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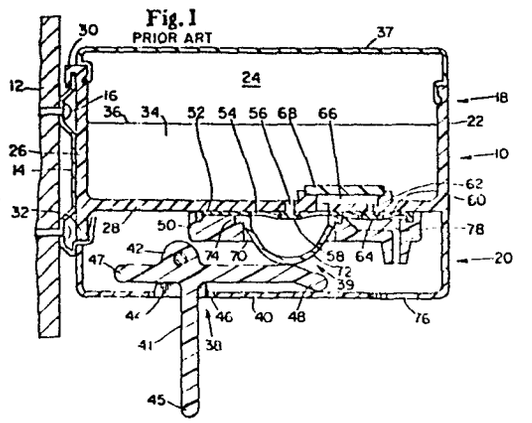
(54) **Liquid soap dispenser with improved pumping mechanism.**

(57) A liquid soap dispensing system includes a closed soap reservoir having a manually actuated pumping mechanism located below and in fluid communication with the reservoir. The pumping mechanism basically comprises a cylindrical bowl having an open end defined by a continuous side wall and a moveable, substantially rigid closed end that is attached about its periphery to the bowl's side wall. The dispenser also includes a hand-pulled lever having two moving ends that pivot around a pivot pin – one end extending outside the dispenser for easy grasping thereof by the user with the other end being in sliding contact with the outer surface of the bowl's rigid end. In operation, a discrete quantity of liquid soap flows from the upper reservoir through a one-way valve and fills the bowl's interior cavity. When the lever's grasping end is pulled, the lever's bulb-contacting end pushes the bowl's rigid end up within the cross-section defined by the bowl's side wall toward the bowl's open end and forces the soap contained therein out through a discharge conduit and into the user's hand. When the lever is released, the bowl expands and draws another discrete charge of soap from the upper reservoir.

Fig. 1
PRIOR ART



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LIQUID SOAP DISPENSER WITH IMPROVED PUMPING MECHANISM

CHARLES L. DILLARD

TECHNICAL FIELD

The present invention relates to apparatus for dispensing liquid soap, and more particularly to an efficient pump mechanism for a liquid soap dispenser.

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for dispensing liquid soap, normally in discrete small quantities or charges. Such dispensing apparatus are used, particularly for hygiene purposes, in public or institutional washrooms or wherever there are a relatively large number of different users. Typically, these dispensers are fastened to a wall near a sink or basin by means or screws, nails, or an adhesive, and dispense a liquid soap that is suitable for cleaning a person's hands and face. Examples of such dispensers can be found in U.S. Patent Nos. 4,429,812; 4,391,309; 4,391,308; 4,345,627; 4,322,019; 4,316,555; 4,173,858; 4,149,573; 4,146,156; and 4,018,363, all being hereby incorporated by reference.

The above-identified patents disclose various types of liquid soap dispensers that all utilize the same basic pumping mechanism comprising a semi-spherical, flexible rubber bowl and a hand-pulled lever having one end in contact with the bowl. In operation, liquid soap from an upper reservoir flows through an aspirating conduit and fills the flexible bowl. When the lever's free end is pulled, the lever's opposite end compresses the bowl and forces the soap contained therein out through a discharge conduit and into the user's hand.

Although the above-described pumping mechanism does accomplish the main objective of dispensing a discrete quantity of liquid soap from the dispenser, it has been found

that because of the bowl's design, only about 25-33% of the bowl's total soap content (typically about 3.0 ml) is discharged per each handle pull, which is only about 0.7-1.0 ml of soap. It has been further found that this amount of soap is insufficient to clean the average person's hands, particularly when the soap is of low concentration. Consequently, the frustrated user must typically pull the handle as often as four or five times before the dispenser discharges a sufficient quantity of soap, which in turn increases wear and tear on the dispenser and its wall anchoring means and significantly decreases the dispenser's useful life.

In light of the above, it is a principal object of the present invention to provide a liquid soap dispenser of the general type described above with an improved pumping mechanism that utilizes a more efficient bowl approximately the same size as the semi-spherical bowl, but which has a voiding efficiency of about 50-75% and corresponds to approximately 1.5-2.0 ml of soap per handle pull. The improved bulb significantly reduces the number of lever pulls necessary to discharge a sufficient amount of soap for the average user. In so providing a more efficient pump mechanism, the dispenser is subject to less wear and tear and has a significantly increased effective life.

SUMMARY OF THE INVENTION

In a particularly preferred embodiment of the present invention, a liquid soap dispenser having an upper liquid soap reservoir is provided with a pumping mechanism located below and in fluid communication with the reservoir. The pumping mechanism basically comprises a cylindrical bowl having an open end and a moveable closed end that is resistant to localized deformation. The dispenser also includes a hand-pulled lever having two moving ends that pivot around a pivot pin - one end extending outside the

dispenser for easy grasping thereof by the user - the other end being in sliding contact with the outer surface of the bowl's rigid, closed end. In operation, a discrete quantity of liquid soap flows from the upper reservoir through a one-way valve and fills the bowl's interior cavity. When the lever's grasping end is pulled, the lever's bulb-contacting end pushes the bowl's rigid, closed end up into the bowl's interior cavity and forces the liquid soap contained therein out through a discharge conduit and into the user's hand. Since the rigid, closed end does not locally deform, the quantity of liquid soap dispensed approximates the volume swept by the cross-sectional area of the rigid, closed end over the entire upward vertical stroke of the lever. When the lever is released, the bowl expands and draws another discrete charge of liquid soap from the upper reservoir through the one-way valve. This process is repeated until the user is satisfied with the amount of soap received from the dispenser.

