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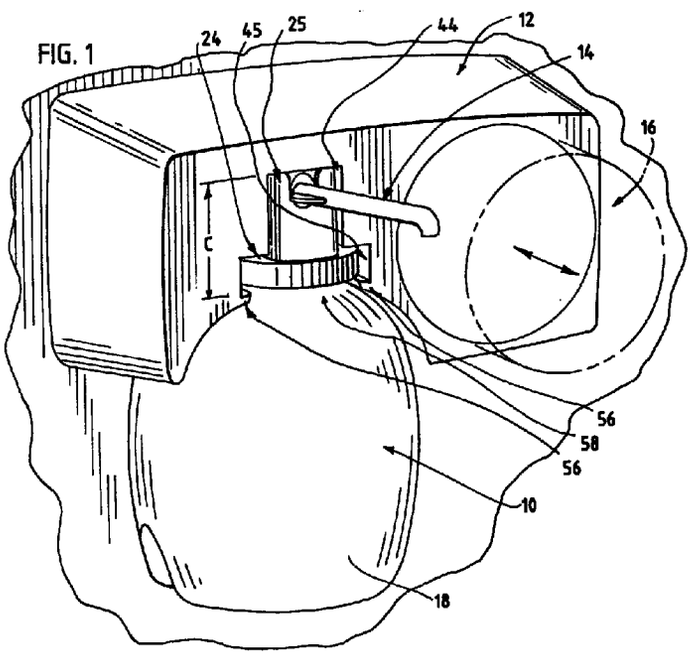
(54) Foamable liquid dispenser

(57) A liquid dispenser (10) for selectively dispensing either foamed or unfoamed liquid (L), such as liquid soap, includes a housing (18) having a liquid storage cavity (200 arranged for entry (46) of pressurized displacement fluid (D); a discharge conduit (34, 14) in fluid communication with said liquid storage cavity (20) to dispense the stored liquid (L); foaming structure (64, 66) for selectively producing foaming of the liquid dispensed through the discharge conduit (34, 14) in selectable alternative to dispensing of unfoamed liquid therethrough; and a switch structure (66) arranged in the discharge conduit (34) for selectively activating said liquid foaming.

FIG. 1



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Description

Background of the Invention

The present invention relates to liquid dispenser devices and more particularly relates to devices for foaming and dispensing foamable liquids.

Numerous foam dispensing devices particularly adapted for foaming and dispensing liquid soap are described for example in U.S. Patent Nos. 4,531,660; 4,957,218; 5,222,633; and 5,238,155. Only the latter patent 5,238,155 describes a foamable liquid dispenser capable of alternatively dispensing either foamed or unfoamed liquid, however, the multiple devices described in this patent require foam producing devices having complex construction including arrangements of partially gas permeable walls for aeration foaming of the liquid as well as either a squeeze bottle or external aeration flow lines for separate optional supply of air to foam the liquid. These disadvantages are eliminated by the foamable liquid dispensers in accordance with the present invention.

Summary of the Invention

In accordance with the present invention, a liquid dispenser for selectively dispensing either foamed or unfoamed liquid, such as liquid soap, includes a housing having a liquid storage cavity arranged for entry of pressurized displacement fluid; a discharge conduit in fluid communication with said liquid storage cavity to dispense the stored liquid; foaming structure for selectively producing foaming of the liquid dispensed through the discharge conduit in selectable alternative to dispensing of unfoamed liquid therethrough; and a switch structure arranged in the discharge conduit for selectively activating said liquid foaming.

In preferred embodiments of the present invention, a valve is arranged in the discharge conduit in order to selectively bleed a portion of displacing air from the head space of the liquid cavity to generate the selective foaming of the liquid. Additionally preferred features include a rotatable spout which prevents any leaking of the dispenser liquid during storage and handling, and an internally dislodgable sealing plug which seals an intake port connectable to the source of displacement fluid to drive displacement of the liquid in the dispensing operation. Additional aspects of the invention also include a receptacle into which the dispenser is removably insertable which also provides self-aligning coupling of the displacement fluid flow passageways from the displacement fluid source into the liquid storage cavity.

