United States Patent

[11] 3,580,510

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[54] **ALL-DIRECTION ATOMIZERS**
10 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **239/327,**
239/338, 239/368, 222/454
[51] **Int. Cl.** **B65d 1/32**
[50] **Field of Search** 239/327,
311, 337, 338, 344, 345, 347, 366, 368, 369, 372;
222/206, 207, 211, 212, 457, 454; 128/173

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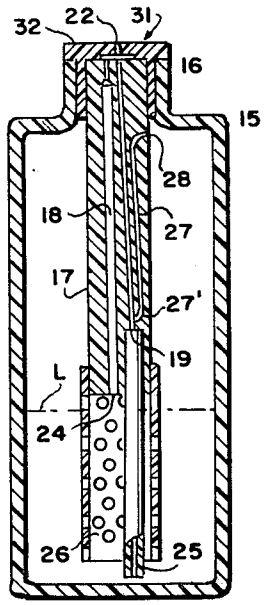
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Primary Examiner—Lloyd L. King
Assistant Examiner—Edwin D. Grant
Attorney—M. D. Nissenbaum

ABSTRACT: A resilient squeeze bottle has an elongated stopper extending downwardly therein, which provides an air duct and a liquid duct extending therealong; said ducts being communicative with a slight mixing chamber at their upper ends, which chamber has an upward discharge orifice. The liquid duct has a branch extending upwardly where it is communicative with the bottle's interior at neck region, and said liquid duct also has a downward extension to the bottom of the bottle. Said stopper has a downward openwork element. Both said stopper and element serve to limit the extent the bottle can be collapsed. The open end of the air duct is always above the liquid in the bottle regardless of the bottle's position when squeezed or not squeezed.