BRIEF DESCRIPTION OF THE DRAWINGS

While this specification concludes with claims that particularly point out and distinctly claim the present invention, it is believed that the present invention will be better understood by reading the following detailed description with references made to the following drawings in which:

Figure 1 is a cross-sectional side view of a dispenser having a pumping mechanism that utilizes a prior art, semi-spherical flexible bowl, said dispenser being shown mounted to a wall with its actuating lever at rest.

Figure 2 is a cross-sectional side view of the dispenser shown in Figure 1 with its actuating lever being pulled by a user and showing the lever's other end compressing and locally deforming the prior art bowl to discharge a discrete charge of liquid soap from the dispenser.

Figure 3 is a cross-sectional side view of a dispenser having a pumping mechanism that utilizes a cylindrical, rigid-ended bulb of the present invention, said dispenser being shown mounted to a wall with its actuating lever at rest.

Figure 4 is a cross-sectional side view of the dispenser shown in Fig. 3 with its actuating lever being pulled by a user and showing the lever's other end elevating the bowl's rigid end of the present invention to discharge a discrete quantity of liquid soap from the dispenser.

Figure 5A is an enlarged cross-sectional view of the bowl shown in Figures 3 and 4 while in its at rest configuration.

Figure 5B is an enlarged cross-sectional view of the bowl shown in Figure 5A while in its elevated configuration.

Figure 6A is a cross-sectional view of another preferred bowl shown in its at rest configuration.

Figure 6B is a cross-sectional view of the preferred bowl shown in Figure 6A while in its elevated configuration.

Figure 7A is a cross-sectional view of yet another preferred bowl shown in its at rest configuration.

Figure 7B is a cross-sectional view of the preferred bowl shown in Figure 7A while in its elevated configuration.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figures 1 and 2, there is shown a prior art liquid soap dispenser generally indicated as 10 that is attached to a wall 12 by a wall anchoring means, which generally comprises a mounting bracket 14 and a plurality of screws 16 or other suitable fastening means. Dispenser 10 has two basic components, which are first, an upper liquid

soap reservoir generally indicated as 18, and second, a lower liquid soap emitting section generally indicated as 20. Upper liquid soap reservoir 18 is substantially box-like in configuration and includes a front wall 22, a pair of opposed side walls 24, a rear wall 26, and a lower partition wall 28, all being preferably molded from a thermoplastic material such that walls 22, 24, 26, and 28 are formed integrally with one another. For easy removal of dispenser 10 from wall 12 for repair or cleaning, the dispenser is removably attached to bracket 14 by, for example, providing the top lateral side edge of rear wall 26 with a U-shaped section 30 that hooks over the top edge of bracket 14. In addition, rear wall 26 extends downwardly beyond lower partition wall 28 to form a downwardly extending mounting flange 32 that rests on top of the lower end of mounting bracket 14.

As seen in Figures 1 and 2, the dispenser's upper reservoir 18 is filled with a quantity of liquid soap 34 to a predetermined level such as 36 by removing top lid 37 and pouring bulk liquid soap from a refill jug or container (not shown) into upper reservoir 18. An example of this type of refillable dispenser is generally shown in the hereinbefore incorporated U.S. Patents 4,146,156 and 4,149,573. Alternatively, the present invention has equal applicability to a dispenser of the type that is refilled with a disposable cartridge or pouch. Examples of such dispensers are shown in the hereinbefore incorporated U.S. Patents 4,316,555; 4,322,019; 4,345,627; 4,391,308; 4,391,309; and 4,329,812.

Still referring to Figures 1 and 2, the dispenser's lower soap emitting section 20 includes actuating means, generally indicated as 38, and a pump mechanism generally indicated as 39. Actuating means 38 and pump mechanism 39 are housed within a lower skirt member 40 that is attached about its periphery to the lower surface of lower partition wall 28. Actuating means 38 comprises an actuating lever 41 that is provided with a pivot pin 42, the opposite ends of

which are mounted in pivot brackets 44 for pivotal movement about the pivot pin's axis. Lever 41 has a gripping portion 45 that extends downwardly from pin 42 through opening 46 in lower skirt member 40, and an actuating arm 48 that projects forwardly from pin 42. Lever 41 preferably also has a stop member 47 that projects rearwardly from pin 42 and comes into contact with skirt member 40 when gripping portion 45 is pulled to prevent the user from pulling the lever too far.

