United States Patent

[11] 3,622,049

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[21] Appl. No. **821,572**
[22] Filed **May 5, 1969**
[45] Patented **Nov. 23, 1971**
[73] Assignee **Shering Corporation**
Bloomfield, N.J.
The portion of the term of the patent subsequent to Oct. 10, 1984, has been disclaimed.

[54] **DISPENSING SYSTEM**
1 Claim, 11 Drawing Figs.

[52] **U.S. Cl.** **222/190,** 222/189, 222/211, 222/207, 239/343, 239/327
[51] **Int. Cl.** **B67d 5/58**
[50] **Field of Search** 222/189, 211, 321, 187, 146, 207, 546, 190; 239/327, 344, 343

[56] **References Cited**

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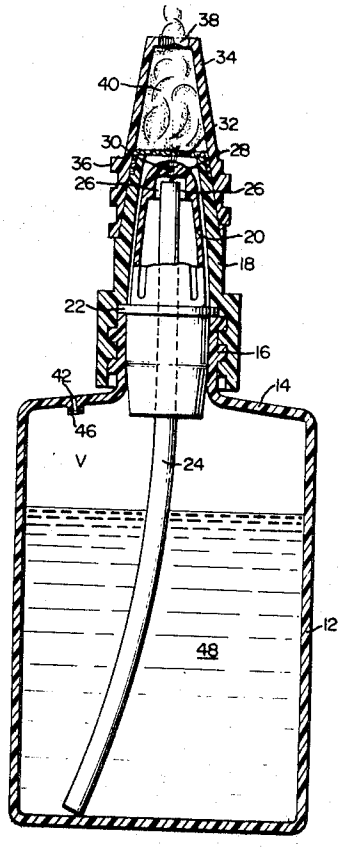
Primary Examiner—Samuel F. Coleman
Assistant Examiner—James M. Slattery
Attorney—Stowell and Stowell

ABSTRACT: A dispenser for dispensing foamable formulations. The liquid is placed in the container portion and exits through a nozzle in the form of a foam. When the walls of the container are squeezed, or when a pressurized gas is introduced, air within it and also the liquid is forced upwardly through a porous member and is mixed, thereby producing foam. After each dose or charge has been dispensed, replacement air enters through a vent, with that portion of the foam which is in the nozzle acting as a valve to prevent reentry of the foam into the interior of the dispenser.