Brief Description of the Drawings

FIG. 1 is a perspective view of one embodiment of a foamable liquid dispenser in accordance with the present invention, installed in a wall-mounted receptacle which provides a source of pressurized displacement fluid;

FIG. 2 is a perspective view of the dispenser of FIG. 1 removed from the receptacle;

FIG. 3, 4 and 5 are fragmentary sectional views illustrating progressive insertion and coupling of the liquid dispenser into the receptacle of FIG. 1;

FIG. 6 is a top plan view of the dispenser of FIGS. 1 and 2 additionally illustrating fragmentary portions of the receptacle installation of FIG. 1;

FIGS. 7 and 8 are fragmentary sectional views similar to FIG. 5 showing comparative rotation of the dispenser discharge spout; and

FIG. 9 is a fragmentary sectional view of a portion of FIG. 7 illustrating comparative closing of a valve which provides for selective foaming of the dispensed liquid.

Detailed Description of the Preferred Embodiment

Referring to FIGS. 1 and 2, one embodiment of a liquid storage container and dispenser in accordance with the present invention is generally designated by a reference character 10. In the illustrated embodiment, the dispenser bottle 10 is removably installed in a wall-mounted receptacle unit 12. The receptacle 12 incorporates a source of pressurizing displacement fluid, preferably air, which is introduced into the inserted dispenser 10 to displace and dispense stored liquid from the dispenser spout 14. The illustrated receptacle 12 incorporates a manually or electrically operated bellows 16 or other air pump structure which generates the air drive for the liquid dispensed, although alternative pneumatic or other displacement fluids can be employed as suited to the dispensed liquid and respective use. In preferred application, liquid soap may be stored within replaceable dispensers 10 retained in the receptacle 12 for convenient dispensing and use for example by medical personnel.

In preferred embodiment, the dispenser 10 enables dispensing the liquid soap as an aerated or foamed lather from the spout 14 but may also alternatively dispense the liquid soap in unfoamed condition in convenient alternative as more fully described hereinafter.

Referring to FIGS. 2 and 5, the dispenser 10 has a molded bottle housing wall 18 which is rigid to withstand pressurizing without distortion, and an interior cavity 20 for storage of a predetermined volume of foamable liquid L, typically liquid soap. As shown in FIG. 5, the bottle wall 18 has an opening mouth 22 which is closed by a cap structure generally designated by reference character 24. The cap structure 24 includes a dip tube 26 for delivery of the liquid soap leading to the spout 14 which is also carried on the cap structure. The cap structure

24 is snap-fit over the bottle mouth 22 employing respective barb joint structures 27,28 on the cap and bottleneck, in order to facilitate assembly, to prevent attempted refilling, and to promote disposability of the dispensers 10.

Referring again to FIG. 5, the dip tube 26 opens into a throat and seat 30 and check ball 32 forming a one-way valve structure integrated into the cap structure 24. The one-way valve structure will maintain a column of liquid within the dip tube 26 as well as the tubing downstream, so that liquid is available from the spout 14 immediately upon initial pump operation. As best shown in FIGS. 7 and 9, the check ball valve structure 30,32 opens liquid flow from the dip tube 26 into a connecting tube 34 formed in the cap structure 24. The connecting tube 34 leads liquid flow into a coupling tube structure 36 integrated into the cap structure 24. The coupling tube structure 36 receives a tubular, spout adaptor elbow structure 38 which is molded to include both a vertical portion 40 and an angular portion 42. The angular portion 42 enables slight incline of the dispenser spout 14 to enable residual foamed or unfoamed liquid to drain back and prevent dripping from the spout between dispensings. The angular portion 42 also provides journaling of the rear portion 15 of the linearly projecting dispenser spout 14 which enables the spout to be rotatable as shown in the comparison of FIGS. 7 and 8. In FIG. 7, the spout 14 is rotated so that the bend of the discharge port 17 is directed downwardly for soap discharge and in this orientation, the flow orifice 19 through the wall of the journaled rear spout portion 15 is aligned for flow communication with the effluent aperture 41 of the vertical elbow portion 40 to provide flow entry into the spout along the path indicated by directional arrows A. For handling and storage of the dispensers 10, FIG. 8 shows the spout 14 rotated 180° relative to the orientation in FIG. 7 so that the discharge port 17 is directed upwardly and the flow orifice 19 is similarly rotated upwardly out of alignment communication with the effluent aperture 41 which is then obstructed by the wall of the spout portion 15 to prevent any leaking of fluid into and from spout 14 even if the check valve ball 32 is unseated for example by inversion of the dispenser 10 during handling or transport. As shown in FIG. 6, the spout 14 is provided with grip flanges 13 to facilitate rotation.

