,

and a purging seal lining that portion of the main passageway normally occupied by said free piston and slidably fitting said piston,

said purging seal terminating at its lower end at an angle, with its shortest longitudinal dimension at the junction of said two passageways.

5. A dispenser comprising

a barrel having a main piston passageway therein and a branch passageway leading therefrom and terminating at a point above the junction of said branch passageway and said main passageway,

a free piston in said barrel, said free piston having a diameter less than the diameter of said main passageway and being out of contact with said main passageway throughout the functioning length of said piston,

means slidably sealing said free piston at the entrance to said barrel,

means normally supporting said free piston in a retracted position with the tip thereof in the neighborhood of the junction of the branch passageway with said main passageway,

and a purging seal lining that portion of the main passageway normally occupied by said free piston and slidably fitting said piston,

said purging seal terminating at its lower end at an angle, with its shortest longitudinal dimension at the junction of said two passageways.

6. A dispenser comprising

a barrel having a main piston passageway therein and a branch passageway leading therefrom at an upwardly directed angle to said main passageway and terminating at a point above the junction of said branch passageway and said main passageway,

a free piston in said barrel, said free piston having a diameter less than the diameter of said main passageway and being out of contact with said main

passageway throughout the functioning length of said piston,

means slidably sealing said free piston at the entrance to said barrel,

means normally supporting said free piston in a retracted position with the tip thereof in the neighborhood of the junction of the branch passageway with said main passageway,

and a purging seal lining that portion of the main passageway normally occupied by said free piston and slidably fitting said piston,

said purging seal terminating at its lower end at an angle, with its shortest longitudinal dimension at the junction of said two passageways.

References Cited by the Examiner

UNITED STATES PATENTS

1,545,208	7/1925	Smith	103—153
2,096,711	10/1937	Fielden	103—203 X
2,118,234	5/1938	Rupp	103—203

ROBERT M. WALKER, *Primary Examiner.*