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SHEET 1 OF 3

FIG 1

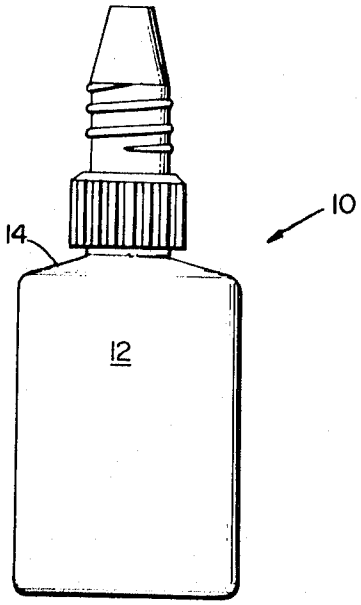

FIG 2

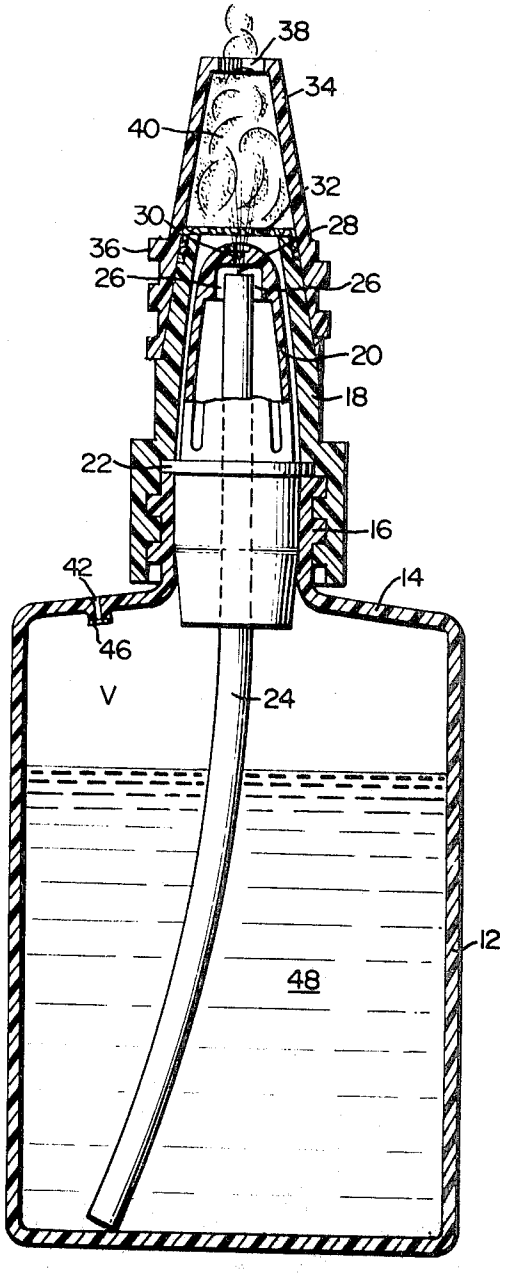

FIG 3.

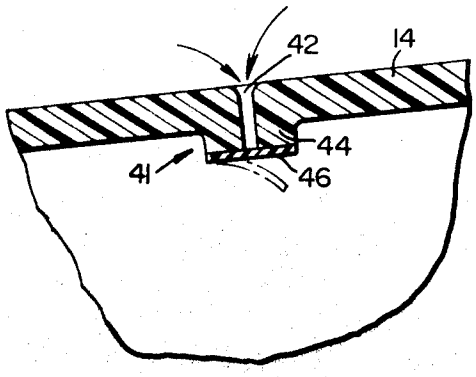

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FIG.4

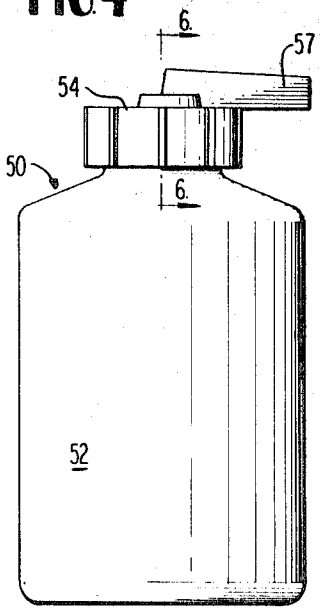
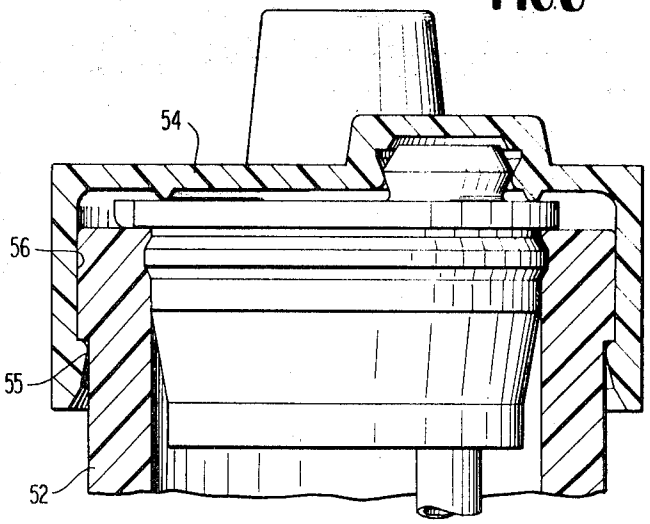