Referring again to FIGS. 1 and 2, the receptacle 12 has a segmented slot structure 44 which opens through both the front and bottom of the receptacle 12 and into which the dispenser bottle 10 is inserted into operative installation and air drive connection. In the illustrated embodiment, the dispenser cap structure 24 has a protective, U-shaped guide wall 25 which not only protects the connective tubing in the cap, but also forms an orienting guide for the insertion of the cap structure 24 into the slot structure 44 for progressive, self-alignment of the air drive intake tube 46 integrated into the cap structure 24 with the air drive delivery tube 48 of the receptacle 12 from the air pump 16. The progressive insertion of the dispenser bottle 10 as shown in FIGS. 3-5 also illustrates the storage sealing plug 50 which slightly projects from the intake opening 47 of the air intake tube 46 which the plug seals during storage and handling of the dispenser 10 until operative installation enters into the receptacle 12. FIG. 3 illustrates that the insertion of the dispenser bottle 10 into the receptacle 12 in direction indicated by arrow B, is guided as aforementioned so that the projecting top of the plug 52 engages and is forced downwardly as shown in FIG. 4 against wedging ramp surface 54 which extends from the air drive connecting tube 48. When the dispenser 10 reaches the fully inserted and installed position shown in FIG. 5, the sealing plug 50 has been entirely dislodged and driven from the intake tube 46 so that the plug drops into the storage cavity 20 where it may merely float upon the foamable liquid without interference in the liquid displacement operation. The removal of the plug 50 fully opens the air drive flow communication between the intake tube 46 and the air drive connecting tube 48 which carries an O-ring 49 seating against the intake opening 47 to seal the drive air flow from the pump 16 into the head space of the liquid storage cavity 20 in the dispenser 10 as shown in FIG. 7.

Referring again to FIG. 1, in order to provide retaining support for the installation of the dispenser 10, the receptacle slot 44 has a medial portion 45 which includes spaced, opposing shoulder rails 56 upon which the annular lower edge 58 of the cap structure 24 is slidably supported as additionally shown in FIG. 6. The height C of the slot 44 is dimensioned so that the upper edge 60 of the U-shaped wall 25 is engaged against or very slightly spaced from the overhead surface wall 62 of the slot 44 as best shown in FIG. 5, in order to insure that the top of the sealing plug 52 engages and is dislodged downwardly by the wedging ramp 54 projecting from the receptacle 12 into the slot 44.

In operation, with particular reference to FIG. 7, activation of the air pump 16, for example, manual operation of a piston pump, produces delivery of drive air through the tubes 48 and 46 as indicated by the directional arrows D which pressurizes the head space within the liquid storage cavity 20 of the dispenser 10 which produces pressurized displacement of the foamable liquid upwardly through the dip tube 26 along the liquid flow path indicated by arrows E. The liquid flow pressure maintains the unseated lift of the check ball 32 and liquid flow into the tube 34. The pressurized drive air also flows across the head space 20a and upwardly along the dispenser wall 18 along the path indicated by arrows F leading to a bleed orifice 64 which is alternatively either opened or closed by a rotatable switch valve structure 66 and flow slot 68. In FIG. 7, the flow slot 68 allows the pressurized air to flow therethrough into the chamber 34 resulting in turbulent air mixture with liquid flowing past the check ball 32. The resulting aerated liquid foam flows from the tube 34 through a first, screen element 70 followed by a second, screen element 72 which served to fragment the aerated liquid into succes-

sively finer bubbles which are expelled along the pathway A from the spout discharge port 17. The dual screen elements 70,72 can be woven or non-woven porous materials suitable to promote generation of a finely-bubbled, foamed liquid. Particularly finely-bubbled liquid soap results have been obtained using two screen elements of the same non-woven polyester obtained from Midwest Filtration Co. which produced generally uniform, fine bubbles and a "wetter" lather and which can be conveniently distributed and retained in antiseptic treatment of hands without need for distribution and dilution of the soap with water which may then be used only for removal of the soap. The dual screen elements also promote bubble subdivision to accommodate variable viscosity of the soap or other liquid to be foamed.