Pump assembly 39 comprises a unitary pump housing 50 that is fixedly secured to the bottom surface of lower partition wall 28 by suitable fasteners or glue. Pump assembly 39 is also provided with an obturator diaphragm, generally indicated by the numeral 52, that is preferably formed of a flexible, deformable material such as rubber or the like. The peripheral edge of diaphragm 52 is received in an accompanying recess in pump housing 50 and securely sandwiched between pump housing 50 and the bottom surface of lower partition wall 28. Diaphragm 52 has a plurality of suction apertures 54 therethrough in surrounding relationship with a suction conduit 56 in lower partition wall 28, said conduit providing exclusive fluid communication between upper soap reservoir 18 and lower emitting section 20. Suction apertures 54 define a central web portion that forms a suction obturator 58 disposed initially in contact with the lower surface of lower partition wall 28 for closing the lower end of suction conduit 56. Similarly, diaphragm 52 is provided with a plurality of discharge apertures 60 disposed in surrounding relationship with a discharge conduit 62 and cooperating to define a central web portion that forms a discharge obturator 64 disposed initially in contact with the lower surface of lower partition wall 28 for closing the lower end of discharge conduit 62. Suction conduit 56 and discharge conduit 62 are in fluid communication with one another by means of passageway 66 that is cut in lower partition wall 28 and

covered by insert 68. Finally, received in the opening 70 of pump housing 50 below the suction obturator 58 is a bowl 72 formed of a flexible and resilient material such as rubber. Bowl 72 is provided with a peripheral flange 74 that is fixedly secured to pump housing 50 around the perimeter of opening 70 for closing the same.

When a user wishes to dispense soap from dispenser 10, he pulls the gripping portion 45 of actuating lever 41 forward in the direction of the arrow shown in Fig. 2, which swings actuating arm 48 up such that it compresses and locally deforms bowl 72 to force the liquid soap contained therein upwardly through, in sequence, suction apertures 54 in diaphragm 52, passageway 66, discharge conduit 62, discharge apertures 60, and out the dispenser through a discharge opening 76 cut in lower skirt member 40 via delivery conduit 78. As shown by the small arrows in Fig. 2, the fluid pressure created by compressing bowl 72 forces suction obturator 58 tight up against suction conduit 56 which prevents the soap from flowing back up into upper reservoir 18. Similarly, the same fluid pressure forces discharge obturator 64 away from discharge conduit 62 which allows the soap to enter delivery conduit 78 and flow out of the dispenser through discharge opening 76 and into the user's hand.

When gripping portion 45 of actuating lever 41 is released, the resilience of flexible bowl 72 causes the bowl to expand and exert an aspirating or suction force on discharge obturator 64 and pulls it back up into sealing engagement with discharge conduit 62 to close delivery conduit 78. Simultaneously, the suction created by expanding bowl 72 pulls suction obturator 58 away from suction conduit 56 and draws a new charge of liquid soap 34 from upper reservoir 18 through suction conduit 56 and into bowl 72. Dispenser 10 is then in a condition to dispense another discrete charge of

soap when the user again pulls the gripping portion 45 of lever 41.

As can be seen in Fig. 2, even when handle 41 is pulled to its limit, approximately 66-75% of the bowl's total volume of soap remains inside bowl 72. With a 3 ml bowl, the amount discharged is only 0.7-1.0 ml per each handle pull. It has been found that this scant amount of soap is insufficient to clean the average person's hands, particularly when the soap is of a low concentration. Consequently, the user must typically pull the handle four or five times to receive an adequate amount of soap which subjects the dispenser and its wall anchoring means to a high degree of wear and tear.

Referring now to Figures 3 and 4, dispenser 10' is substantially identical to the dispenser shown in Figures 1 and 2 with the exception of an improved bowl generally indicated as 80. As seen in Figure 3, bowl 80 is substantially cylindrical and comprises a substantially rigid sidewall portion 81, a substantially rigid end 82, and a thin flexible portion 83 joining the two. Preferably, bowl 80 is of unitary construction and can be molded from a wide variety of materials that are both flexible and have a "memory", e.g. butyl, silicone, or latex rubber, or a thermoplastic material such as low density polyethylene or high density polyethylene. As with the dispenser shown in Figs. 1 and 2, bowl 80 is nested within opening 70 of unitary pump housing 50 directly below suction conduit 56 with the bottom surface of rigid end 82 being in sliding contact with actuating arm 48. When a user wishes to dispense soap from dispenser 10', he pulls the gripping portion 45 of actuating lever 41 in the direction of the arrow shown in Fig. 2, which swings actuating arm 48 upward into engagement with rigid end 82 and pushes it up into the interior section of bowl 80 while flexible portion 83 stretches. As rigid end 82 travels up inside bowl 80, the soap contained therein also rises and, as in the dispenser shown in Figs. 1 and 2, flows upwardly

through, in sequence, suction apertures 54 in diaphragm 52, passageway 66, discharge conduit 62, discharge apertures 60, and out the dispenser via discharge opening 76 and delivery conduit 78. As shown by the small arrows in Fig. 4, the fluid pressures created by elevating rigid end 82 forces suction obturator 58 tight up against suction conduit 56 which prevents the soap from flowing back up into upper reservoir 18. Similarly, the same fluid pressures force discharge obturator 64 away from discharge conduit 62 which allows the soap to enter delivery conduit 78 and flow out into the user's hand.

When gripping portion 45 of actuating lever 41 is released, the elasticity and "memory" of flexible portion 83 draws rigid end 82 back to its original position, as shown in Fig. 3. In addition, actuating lever 41 can also be provided with a spring that will pull lever 41 back to its original position. The downward movement of rigid end 82 exerts an aspirating or suction force on discharge obturator 64 and pulls it back up into sealing engagement with discharge conduit 62 to close delivery conduit 78. Simultaneously, the same aspirating force also pulls suction obturator 58 away from suction conduit 56 and draws a new charge of liquid soap 34 from upper reservoir 18 through suction conduit 56 and into bowl 80. Dispenser 10' is then in a condition to dispense another discrete charge of soap when the user again pulls the gripping portion 45 of lever 41.