FIG.6



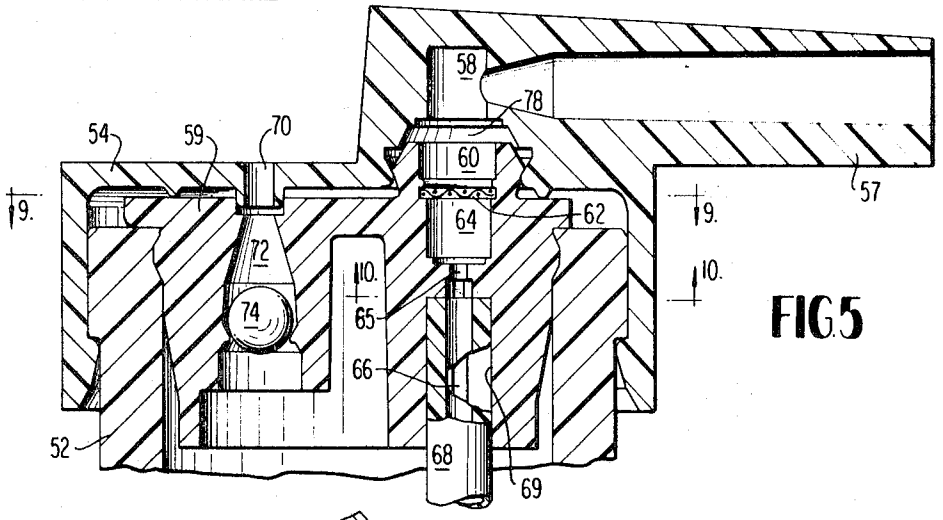


FIG.5

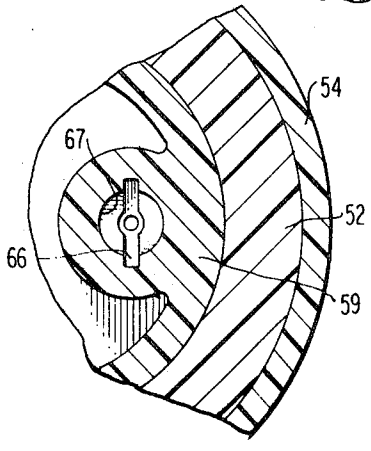


FIG.10

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FIG.7

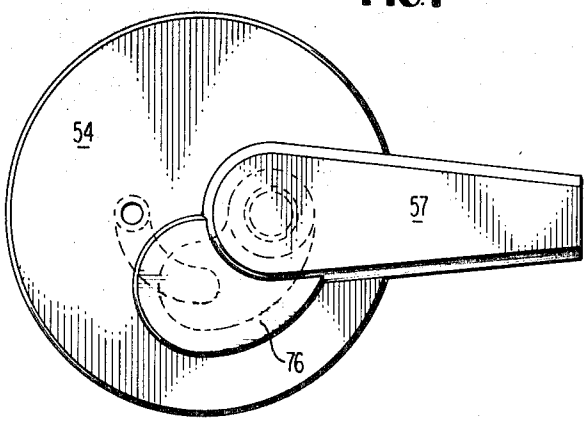
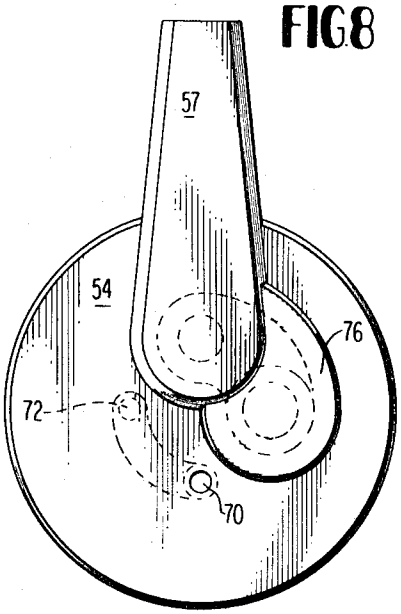