As shown in FIG. 9, when unfoamed liquid mad be desired as an alternative to dispensing of aerated liquid, the bleed valve structure 66 need only be conveniently rotated to operate as a switch to close the bleed orifice with rotation of the channel 68 to prevent air flow communication from the head space of the storage cavity 20a into the tube 34. The convenient switch from dispensing either foamed or unfoamed liquid enables for example personal preferences among multiple medical personnel employing a single liquid soap dispenser.

While a preferred embodiment of the present invention is shown and described, it is envisioned that those skilled in the art may devise various modifications and equivalents without departing from the spirit and scope of the appended claims.

Claims

1. A liquid dispenser (10) for selectively dispensing foamed liquid therefrom, comprising: a housing (18) having a liquid storage cavity (20) arranged for entry of a displacement fluid (D); a discharge conduit (34, 14) in fluid communication with said liquid storage cavity (20) for dispensing said liquid (L) therethrough; and foaming means for selectively producing foaming of said liquid (L) dispensed through said discharge conduit (34, 14) in selective alternative to unfoamed dispensing of said liquid therethrough; characterized by:

   switch means (66) arranged in the discharge conduit (34, 14) for selectively activating said liquid foaming.

2. A liquid dispenser (10) according to claim 1, characterized in that said foaming means comprises aeration means (64, 68) for selectively introducing gas (D) into said discharge conduit (34, 14) to produce foaming mixture of said gas and said liquid dispensed therethrough.

3. A liquid dispenser according to claim l, further characterized by a displacement fluid flow passageway (46) opening into said liquid storage cavity (20), said flow passageway (46) being connectable to a supply source (12) for said displacement fluid (D). and a branch passageway (20a) for said displacement fluid (D) from said passageway (46) to said foaming means (64, 68) for selectively introducing said displacement fluid (D) into said discharge conduit (34, 14) to produce foaming mixture thereof with said liquid dispensed therethrough.

4. A liquid dispenser according to claim 3, characterized in that said displacement fluid branch passageway (20a) comprises a portion of said liquid storage cavity (20).

5. A liquid dispenser according to claim 4, characterized in that said portion of said liquid storage cavity (20a) provides displacement fluid flow communication to said switch means (66) through which said displacement fluid (D) is selectively introduced into said discharge conduit (34, 14) for said liquid foaming therein.

6. A liquid dispenser according to claim 1, characterized in that said housing (18) comprises a container body (18) including said liquid storage cavity (20) having an opening mouth (22) and a cap (24) closing said opening mouth, wherein said foaming means (64, 66) is arranged on said cap (24).

7. A liquid dispenser according to claim 6, wherein said switch means (66) comprises valve means (66) on said cap (24) for selectively introducing foaming fluid (D) into said discharge conduit (34, 14) to produce foaming mixture of said liquid dispensed therethrough.

8. A liquid dispenser according to claim 1; characterized by: a dispensing spout (14) in fluid communication from said discharge conduit (34); and

   obstructing means (15) arranged on said dispensing spout (14) for selectively blocking flow of said liquid through said spout.

9. A liquid dispenser according to claim 8, characterized in that said obstructing means (15) comprises a journal structure (42) for rotation of said dispensing spout (14) between a first position enabling said fluid communication with said discharge conduit (34) and a second position in which said fluid communication is blocked.

10. A liquid dispenser according to claim 1 characterized by an intake passageway (46) for displacement fluid flow (D) into said liquid storage cavity (20) said intake passageway (46) having a movable seal means (50) for sealing said intake passageway (46) until unseating therefrom for displacement fluid flow (D) through said intake passageway (46) into said liquid storage cavity (20).

11. A liquid dispenser (10) characterized by a combination with receptacle means (12) for receiving insertion of at least a portion (24) of said liquid dispenser and wherein said receptacle mens (12) comprises dislodging means (54) for deflecting a seal means (50) to enable displacement fluid flow (D) through said intake passageway (46).