As mentioned earlier herein, although bowl 80 is approximately the same size as the prior art, semi-spherical bowl 72, bowl 80 has approximately a 50-75% voiding efficiency as compared to a 25-33% voiding efficiency for bowl 72. The approximately double efficiency of bowl 80 means that the user must pull actuating lever 41 only about half as many times to receive the same amount of soap as when bowl 72 is utilized, which in turn significantly reduces the wear and tear that dispenser 10' and its wall anchoring means are

subjected to, thereby significantly increasing the dispenser's effective life.

Figures 5A and 5B are enlarged cross-sectional views of bowl 80 with Fig. 5A showing rigid end 82 in its at rest condition as seen in Fig. 3, and with Fig. 5B showing rigid end 82 in its elevated condition as seen in Fig. 4. Fig. 5B shows how substantially rigid end 82 resists localized deformation while thin portion 83 stretches and how the lowermost edge of sidewall portion 81 curls inward to a small degree when rigid end 82 is pushed up inside the interior cavity of bowl 80. When lever 41 is released, the elasticity and "memory" of thin portion 83 pulls rigid end 82 back to its at rest position as seen in Fig. 5A. To achieve the requirements of elasticity, "memory" and durability, bowl 80 is preferably molded from a silicone or urethane rubber, an example of the latter being A-7 available from American Cyanamide, Co., One Canyon Plaza, Wayne, New Jersey 07470.

Figures 6A and 6B illustrate another preferred embodiment of the present invention. In Fig. 6A, bowl 90 has a substantially rigid sidewall portion 81, a substantially rigid end 92, and a thin portion 93. Thin portion 93, which joins sidewall portion 91 to rigid end 93, is initially folded in a U-configuration that unfolds as opposed to stretching as rigid end 92 is pushed up into the interior of bowl 100, as seen in Fig. 7B. For this type of bowl construction, it is highly preferred that actuating lever 41 be spring-loaded and that actuating arm 48 be firmly attached to rigid end 93 so as to draw it back to its initial at rest position. Although there would be increased costs associated with the spring and the securement required between rigid end 93 and actuating arm 48, one advantage of this type of bowl design is that thin portion 93 is less susceptible to early fatigue and rupture.

Figures 7A and 7B illustrate yet another preferred embodiment of the present invention. In Fig. 7A, bowl 100 has a sidewall portion 101, a substantially rigid end 102, and a transition area 103 that is of substantially the same thickness as sidewall portion 101. As seen in Fig. 7B, transition area 103 rolls up into a folded configuration as rigid end portion 102 is pushed up into the interior of bowl 100. As with the bowl shown in Fig. 5A, the elasticity and "memory" of transition area 103 draws rigid end 102 back to its original at rest position when lever 41 is released. Preferably, bowl 100 is injection molded ethylene propylene rubber, e.g. Epcar ®, which is available from the B. F. Goodrich Co., 500 S. Main Street, Akron, Ohio 44318. Alternatively, bowl 100 can be thermoformed from a thermoplastic material such as low density polyethylene or high density polyethylene.

From the preceding description and illustrations, it will be apparent to those skilled in the art that many different configurations and variations of the present invention may be practiced to achieve the present invention's objectives. Accordingly, the following claims are intended to embrace all such configurations and variations that fall within the spirit and scope of the present invention.

CLAIMS

1. A dispenser for dispensing a discrete, predetermined quantity of liquid, said dispenser comprising:

(a) a closed wall structure defining a liquid reservoir, said liquid reservoir having a bottom surface;

(b) a pumping mechanism attached to said bottom surface of said liquid reservoir and in fluid communication with said reservoir for dispensing a liquid therefrom, said pumping mechanism including a hollow cylindrical bowl having an open end defined by a continuous side wall and a moveable, substantially rigid closed end located opposite said open end, said rigid end being connected about its periphery to said sidewall;

(c) a discharge conduit, said discharge conduit being in fluid communication with said pumping mechanism; and

(d) means for moving said rigid end of said bowl within the cross-section defined by said side walls and toward said open end of said bowl thereby discharging said liquid from within said bowl to the exterior of said dispenser through said discharge conduit.

2. A dispenser for dispensing a discrete, predetermined quantity of liquid, said dispenser comprising:

(a) a closed wall structure defining a liquid reservoir, said liquid reservoir having a bottom surface;

(b) a pumping mechanism attached to said bottom surface of said liquid reservoir and in fluid communication with said reservoir for dispensing a liquid therefrom, said pumping mechanism including a hollow cylindrical bowl having an open end defined by a continuous

side wall and a moveable, substantially rigid closed end located opposite said open end and connected about its periphery to said sidewall with a thin, flexible portion;

(c) a discharge conduit, said discharge conduit being in fluid communication with said pumping mechanism; and

(d) means for moving said rigid end of said bowl within the cross-section defined by said side walls and toward said open end of said bowl thereby discharging said liquid from within said bowl to the exterior of said dispenser through said discharge conduit.