FIG.8



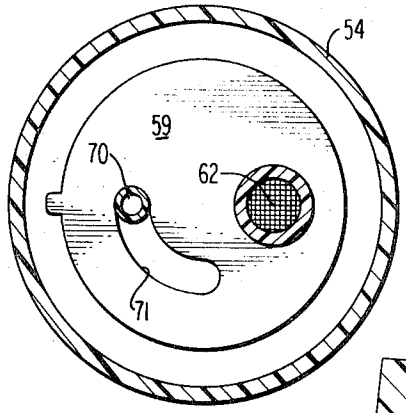


FIG.9

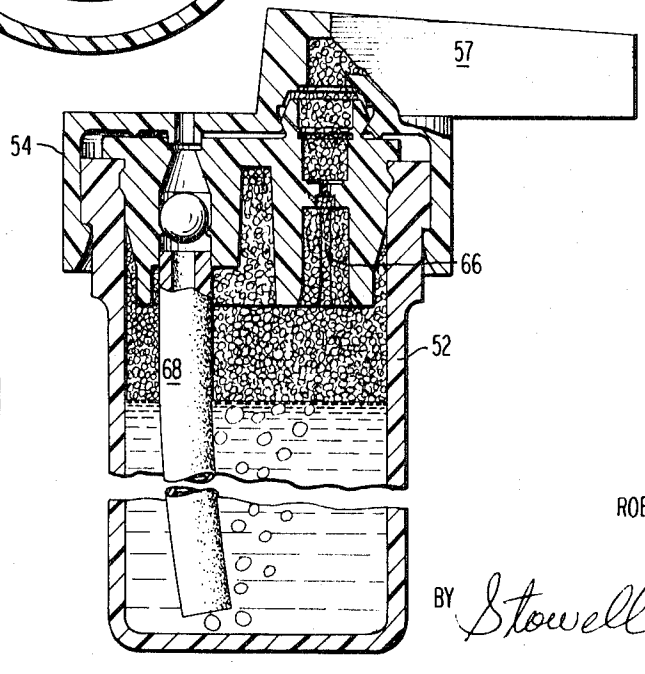


FIG.11

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DISPENSING SYSTEM

This invention relates to an improved dispenser for foamable liquids such as medicaments, hair conditioners, window cleaners, and the like, and in particular to a dispenser which will cause such liquid to mix with air and to thereby be dispensed in the form of an air-liquid foam.

The dispenser has particular utility as a dispenser of medicaments as it is often the desire of medical practitioners that certain medicaments be applied in the form of a foam. Such foamed medicaments are sometimes applied within body cavities which open to the exterior portion of the body. Accordingly, there arise situations wherein rather long nozzles are required.

In general, the prior art is aware of collapsible wall containers as, for example, seen in my prior U.S. Pat. Nos. 3,361,304 and 3,346,146. The prior art is also aware of a general class of containers having spouts or nozzles for dispensing liquids as may be seen, for example, in U.S. Pat. No. 2,752,199 issued to Newell, and No. 1,735,784 issued to Olson. Further, both of these latter two examples of the prior art are of a resilient wall construction wherein a temporary increase in container pressure is obtained by manually deforming the one or more walls of the container. While containers of these types, and particularly of the types illustrated in my two above prior patents, have been in the main satisfactory, certain difficulties have been observed and problems have arisen in dispensing medicaments and other foamable liquids in the form of an air-liquid foam.

These problems arise particularly in the case of repeated dispensing action over short intervals of time. An example of this would be wherein the user squeezes the resilient container several times over a relatively short period in order to obtain a relatively large quantity of foam. With certain dispensing containers having relatively short nozzles the problems which arise are relatively minor and do not require particular attention.

In dispensing foamable liquids from squeeze-type containers, the liquid itself is of necessity a foamable formulation, as distinguished from nonfoaming liquids employed in ordinary squeeze-spray containers. Such foamable formulations generally contain surface-active agents and are well understood by those skilled in the art. The foamable liquids cause foam to form in the bottle from intake air through the delivery orifice after each squeeze. Upon repeated action, the container can be so filled with foam that repeat squeezings feed foam through certain air vents to thereby change the forces delivering air and liquid through the main dispensing orifice. This in turn results in a heavier foam than desired or else results in dispensing liquid through the foamer head. Thus, by reference to FIG. 1 of my prior U.S. Pat. No. 3,361,304, rapid squeezing of the container can result in foam finding its way into the interior of the container and, with continued squeezing, foam instead of merely air will pass upwardly through the openings **36** to thereby produce a poor foam and/or nonuniform doses. Unless the dispenser is designed to function in this manner, such a mode of operation is to be avoided if possible.

This problem of foam formation within the container, as opposed to foam formation outside of the container as intended, is accentuated proportionately to the amount of residual foam in the nozzle. The reader will appreciate that after the user has squeezed the container several times in order to dispense foam, there will be some foam left within the nozzle after the last squeeze. This foam generally sucks back slowly, partially and variably, into the air bypass openings and also down into the dip tube itself. Even though the foam is not usually very viscous, sufficient resistance is developed in the dip tube so that on repeat squeezes sometimes little or variable or no foam is delivered because the increase in pressure on top of the liquid when the container is squeezed may result merely in the passage of air through the air passage ways at the top of the container.

Such departure from desired and satisfactory action is especially troublesome with repeat action in the case of relatively

lengthy delivery tips or nozzles. For example, approximately one-eighth inch to 1 foot nozzles may be required in the administration of a foamed product in certain body cavities such as the rectum, the vagina, the ear, etc. The dispensing behavior with such relatively lengthy and elongated tips or nozzles accentuates the above-described results and consequences of the necessarily residual foam in the nozzle at the end of each squeeze.