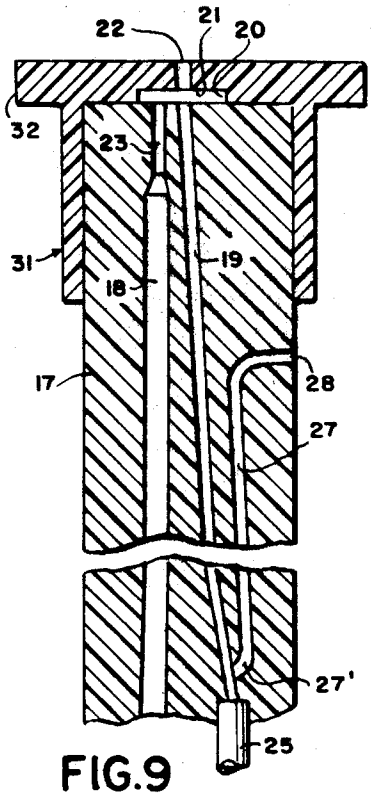


FIG. 9

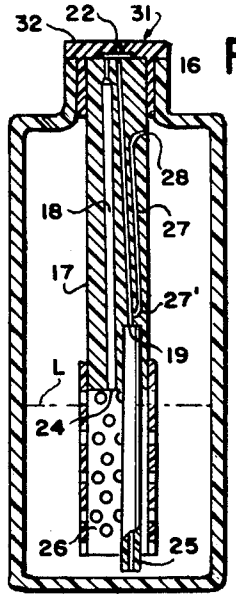


FIG. 1

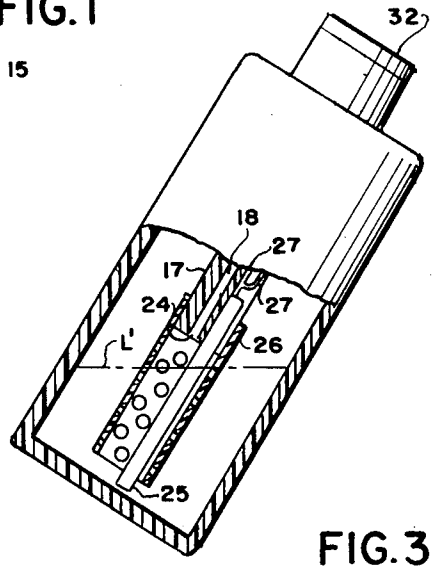


FIG. 2

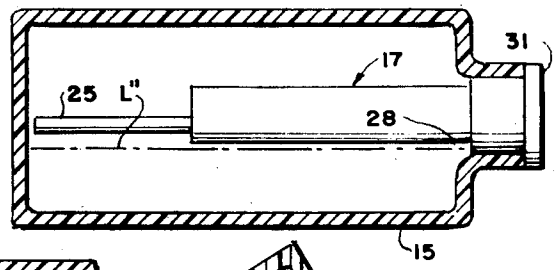


FIG. 3

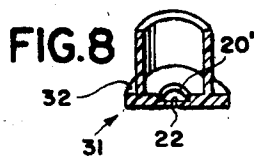


FIG. 8

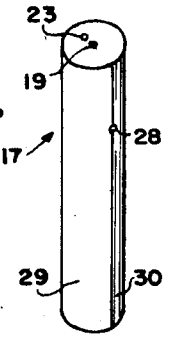


FIG. 7

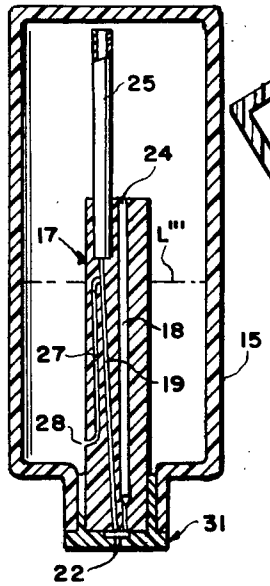


FIG. 5

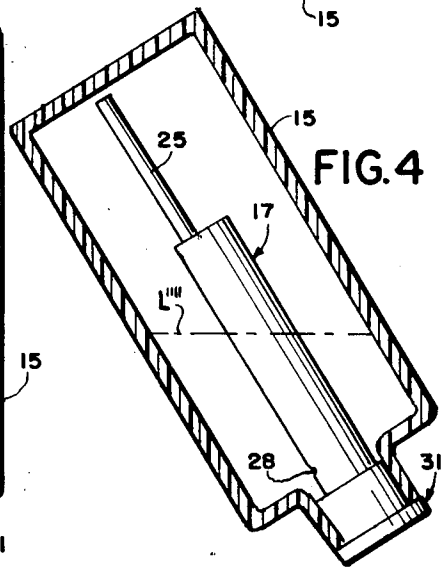


FIG. 4

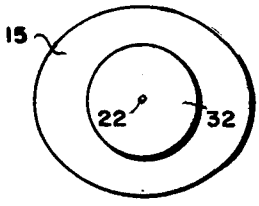


FIG. 6

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ALL-DIRECTION ATOMIZERS

The present invention relates to atomizers of the squeeze-bottle type, for perfumes, cosmetic and pharmaceutical solutions, and other liquids.

Heretofore, this class of atomizers operated properly only if held erect or sightly inclined to vertical, for lateral or upward discharge, depending upon the discharge orifice direction the device was designed for. At other positions at variance with the upright, especially when the device was held to discharge downwardly in any direction which might be true vertical or slanted, the emission of liquid was not an atomized spray, but a thin continuous stream. At many positions in hand, there would be no discharge at all.

It is therefore the principal object of this invention to provide a novel and improved squeeze-bottle-type atomizer construction, which will discharge an atomized spray in any direction desired, depending upon its position in hand.

A further object thereof is to provide a novel and improved atomizer of the character described, which is of simple construction, reasonable in cost to manufacture, all parts of which may be molded of plastic and easily assembled, simple to use, positive in action and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For one practice of this invention, there is an elongated stopper fitted in the neck of an elongated resilient squeeze bottle, and said stopper extends downwardly in said bottle to a predetermined level. The stopper at its upper end region, has a slight internal chamber whose upper wall has an upward discharge orifice. The capillary upper end of an air duct, and the upper end of a capillary liquid duct, extend from the lower wall of said chamber and are respectively communicative with said chamber. Said ducts extend longitudinally along and within said stopper body, and open at the stopper's lower end. However, the lower end of the liquid duct has a communicative tubular extension downwardly therefrom so the lower open end of said extension is very near the bottle's floor. The liquid duct also has a branch along itself in the stopper body, the lower end of which branch extends from and is connected to said liquid duct near the bottom end of the stopper, while the upper end of said branch extends to the bottle's neck region where it is communicative with the bottle's interior. A desirable, but optional openwork element extending downwardly from the stopper, limits the extent the bottle can be collapsed when squeezed at its lower region; the diameter of the stopper being sufficient to limit the collapse of the bottle when squeezed at its middle or upper regions. The lower end of the air duct, meaning the open end of the air duct within the bottle, is always above the liquid in the bottle, regardless of the position of the bottle, when squeezed or not squeezed.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is a central longitudinal section of an atomizer embodying the teachings of this invention. The device is shown in upright position, and when operated, will discharge vertically upwardly.

FIG. 2 is an elevational view of the atomizer, shown partly in section, and position tilted. When operated, the discharge will be slanted upwardly.

FIG. 3 is a longitudinal section of the atomizer, partly in section and positioned horizontally. Further explanation will be given relating to a horizontal discharge. This view is of a slightly modified embodiment, in that an auxiliary component is omitted.