3. A dispenser for dispensing a discrete, predetermined quantity of liquid, said dispenser comprising:

(a) a closed wall structure defining a liquid reservoir, said liquid reservoir having a bottom surface;

(b) a pumping mechanism attached to said bottom surface of said liquid reservoir and in fluid communication with said reservoir for dispensing a liquid therefrom, said pumping mechanism including a hollow cylindrical bowl having an open end defined by a continuous side wall and a moveable, substantially rigid closed end located opposite said open end and connected about its periphery to said sidewall with a flexible transition area;

(c) a discharge conduit, said discharge conduit being in fluid communication with said pumping mechanism; and

(d) means for moving said rigid end of said bowl within the cross-section defined by said side walls and toward said open end of said bowl

thereby discharging said liquid from within said bowl to the exterior of said dispenser through said discharge conduit.

4. The dispenser as recited in Claims 1, 2, or 3 further comprising:

(e) a lower skirt member, said lower skirt member surrounding said pumping mechanism and being attached to said bottom surface of said liquid reservoir.

5. The dispenser as recited in Claim 4 wherein said means for moving said substantially rigid end of said bowl toward said open end of said bowl comprises a lever, said lever being pivotally mounted to said lower skirt member and having a first end and a second end, said first end extending downwardly to a point exterior of said lower skirt member, said second end being in sliding contact with said substantially rigid end of said bowl.

6. The dispenser as recited in Claims 1, 2, or 3 wherein said substantially rigid closed end of said bowl is planar.

7. The dispenser as recited in Claims 1, 2, or 3 wherein said hollow cylindrical bowl is made from a material selected from the group consisting of butyl, silicone, latex, and urethane rubber.

8. The dispenser as recited in Claims 1, 2, or 3 wherein said hollow cylindrical bowl is made from a thermoplastic material.

9. In a system for dispensing a discrete, predetermined quantity of liquid from a reservoir containing

said liquid, said system including a flexible, resiliently deformable bowl, liquid communication means between said reservoir and said bowl, and a moveable lever in contact with said bowl and which deforms said bowl when pulled to discharge said liquid from within said bowl, the improvement wherein said bowl is cylindrical and has an open end defined by a continuous side wall and a substantially rigid closed end located opposite said open end and connected about its periphery to said continuous side wall, said rigid closed end being in sliding contact with said lever and being moveable within the cross-section defined by said side walls toward said open end of said bowl when said lever is pressed against said rigid closed end of said bowl to discharge the liquid contained therein therefrom.