In an attempt to overcome the above-described problems in dispensing foamed medicaments from resilient wall containers, various remedies were attempted. It was found that a check valve at the upper end of the dip tube helped somewhat. Also, different internal diameters of dip tubes were tried and some improvement was noted. Finally, an inlet valve in the squeeze bottle itself was conceived and the noted effect was dramatic in its benefits. Further, this single valve in the container wall was found to overcome the noted difficulties and no other valves were required. With the valve in the container wall, there is minimal or no suck-back of the foam. This surprising result is considered to be due to the following factors. Apparently the viscosity of the foam in the small interstices of the porous foam forming structure causes the foam mass to function, for practical purposes, like a check valve. The air required to refill the partial vacuum within the container above the liquid medicament enters rapidly and preferentially through the container wall valve. Thus, instead of relying upon plural check valves, by this discovery one is able to utilize the viscosity of the foam itself as a virtual check valve adjacent the top of the dip tube.

In the drawings:

FIG. **1** is a side elevational view of a typical resilient wall container adapted for practicing this invention which may conveniently be formed of plastic or the like.

FIG. **2** is a cross-sectional view of the device shown in FIG. **1**.

FIG. **3** is an enlarged detailed fragmentary view illustrating a typical check valve in the container wall.

FIG. **4** is a view similar to FIG. **1**, and illustrates an embodiment of the invention.

FIG. **5** is a cross section of the upper portion of FIG. **4**.

FIG. **6** is a partial cross section on line **6—6** of FIG. **4**, and taken at right angles to the section of FIG. **5**.

FIGS. **7** and **8** are top views, in two nozzle positions, of the embodiment of FIG. **4**.

FIG. **9** is a view taken along section **9—9** of FIG. **5**.

FIG. **10** is a view taken along section **10—10** of FIG. **5**.

FIG. **11** is a cross-sectional view, similar to that of FIG. **5**, and illustrates a variant.

Referring now to the drawings, the numeral **10** denotes generally a resilient wall dispensing container suitable for the practice of this invention. The container is defined by a main and lower portion **12**, an intermediate portion **14** and an upper neck portion **16**. As illustrated in my U.S. Pat. No. 3,346,146, the external surface of neck **16** is provided with threads to receive complementary threads of a cap element or foamer fitment **18** which may also be formed of plastic, and whereby the fitment may be releasably secured to the container. An elongated and separable head element **20** is provided at a medial portion thereof with an integral flange **22** adapted to seat, as illustrated, on top of the neck **16** and is borne against by a portion of integral cap element **18**. It will be noted that when the fitment **18** is in its threaded relationship with the container neck, a shoulder portion on the fitment engages the flange **22** to securely maintain the outlet orifice means or head element **20** in its seated engagement within the neck portion of the container. A conventional dip tube formed of plastic or the like is denoted by the numeral **24** and is positioned with one end at the bottom of the container while its other end is supported (as by friction fit) within a bore at the upper end of head **20**. The numeral **26** denotes either one of two bypass air passages radially positioned with respect to the upper end of dip tube **24**, with the lower end of each passageway communicating with the interior of head element **20** and hence with the interior of the container **10**.

The upper ends of these vents 26 communicate with a horizontally extending passageway 28, the latter in turn communicating with a vertically extending passageway 30 in the extreme upper end of head 20. The upper end of the fitment encloses the head or outlet nozzle portion 20 and a porous element 32 is secured across the upper portion of the fitment. The porous element is similar to and for the same purpose as disclosed in U.S. Pat. No. 3,346,146. A nozzle 34 also of plastic is fitted over the cap element 18 and may itself be provided with external threads 36 for the reception of a second cap or closure member not illustrated. The uppermost portion of nozzle 34 is apertured as at 38 and the numeral 40 denotes an air-liquid medicament foam in the interior of the nozzle.

Referring now to FIG. 3, the numeral 41 connotes a valve defined by an aperture 42 in the wall of segment 14 and may preferably be formed through a portion of the container wall which is slightly thickened, as denoted by the numeral 44. Number 46 denotes a flap shown in solid line in its closed position and in its open position is indicated by the dashed lines. The curved arrows adjacent the passageway 42 denote ambient air passing from the exterior to the interior of the container.