FIG. 1

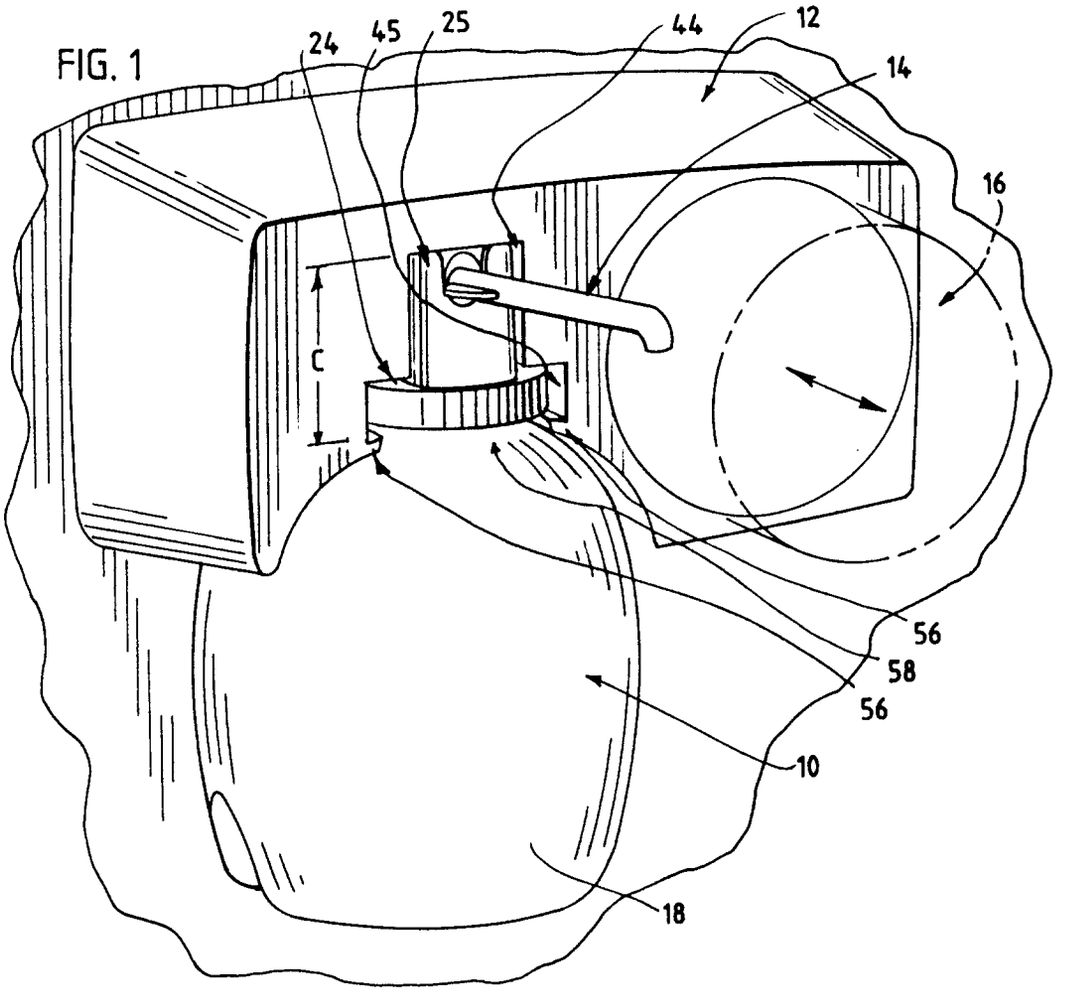


FIG. 2

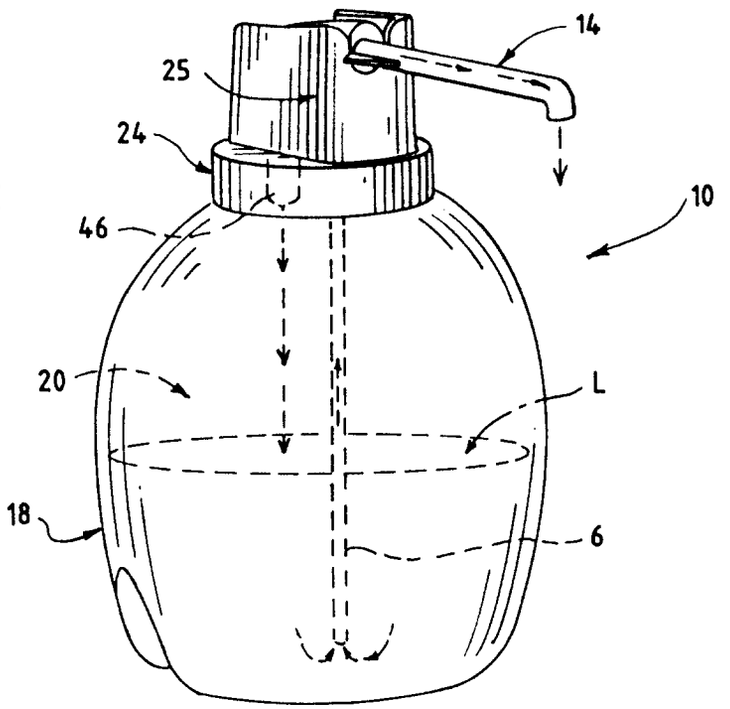