Fig. 1
PRIOR ART

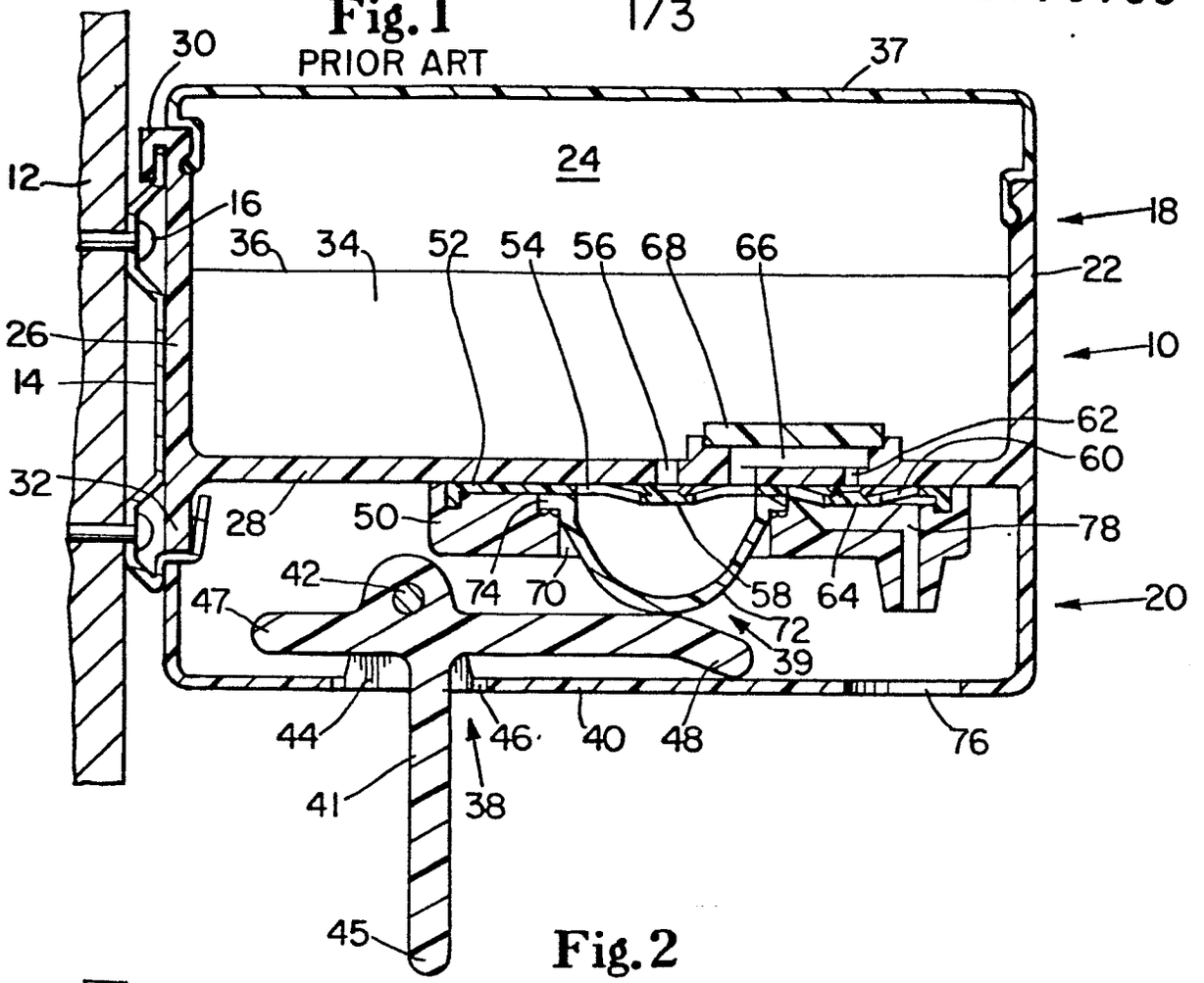

Fig. 2
PRIOR ART

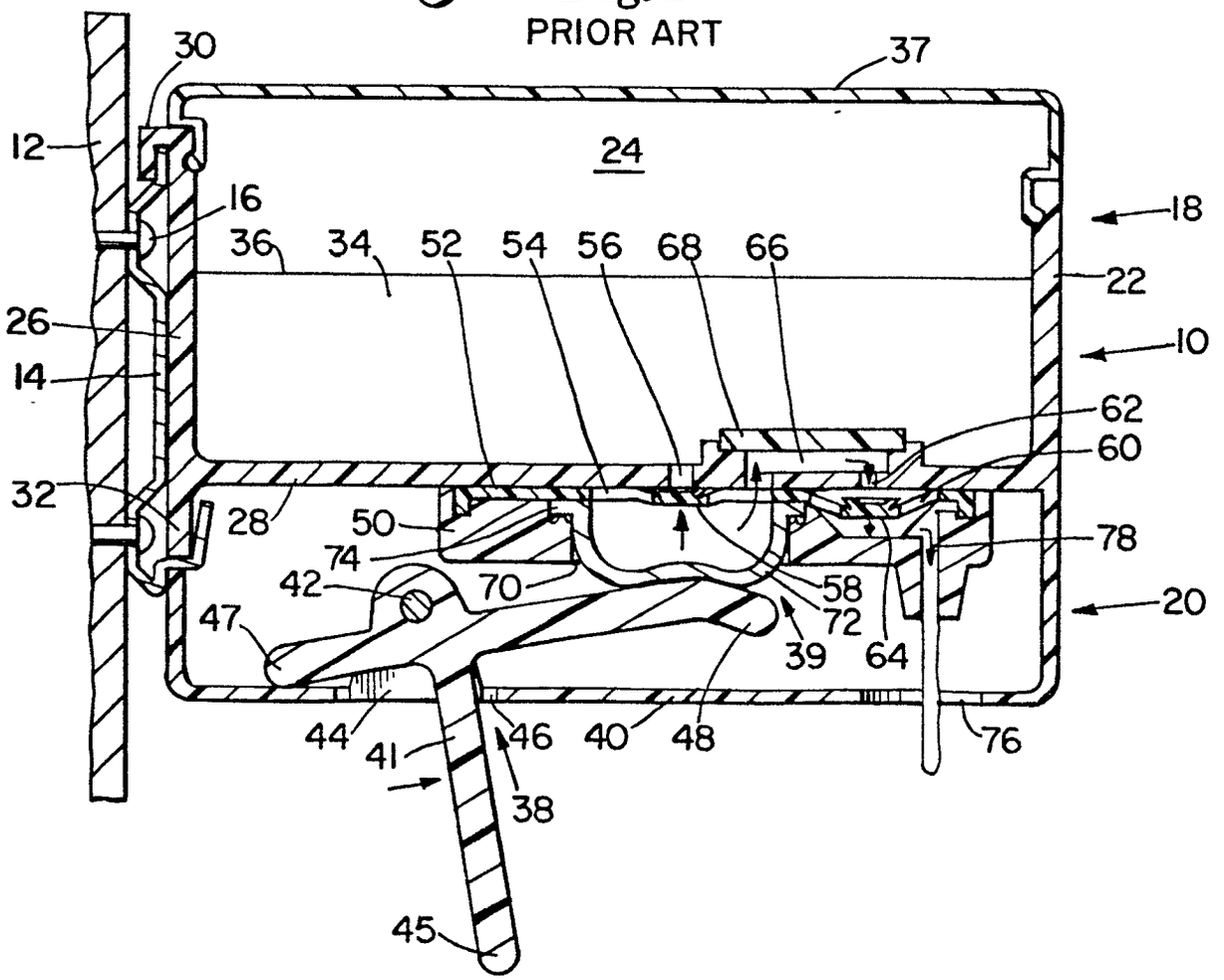