The numeral 48 denotes a supply of foamable liquid placed in the container and adapted to be dispensed. In operation, the user grasps the container 10 and squeezes the sides together, thereby increasing the pressure within the volume V of the container above the medicament 48. This increase in pressure is accompanied by two actions. The first action is that liquid 48 is forced upward through the dip tube 24 and exits through its top towards aperture 30. At the same time, air within the volume V is forced upwardly through the passageways 26 and into passageway 28. The flow of upcoming liquid from dip tube 24 is intersected by this air in passageway 28 and accordingly there is formed a mixture of liquid and air immediately above the dip tube 24. This mixture passes through opening 30 and impinges onto porous element 32. A foam denoted by the numeral 40 is formed, with the foam being dispensed from nozzle 34 through exit opening 38.

The reader will now be in a position to comprehend the state of affairs mentioned which would exist without the valve 46. Thus, after the sides of the container 10 had been squeezed inwardly to their maximum deformation by the user, the resilient walls would move outwardly in order to resume their original position. This results in a partial vacuum within the volume V. A consideration of FIG. 2 will show that, with the foam 40 residium in the nozzle, the partial vacuum will be abated by ambient air coming into the nozzle through the upper opening 38 and carrying some of the foam back through the porous element 32 and into the opening 30. From this point, the foam will divide, a portion going down into the dip tube 24 and a portion going down through passageways 26 and into the interior V of the container. When only one or two squeezing dispensing operations are employed, this described behavior is particularly troublesome. However, it will readily be comprehended that with extremely rapid squeezing over short time intervals with rather lengthy nozzles, the amount of foam which may be drawn back into the container 10 can be substantial. As explained above, the presence of foam within the container 10 will nearly always result in subsequent dispensing operations yielding the desired material in a form other than the intended air-liquid foam.

In accordance with this invention, a valve such as that illustrated at FIG. 3 of the drawings is placed in the container wall. The valve is a so-called one-way or check valve and will admit air from the outside into the container but not the reverse flow path. With the valve, when the resilient walls commence to return to their original position after being squeezed, the partial vacuum thus created will cause the valve 41 to be opened, thus admitting air from the exterior and abating the vacuum. Due to its viscosity, the foam mass 40 residuum in the nozzle 34, in conjunction with the porous member, will act as a valve to prelude entry of ambient air through the nozzle 34, as opposed to the entry of foam into the container by virtue of the above-described action without the valve 41.

It will be understood that the same results would not follow by placing a check valve in the upper portion of the dip tube 24, in a manner similar to the check valve at the upper end of the dip tube of the above-noted Newell patent. Further, by virtue of this invention, such a check valve is unnecessary in dispensing a foam which generates a mass great enough to act as a check valve itself when the partial vacuum is being relieved after the maximum amount of container squeeze.

It will further be observed that the particular type of valve, illustrated in detail at FIG. 3 of the drawings, is not critical for the practice of this invention. For example, the valve could be of the spring-urged ball type or could be of any other convenient type. It will further be understood that the valve could be placed at any part of the container which is above the liquid medicament level. The flow passage defined by the check valve, such as flow passageway 42, defines a second or distinct flow passageway relative to the opening 30. The latter may be defined as a first or main exit or flow passageway of the container.

As an example of parameters which have been successfully employed, reference is made to my U.S. Pat. No. 3,361,304. For example, the outlet opening 30 may preferably be from 0.025 to 0.042 inches in diameter, the dip tube 24 may have a bore of 0.022 to 0.082 inches in diameter, and the area of the vents 26 from 0.0009 to 0.0018 square inches.

Referring now to FIGS. 4 through 11 of the drawings, a modification of the invention is illustrated. In FIG. 4, a configuration similar to the embodiment of FIG. 1 is illustrated, wherein the numeral 50 denotes generally a dispenser/container similar to the dispenser 10 illustrated at FIGS. 1 and 2 of the drawings. The numeral 52 denotes the main lower body of the dispenser, similar to element 12 of FIGS. 1 and 2, and is defined by a container having a narrowed mouth. An upper cap 54 is snapped on to sidewalls of the mouth of the container by virtue of an inwardly extending lip 55 engaged as show with a thickened portion 56 around the upper part of the mouth of container 52. The cap 54 also carries an integral nozzle 57 having an inlet or rear chamber 58 at its entrance end. A plug 59 is positioned over and closes the mouth of the container. The plug contains an opening or passageway 60 therethrough surrounded at the upper surface of the plug by upstanding walls. The numeral 62 denotes a foam producing element, here in the form of a wire screen. This element is similar to element 42 of my U.S. Pat. No. 3,346,146. When a foamable liquid passes through the screen 62, the action of the liquid passing through the interstices promotes the formation of a foam. The numeral 64 denotes yet another portion of the opening or passageway through the plug 59, above a narrowed region 65. Slots 66 are provided in the wall of aperture 67. The numeral 68 denotes a dip tube extending from socket 69 in the lower portion of the plug 59, to adjacent the bottom of container 52. The slots 66 provide air passages communicating with the interior of the container and the region 65. The elements thus far described, including the screen 62, may conveniently be formed of plastic.