FIG. 3

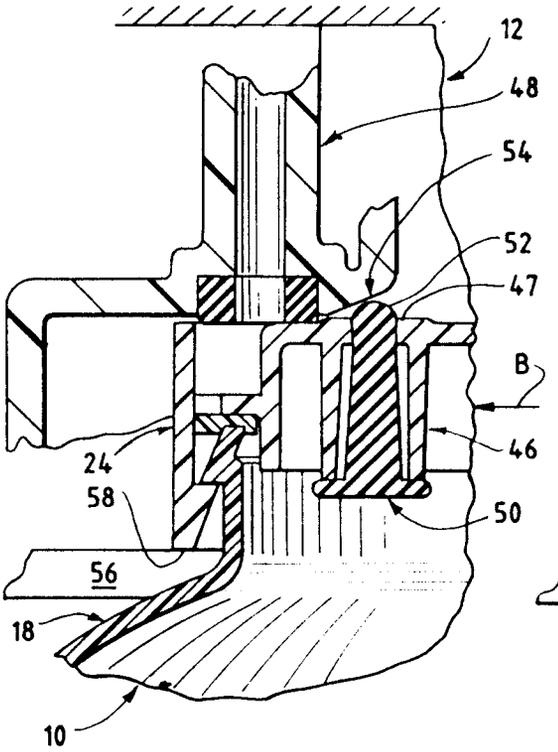


FIG. 4