Fig. 3

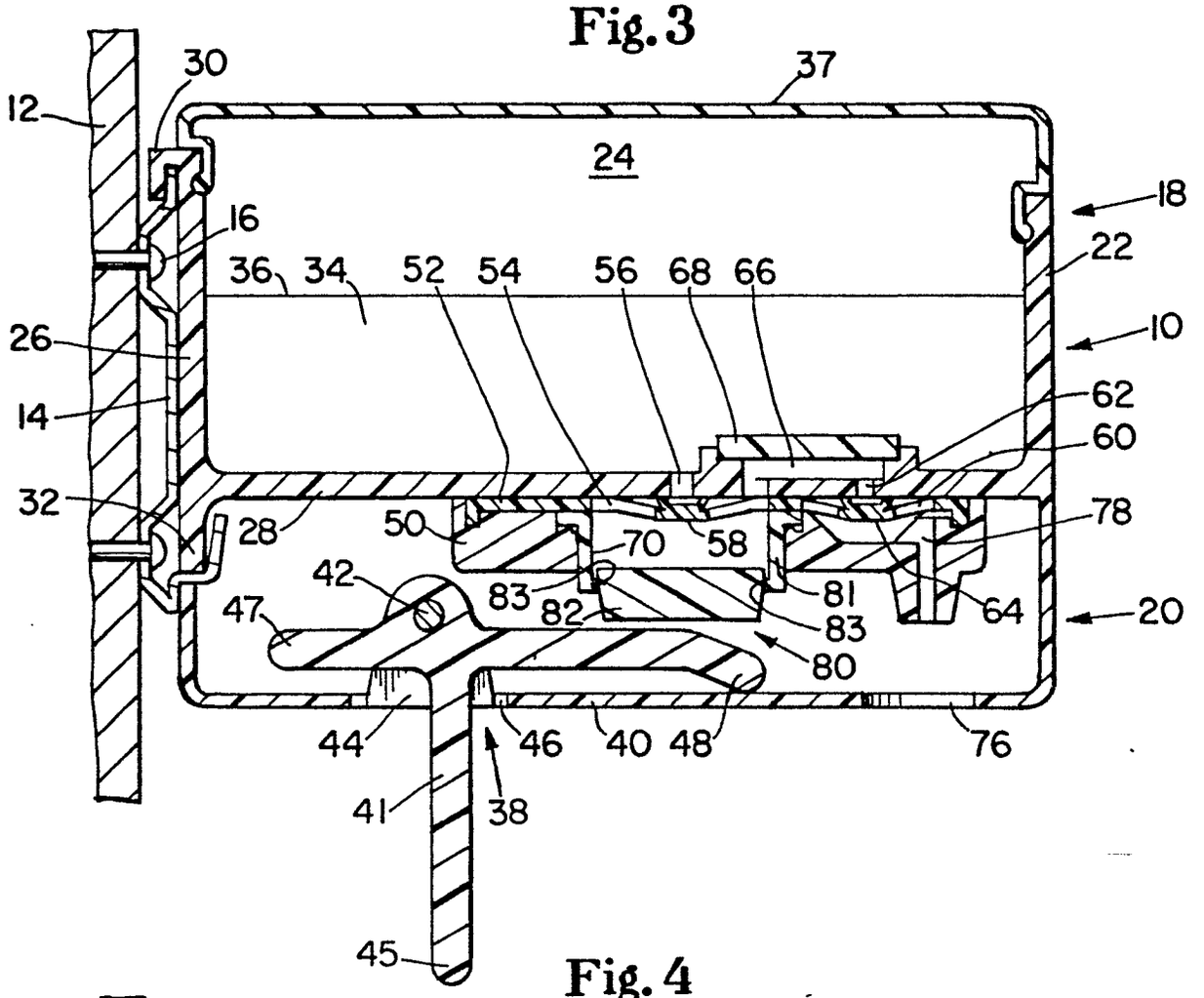
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Fig. 4