The numeral 70 denotes an aperture extending completely through the cap 54 and, as illustrated at FIG. 5 of the drawings, in operative position registers with a second passageway or opening 72 through the plug 59. A ball element 74 rests on protrusions formed within the opening. In the illustrated position, ambient air is free to pass in through opening 70 and around the ball 74 into the interior of container 52. Upon a sudden increase in pressure within the container, the ball 74 is pushed upwardly and thereby blocks airflow through passage 72.

As illustrated particularly at FIGS. 7, 8 and 9 of the drawings, the cap 54 is rotatable on and about the mouth of container 52. In the position indicated at FIG. 7 of the drawings, the opening 70 in the cap 54 registers with opening 72 in plug 59. Further, cavity 58 at the end of the nozzle 57 is in registry with opening 60 and mesh 62. This is the dispensing position of the cap relative to the container. After the dispensing operation has taken place and it is desired to store

the container until the next use, the cap is rotated from the position indicated at FIG. 7 to that shown at FIG. 8. The opening 70 has moved clockwise so as to be out of registration with opening 72. An arcuate slot 71 carries a downwardly extending protrusion around the periphery of opening 70 and functions as a guide. The opening 72 is thus protected from ambient external conditions during storage. The nozzle 57 carries an integral extension 76 having therein a curved channel 78 into which the walls around opening 60 extend and abut. During rotation, the curved channel slides over the upwardly extending portions around opening 60. In the position shown in FIG. 8, the opening 60 is out of registration with chamber 58 and the contents of container 52 are accordingly protected.

During the operation of the embodiments above described, the general mode of operation is the same as that described with respect to the embodiment illustrated at FIG. 2 of the drawings. The air passageways 66 correspond to passages 26, with the same foam producing action in cooperation with mesh 62.

Turning now to FIG. 11 of the drawings, a variant is illustrated wherein the dip tube 68 is attached to the lower part of opening 72, instead of to opening 69. During the operation of this embodiment of the invention, the container 52 is squeezed several times, the recovery to original configuration of the resilient sidewalls of 52 being accompanied by an influx of air through opening 70 and down into dip tube 68. Some foam is generated within the interior of lumen of the dip tube. With repeated squeezings the interior of the container 52 above the liquid level is filled with foam which finds its way out through the dispensing snout 57, passing through screen 62, where it is reformed before final exit.

While intended primarily for use in the illustrated, upright positions to dispense a foam, the dispensing systems of each embodiment may dispense a liquid instead, by inverting the container and then squeezing or applying the pressure discharge gas. A liquid spray may also be dispensed by removing the foamer element 32 of the embodiment of FIG. 2 or the foamer element 62 of the embodiment of FIG. 5 and operating the dispenser in the upright position.

I claim:

1. A combination dispenser comprising a container having an outlet opening and a deformable sidewall, an outlet orifice member releasably carried over the outlet opening, a dip tube depending from said outlet orifice member for directing liquid from the container to the outlet orifice when the container sidewall is squeezed inwardly, a tubular foamer fitment releasably and coaxially carried by said outlet orifice member, said fitment member having an opening of substantially larger diameter than said outlet opening therethrough, a porous element mounted in said fitment across the said opening and in spaced relation to said outlet orifice, a foam-receiving chamber having an opening therethrough releasably carried by said foamer fitment, said foam-receiving chamber acting as a valve because of the collection of a foam mass residuum therein to preclude entry of air into said container through said outlet opening, valve means in the sidewall of the container below said chamber, said valve means allowing the passage of ambient air only into said container, and closure means for said dispenser.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,622,049 Dated November 23, 1971

Inventor(s) Robert E. Thompson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 55, "is particularly" should read --- is not particularly ---. Column 3, line 47 "residium" --- should read -- residuum ---. Column 3, line 73, "prelude" should read --- preclude ---. Column 4, line 37, "show" should read --- shown ---.

Signed and sealed this 2nd day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents