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SIMPLY OPERATING PUSH PLUNGER PUMP HOUSED IN A CONTAINER

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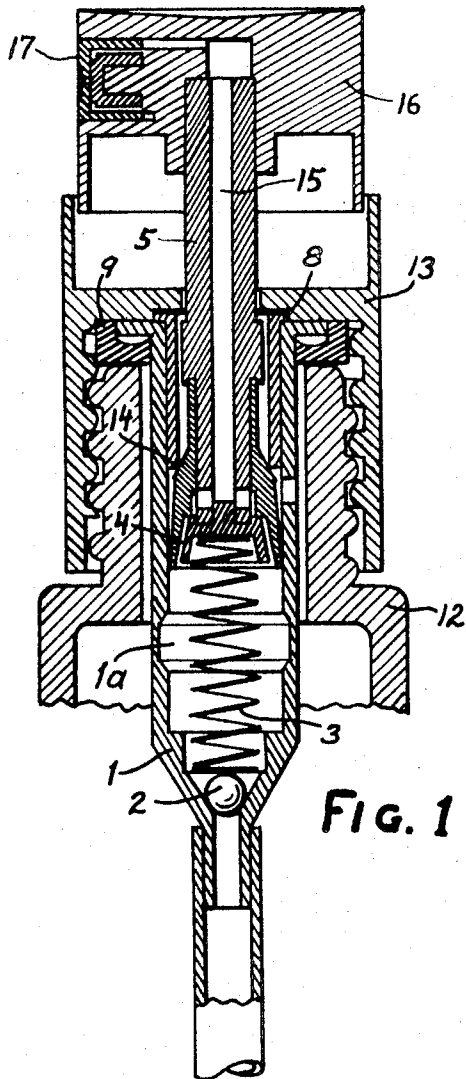


Fig. 1

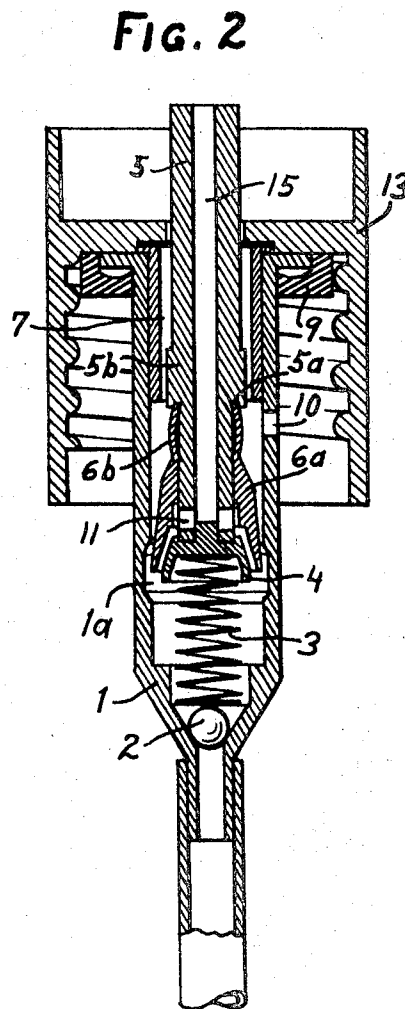


Fig. 2

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SIMPLY OPERATING PUSH PLUNGER PUMP HOUSED IN A CONTAINER

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4 Claims

ABSTRACT OF THE DISCLOSURE

A hand actuated simply operating push plunger pump with a compression spring 3 in the pump cylinder 1, the spring pressing against a valve plate 4 of an outlet valve that is opened by means of a hollow plunger stem 5 but with the plate pressing against a valve seat in pump plunger 6a, 6b while the pump is at rest, in combination with a sealing sleeve 7 in the pump cylinder in a position between the plunger and the closure cap 13 on the container where the sleeve will be engaged, while the pump is at rest, by a plunger consisting of a cuff and a neck 6b, there being in the pump cylinder a pressure equalizing opening 10 which in the resting position is at the level of the space between the plunger cuff and the sealing sleeve whereby the air equalizing path is sealed off by the latter during the resting stage, but where during the actuating stroke the inside of the container is kept in communication with the outside atmosphere, characterized in that the plunger 6a, 6b with its thin walled elastic neck 6b is adapted to be axially coordinated with an enlargement 5b on the plunger stem 5.

Cross-references to related applications

Applicants claim priority under 35 U.S.C. 119 for German application P 41213, filed Jan. 17, 1967.

The disclosure of copending U.S. patent application Ser. No. 557,765, now Patent No. 3,406,909, filed June 15, 1966 is incorporated herein.

Background of the invention

The field of the invention is apparatus for dispensing with a discharge assistant.

The present invention is particularly related to hand actuated dispensers which are screwed onto the tops of perfume bottles or other liquid containers where it is desired to dose, spray or atomize the contents thereof. The state of the prior art dispensers is represented by German Patent 1,201,684, granted Jan. 29, 1964, German Utility Patent 1,920,632, granted Apr. 12, 1964, German Utility Patent 1,735,455, granted May 2, 1956, and French Patents 760,904 and 1,177,620, published Sept. 15, 1933 and June 28, 1957 respectively.

The prior art dispensers, particularly the dispenser of German Patent 1,201,684, have the disadvantage of requiring that the parts be very accurately dimensioned which further requires difficult and expensive finishing, and as a result delays the closing of the outlet valve.

Summary of the invention

Having in mind the limitations of the prior art, it is a general object of the present invention to avoid said limitations.

An object of the present invention is to provide a hand operated pump dispenser wherein the suction stroke commences without delay and immediately upon the release of the plunger.

Further objects and advantages of the invention will

become apparent upon study of the specification, drawings and claims.

According to the present invention, a hand actuated simply operating push plunger pump with a compression spring in the pump cylinder is provided. The spring presses against a valve plate of an outlet valve that is opened by means of a hollow plunger stem. While the pump is at rest the plate presses against a valve seat in a pump plunger. A sealing sleeve is combined in the pump cylinder in a position between the plunger and the closure cap of the container. The sleeve is engaged, while the pump is at rest, by a plunger consisting of a cuff and a neck. The pump cylinder has a pressure equalizing opening which in the resting position is at the level of the space between the plunger cuff and the sealing sleeve whereby the air equalizing path is sealed off by the latter during the resting stage. During the actuating stroke the inside of the container is kept in communication with the outside atmosphere.

A particular feature of the present invention comprises having the plunger connected by a thin walled elastic neck to the side of the plunger stem.

The pump of this invention is suitable for many purposes, e.g., for dosing, spraying and atomizing from suitable containers from which a liquid, e.g., a combustible volatile, etching or odoriferous liquid, either good- or bad-smelling, can be expelled.

The pump of the present invention has important advantages over known pumps. At the beginning of the pressure movement, the compressed liquid in the cylinder opposes the downward movement of the plunger cuff so that the elastic neck portion thereof is compressed by continued downward movement of the valve stem. Upon termination of the downward movement and release of the hand-applied pressure and escape of fluid from the cylinder into the plunger rod, the elastic neck portion forcibly engages the plunger cuff with the valve plate, thereby closing the outlet valve. Closure of the outlet valve occurs as soon as the hand applied pressure is released, regardless of whether or not the suction movement commences immediately. Complete suction action commences therefore immediately upon initiation of the suction movement. In the prior pumps this occurs somewhat later, namely not until after the valve plate has been pressed against the plunger cuff during the suction stroke. During this time interval there is no suction force exerted because air from the outside can then enter the pump cylinder through the hollow plunger rod. A quick and dependable closing of the outlet valves in the prior constructions is dependent upon the friction between the plunger cuff and the inner wall of the pump cylinder being greater than the friction between the plunger cuff and the plunger stem. This means that the dimensions of the plunger must be critically accurate if dependable functioning of the pump is to be expected. But even if a plunger of such exact dimensions is produced, there is always the possibility, with elastic substances of the kind that must be used in such devices, of the frictional characteristics of the parts undergoing unfavorable changes. In the pump of the present invention, the functioning does not depend on such frictional relations.

In the present invention the plunger neck is securely attached and sealed in an annular groove around the plunger rod. This also has the advantage of keeping the connection between the plunger and the plunger rod permanently sealed. It is therefore not possible during the pressure stroke for any liquid to enter the space between the plunger neck and pump cylinder which would prevent such liquid from being ejected by the nozzle as happens with prior pumps under normal conditions. It is also advantageous to have the sealing sleeve inserted with a friction fit into the pump cylinder so that while in the

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resting position the pressure equalizing path is sealed off by the tight contact of the plunger cuff with the lower exposed and preferably innermost edge of the sealing sleeve.

The present construction also has other advantages. In the prior pumps the sealing sleeve is formed of rubber because in its resting position where it is continually under spring pressure, it is urged against an additional closure plate. It should be made of rubber so that it will resume its original form even after remaining for long periods of time under pressure. Rubber, however, has the disadvantage of deteriorating in the presence of various liquids, with loss of its original properties. In the pump of this invention, it is not only the construction that is greatly simplified (by the omission of the pressure plate), but it is also possible by choice of suitable materials for the sealing sleeve e.g., Teflon or polypropylene, to avoid chemical attack by various liquids thereon. The use of a rigid material for the sealing sleeve also has the advantage that in the resting condition where the plunger cuff seats on the inner edge of the sleeve, the force of the spring is exerted only on the sleeve. The plunger neck is therefore not under compression while in the resting condition so that even after remaining idle for a long period of time it does not lose its elasticity.

Finally, another advantageous feature of the pump of this invention is that inside the pump cylinder in the region of the plunger cuff at the end of its compression stroke there is an annular enlargement in such a position that between the plunger cuff and the enlargement there is an annular slit with additional advantages. In prior pumps during the pressure stroke an elastic expansion occurs, especially of the pump cylinder and plunger, as a result of the increased fluid pressure. At the end of the pressure stroke this expansion returns to normal with the fluid pressure diminishing only gradually. The result is that the expulsion of the liquid occurs only gradually. This is, however, a disadvantage for pumps that are to be used for different purposes. If, for example, the pump forms part of an atomizer, droplets of liquid will then remain on the nozzle after each operation which are undesirable. Also, when the pump is used for dosing purposes, exact dosing will not be possible. These disadvantages are avoided by the pump of this invention by the provision that just before arriving at the lower end of travel of the plunger, the fluid pressure in the cylinder is suddenly vented through the relatively wide slit between the plunger and the enlarged portion of the inner cylinder wall. This causes the expulsion from the nozzle to be suddenly interrupted.

Description of the drawing

In the two figures of the drawing, an embodiment of the pump of this invention is shown. The two figures show the pump in longitudinal section.

FIGURE 1 shows the pump in its stationary condition; and

FIGURE 2 shows the pump at the end of its forward stroke.

In the lower end of the pump cylinder 1 the inlet valve is shown in the form of a ball valve 2. The strong pressure spring 3 presses directly against the valve plate 4 which is fastened to the lower end of the plunger rod 5 and presses against a plunger 6a, 6b mounted on the plunger rod. The plunger consists of a cuff 6a and a neck 6b, the latter being firmly seated in an annular groove 5a in an enlarged portion 5b of the plunger rod 5. In the upper portion of the pump cylinder 1 a sealing sleeve 7 of rigid material is pressed down to a depth limited by the flange 8. The sealing member 9 forms a seal between the pump cylinder 1 and the opening of the container 12. A pressure equalizing opening 10 is formed in the wall of the pump cylinder 1 to keep the pressure in the container 12 equal to that of the atmosphere, and also to return to the container any leakage liquid from the cylinder. The lower end of the plunger has a transverse bore 11 to per-

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mit liquid to enter the bore 15 in the plunger rod 5 when the outlet valve is open. The inner wall of the pump cylinder is enlarged in the region of furthest downward movement of the plunger cuff 6a. The pump carries a closure cap 13 for mounting it on the container 12. The lower end of the sealing sleeve 7 presents an edge 14 against which the plunger cuff 6a is pressed while the pump is at rest. The plunger rod 5 carries at its upper end an actuating head 16 to the side of which an atomizing nozzle 17 is fastened.