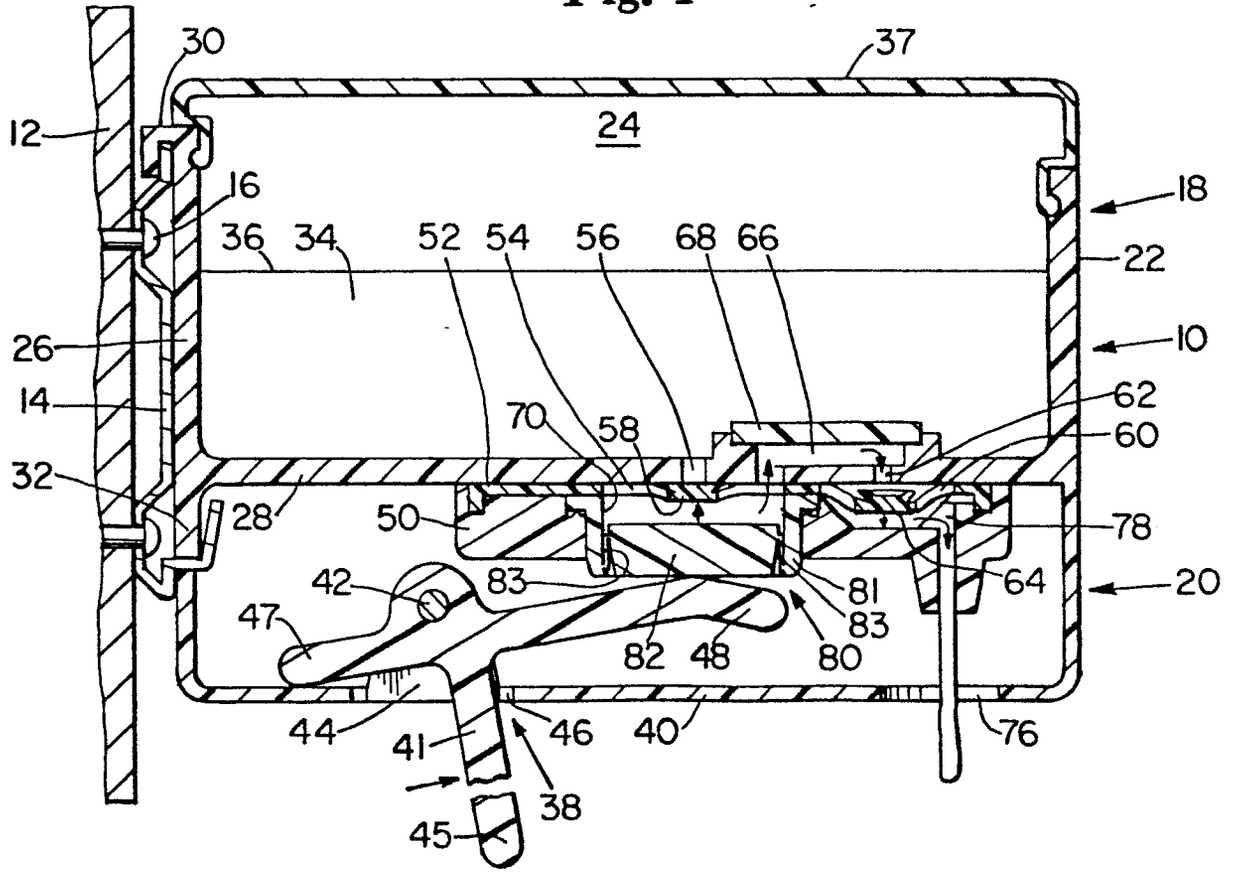
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Fig. 5A

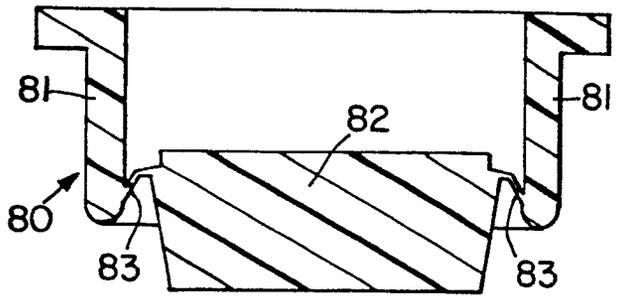

Fig. 5B

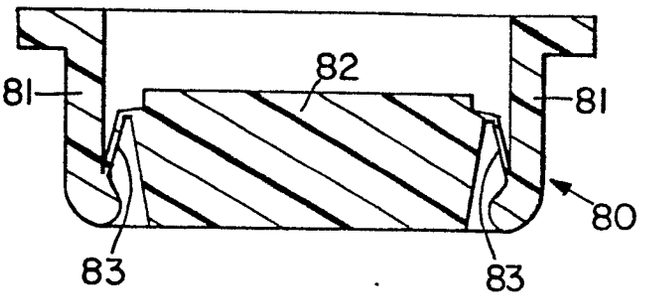

Fig. 6A

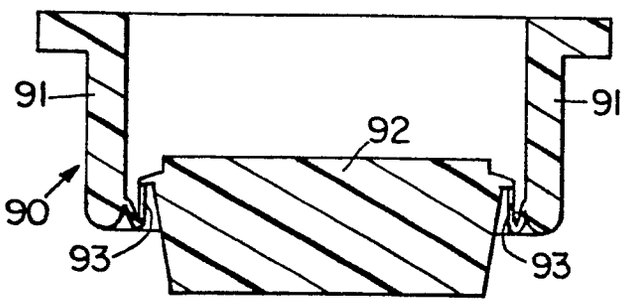

Fig. 6B

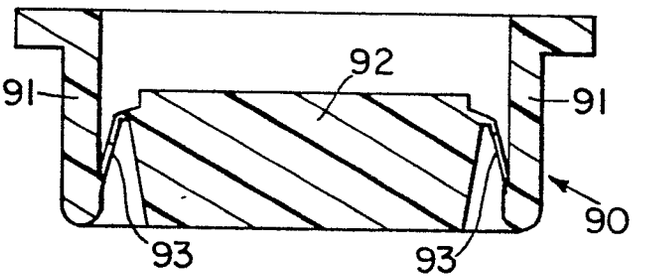

Fig. 7A

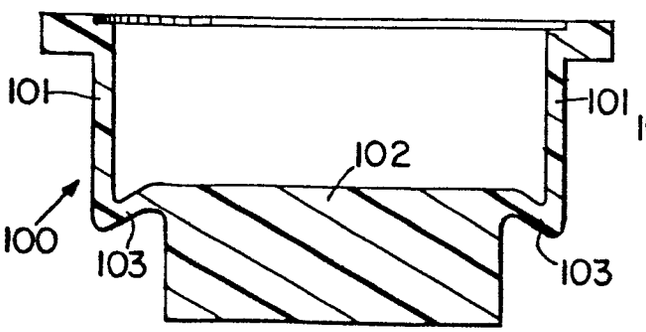

Fig. 7B