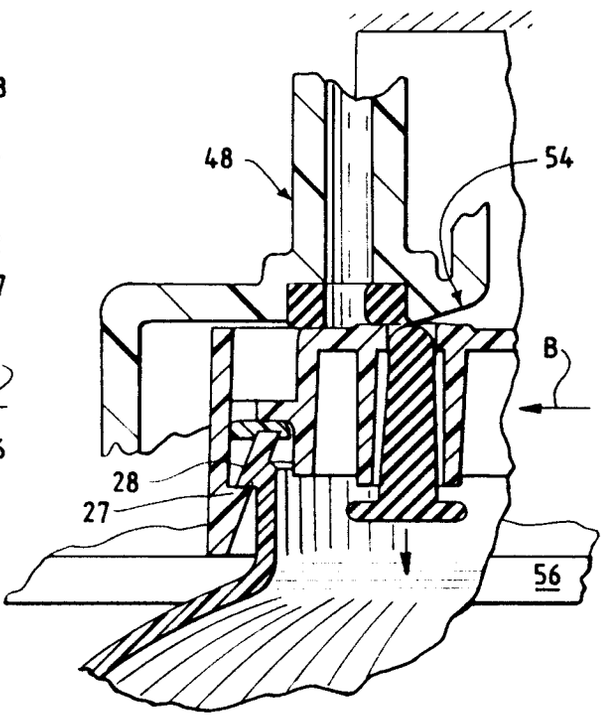
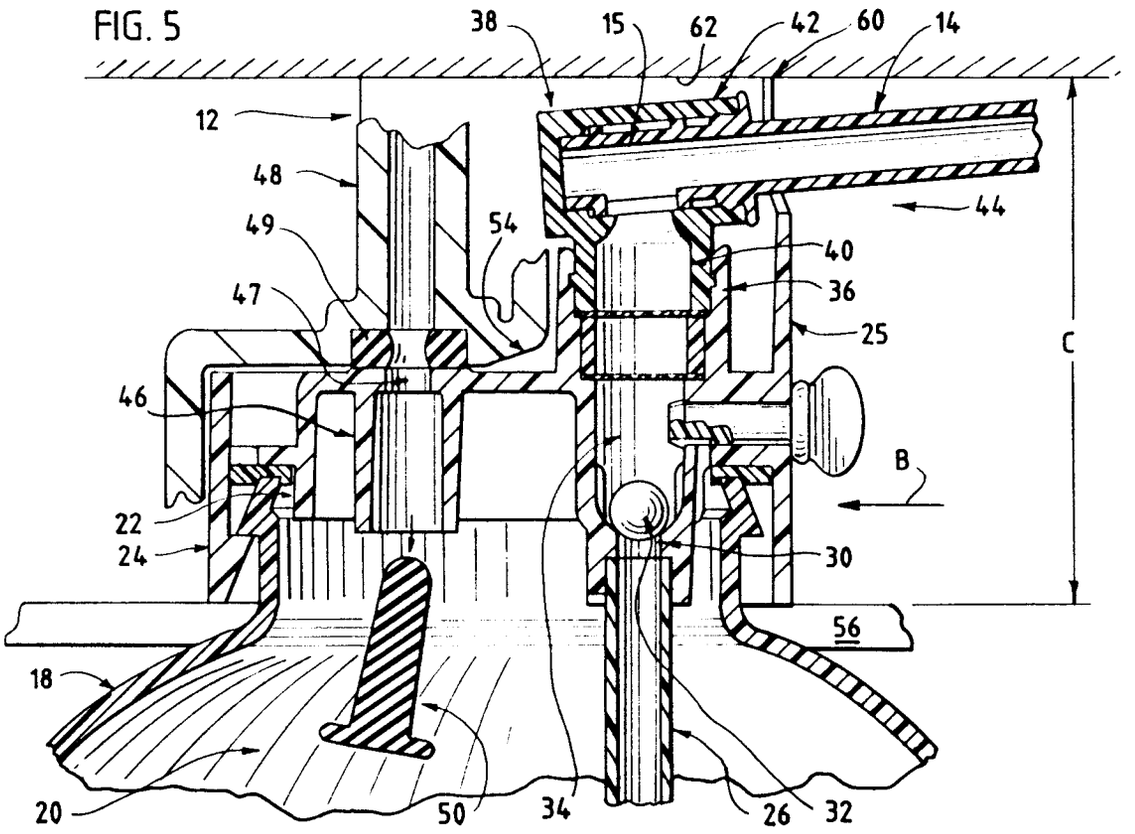