Description of the operation of the preferred embodiment

The pump of this invention operates as follows:

While at rest, as FIGURE 1 shows, the compression spring 3 presses the valve plate 4 against the plunger cuff 6a to urge the latter against the inner edge 14 of the sealing sleeve 7. The effect of this is on the one hand to close the fluid passageway through the outlet valve formed by the valve plate 4 and the plunger cuff 6a to the bore 15 in the plunger rod 5, and on the other hand the engagement of the plunger cuff 6a with the inner edge 14 of the sealing sleeve 7 prevents the liquid from escaping through the air pressure equalizing opening 10, along the sealing sleeve 7 and through the slit between plunger rod 5 and the closure cap 13.

If the upward pressure of the spring 3 is counteracted, a downward movement will first be imparted to the plunger rod 5 and to the plunger cuff 6a mounted thereon. This increases the fluid pressure in the lower part of the pump cylinder 1 acting upwardly against the plunger cuff 6a shifting the latter upwardly along the plunger rod 5. The plunger neck 6b is thereby compressed and bulged out, thereby opening the outlet valve. The liquid in the lower part of the pump cylinder now escapes through the transverse bore 11 and through the bore 15 of the plunger rod. Shortly before the end of the pressurizing movement (see FIGURE 2), the plunger cuff reaches the annular enlargement 1a in the inside wall of the cylinder 1. An annular passageway of relatively large cross section is thereby formed between the plunger cuff 6a and the annular enlargement 1a in the inside cylinder wall, whereby the escape opening for the liquid is increased and a sudden pressure drop in the pump cylinder 1 is achieved. The elastic bulging out of the plunger neck 6b is thereby caused to collapse. After the pressure upon the bottom of the plunger cuff 6a has been relieved, the elastic compression of the neck 6b causes the cuff to move downward toward the valve plate 4. The outlet valve is forcibly and quickly closed thereby, and any further escape of liquid is effectively prevented, independently of the initiation of the suction stroke. Hence there is no drop formation at the outlet side of the nozzle 17. As soon as the downward pressure on the actuating knob 16 and plunger rod 5 is relieved, the knob and the rod together with the plunger cuff 6a are moved upwards by the spring 3 whereby the outlet valve is already closed. As soon as the plunger cuff 6a has left the annular enlargement 1a in the pump cylinder 1, it forms a fluid-tight seal with the inner wall of the cylinder so that upon further upward movement it diminishes the pressure in the cylinder 1, thereby drawing more liquid from the container 12 upwardly past the ball check valve 2. After the end of the upward movement the entire system will shut off from the outside as above described, thereby rendering it fluid tight regardless of the position of the pump and container.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions.

We claim:

1. A hand-actuated push plunger pump adapted to be mounted on a container (12) and comprising a pump cylinder (1) with a flanged upper end that is held firmly with a fluid-tight seal upon the upper end of the container by means of a cap (13), a sealing sleeve (7) of rigid ma-

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terial positioned in the upper end of the pump cylinder, an upwardly opening check valve (2) in the lower end of the pump cylinder, a hollow plunger rod (5) urged upwardly by a spring (3) and carrying an actuating head (16) with an atomizing nozzle (17) at the upper end of the rod and a valve plate (4) over its lower end, the plunger rod having an enlarged portion (5b) and carrying an upwardly tapered plunger (6a) with an elastic bulgable neck (6b) attached at its upper end with a fluid tight fit to the plunger rod immediately below the enlarged portion (5b), said plunger having sufficient limited sliding movement on the rod to form fluid-tight contact with both the valve plate (4) and the lower end of the sealing sleeve (7) when the plunger rod is at the upper end of its upward movement, the plunger rod having a transverse radial bore (11) through its lower end between the plunger and the valve plate (4) and the cylinder (1) having a transverse pressure-equalizing opening (10) through its wall between the sealing sleeve (7) and the plunger (6a) so that when the plunger rod is moved downwardly by hand the plunger will first disengage the sealing sleeve to bring the inside of the container into communication with the outside and then, with the help of the increased fluid pressure in the cylinder, the plunger will also become suddenly disengaged from the valve plate (4) to permit the pressurized fluid in cylinder (1) to flow through bore (11) into the hollow plunger rod (5) and out through the atomizing nozzle until when near the end of downward movement the diminished fluid pressure in the cylinder will permit sudden downward movement of the plunger into fluid-tight engagement with the valve plate (4) to keep the transverse bore (11) closed during the ensuing upward movement and until after the next downward movement has commenced.

2. A hand-actuated push plunger pump adapted to be mounted on a container (12) and comprising a pump cylinder (1) with a flanged upper end that is held firmly with a fluid-tight seal upon the upper end of the container by means of a cap (13), a sealing sleeve (7) of rigid material positioned in the upper end of the pump cylinder, an upwardly opening check valve (2) in the lower end of the pump cylinder, a hollow plunger rod (5) urged upwardly by a spring (3) and carrying an actuating head (16) with an atomizing nozzle (17) at the upper end of the rod and a valve plate (4) over its lower end, the plunger rod having an enlarged portion (5b) with an annular groove (5a) and carrying an upwardly tapered plunger (6a) with an elastic bulgable neck (6b) attached at its upper end to the plunger rod by seating in annular groove (5a), said plunger having limited sliding movement on the rod to form fluid-tight contact with both the valve plate (4) and the lower end of the sealing sleeve (7) when the plunger rod is at the upper end of its upward movement, the plunger rod having a transverse bore (11) through its lower end between the plunger and the valve plate (4) and the cylinder (1) having a transverse pressure-equalizing opening (10) through its wall between the sealing sleeve (7) and the plunger (6a) so that when the plunger rod is moved downwardly by hand the plunger will first disengage the sealing sleeve to bring the inside of the container into communication with the outside and then, with the help of the increased fluid pressure in the cylinder, the plunger will also become suddenly disengaged from the valve plate (4) to permit the pressurized fluid in cylinder (1) to flow through bore (11) into the hollow plunger rod (5) and out through the atomizing nozzle until when near the end of downward movement the diminished fluid pressure in the cylinder will permit sudden

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downward movement of the plunger into fluid-tight engagement with the valve plate (4) to keep the transverse bore (11) closed during the ensuing upward movement and until after the next downward movement has commenced.

3. A hand-actuated push plunger pump adapted to be mounted on a container (12) and comprising a pump cylinder (1) with a flanged upper end that is held firmly with a fluid-tight seal upon the upper end of the container by means of a cap (13), a sealing sleeve (7) of rigid material positioned in the upper end of the pump cylinder, an upwardly opening check valve (2) in the lower end of the pump cylinder, a hollow plunger rod (5) urged upwardly by a spring (3) and carrying an actuating head (16) with an atomizing nozzle (17) at the upper end of the rod and a valve plate (4) over its lower end, the plunger rod also carrying an upwardly tapered plunger (6a) with an elastic bulgable neck (6b) attached at its upper end to the plunger rod, said plunger having limited sliding movement on the rod to form fluid-tight contact with both the valve plate (4) and the lower end of the sealing sleeve (7) when the plunger rod is at the upper end of its upward movement, the plunger rod having a transverse bore (11) through its lower end between the plunger and the valve plate (4) and the cylinder (1) having a transverse pressure-equalizing opening (10) through its wall between the sealing sleeve (7) and the plunger (6a) so that when the plunger rod is moved downwardly by hand the plunger will first disengage the sealing sleeve to bring the inside of the container into communication with the outside and then, with the help of the increased fluid pressure in the cylinder, the plunger will also become suddenly disengaged from the valve plate (4) to permit the pressurized fluid in cylinder (1) to flow through bore (11) into the hollow plunger rod (5) and out through the atomizing nozzle until when near the end of downward movement the diminished fluid pressure in the cylinder will permit sudden downward movement of the plunger into fluid-tight engagement with the valve plate (4) to keep the transverse bore (11) closed during the ensuing upward movement and until after the next downward movement has commenced, said cylinder (1) having an internal enlargement (1a) into which the plunger moves during the lowermost portion of its downward movement so as to leave an annular passageway between the plunger and the inner surface of the enlargement.

4. The pump of claim 2 whose sealing sleeve (7) has at its upper end a flange (8) that is clamped between the flanged upper end of the cylinder (1) and the cap (13), the lower end of the sleeve forming an annular shoulder inside the cylinder (1).

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WILLIAM L. FREEH, Primary Examiner

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