FIG. 5



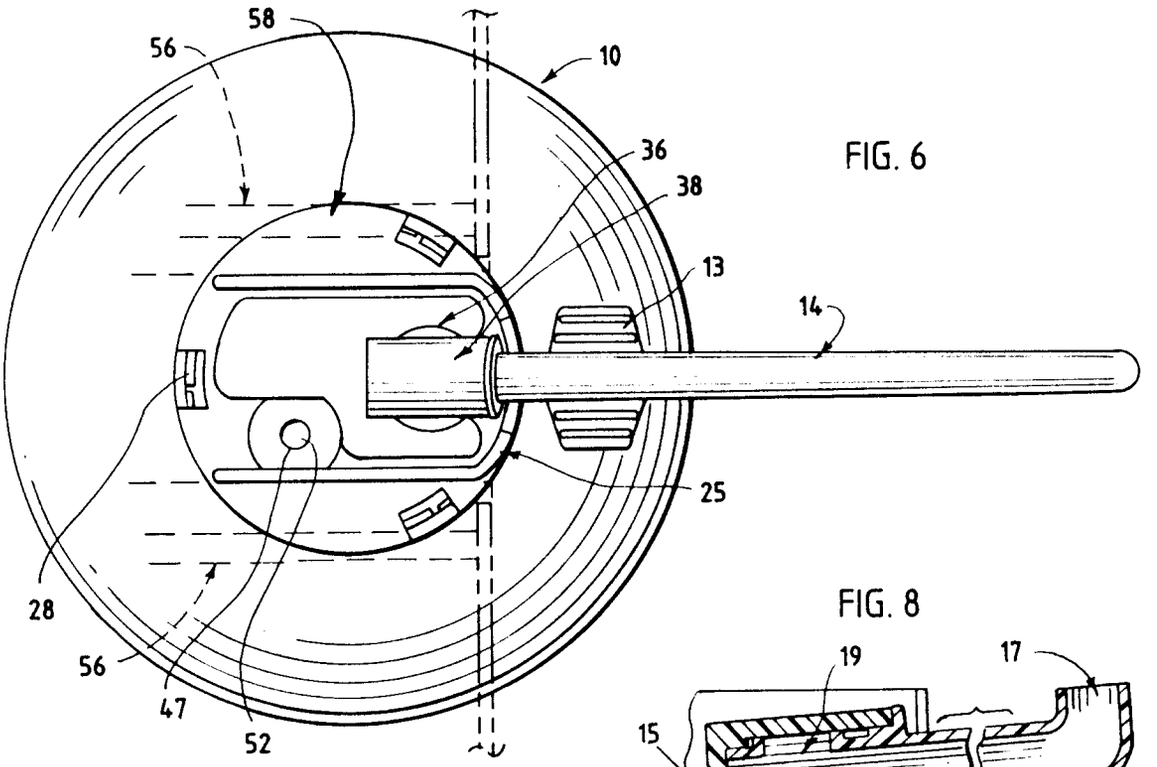


FIG. 6

FIG. 8

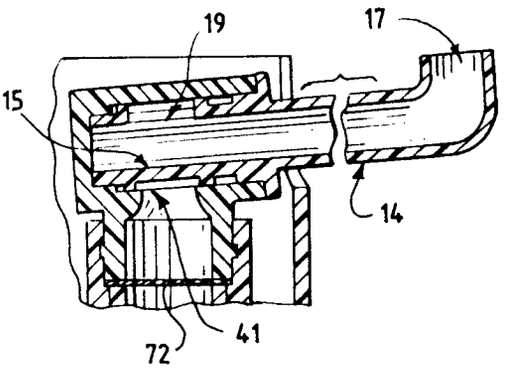


FIG. 7

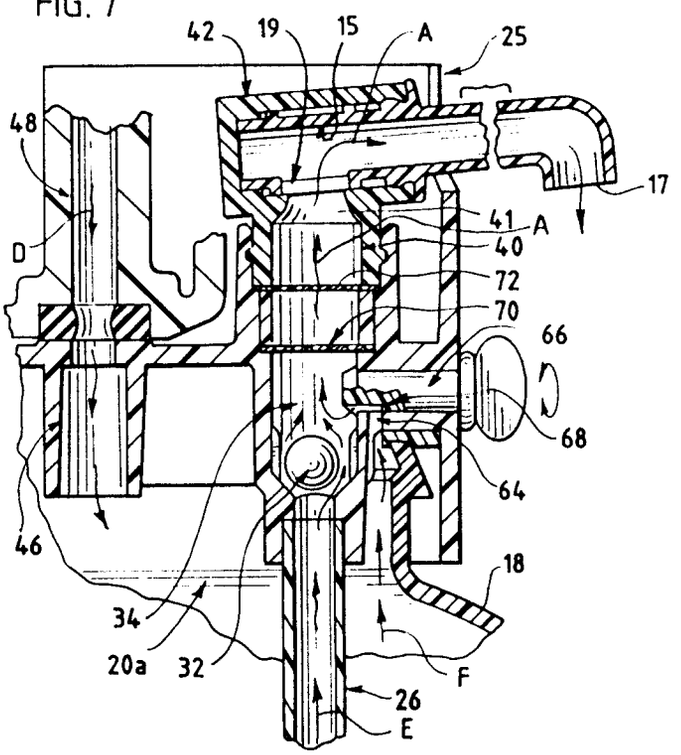


FIG. 9