FIG. 4 is a view like FIG. 3, showing the atomizer in inverted but slated position. When operated, the discharge will be slanted downwardly.

FIG. 5 is a central sectional view of the atomizer of FIG. 3, shown in inverted vertical position. When operated, the discharge will be due downwardly.

FIG. 6 is a bottom view of FIG. 5, and is also the top plan view of FIG. 1.

FIG. 7 is a perspective view of a practical construction for part of the stopper structure.

FIG. 8 is a sectional perspective view of a practical construction for the remaining part of the stopper.

FIG. 9 is a fragmentary enlarged central sectional view of the stopper.

In the drawing, the numeral **15** designates generally a resilient squeeze bottle molded of a plastic as polyethylene or of rubber, preferably with a neck **16**, fitted with an elongated stopper denoted generally by the numeral **17** which extends downwardly into the bottle a predetermined distance. Said stopper is provided with an air duct **18**, and a capillary liquid duct **19** close alongside each other, both of which start open at the lower end of the stopper and extend upwardly therethrough when they are communicative with a slight mixing chamber **20** within the upper region of said stopper. The air duct **18** discharges against the ceiling **21** of said chamber to one side of a central, vertically upward discharge orifice **22**, which is in registry with the upper end of the liquid duct **19**; the upper ends of said ducts being extremely close to one another. The upper end of the air duct is reduced to capillary size as shown at **23**. The open lower end of said air duct is indicated by the numeral **24**. The lower end of the liquid duct **19**, has a downwardly tubular extension **25**, reaching very close to the bottom of the bottle. Some bottle shapes require an openwork structure which may be a perforated tube **26**, which extends downwardly from the stopper body, reaching close to the bottom of the bottle. The liquid duct **19** has a branch **27** spaced therealong in the stopper body, extending upwardly from its connection **27** to said liquid duct, which is near the lower end of the stopper, to near the neck region of the bottle, where said branch opens at **28** to be communicative with the bottle's interior.

Suggested dimensions for the capillary ducts **19**, **27** and **23**, is one thirty-second of an inch in diameter, and for the air duct **18**, a diameter of one-sixteenth of an inch.

A practical and preferred manner of stopper construction, is to make it of three molded plastic parts. These are indicated by the numerals **29** and **30**, which are semicylindrical pieces of equal size, and the third part **31** is an inverted cup of some resilient quality, having a flange to form a head **32** at its closed end. The parts **29**, **30** are formed with channels in their respective flat faces, one right and the other left, so when placed with such faces in contact and cemented together or otherwise joined in such relation, the channels in one, match the channels in the other, to form the air duct **18** with its reduced end **23**, the fluid duct **19**, and the branch **27** respectively. The cup **31** has a central discharge orifice **22** through its head **32**, which hole is provided with a slight counterbore **20'** of a depth of capillary dimension within the cup's interior. Said cup is set as a cap onto and in contact with the upper end of the cemented cylinder form made of **29** and **30**, and cemented thereto. Thus attaining a stopper of unitary structure; the mouth of the said counter bore **20'** being thus closed to form the mixing chamber **20**. When the said stopper is set into the bottle so its head **32** rests against the bottle's mouth rim as shown in FIG. **1**, said head will serve as a stop to assure the proper position so that the open end **24** at the bottom of the air duct, shall be its necessary distance from the bottle's bottom, and the bottom is tightly "corked" by the cap **31**.

For the proper operation of this atomizer **33**, it is necessary that the lower open end **24** of the air duct **18**, shall at all times be above the supply of liquid **34** in the bottle **15**, regardless of the position of the bottle, when squeezed or not squeezed. It is to be noted that when the bottle is squeezed, the level of the liquid **34**, will in many instances rise a bit. The extent to which the bottle can be collapsed by a squeezing action done by pinching opposite wall sections, might be limited by the nature of the material it is made of, by the shape of the bottle, by the stiffness of its floor and ceiling walls, by the diameter size of the stopper **17**, and as may be necessary in some constructions

where the bottle is rather "soft," by the inclusion of a rigid spacer means as for instance the perforated tubular extension 26. The initial supply of liquid in the bottle is therefore limited to attain the conditions aforesaid which are necessary for the atomizer to function properly. It is evident that the largest permissible liquid supply shall be less than half the available volume of the bottle 15, and that the stopper 17 shall be of a length to extend into the bottle so the available volume in the bottle which encircles the periphery of said stopper shall be more than half the total available volume in the bottle, and that the open end 24 of the air duct shall be above the liquid's level when the atomizer is positioned erect as in FIG. 1, and squeezed to the greatest extent possible, at opposite wall regions of the lower part of the bottle, and also that said open end 24 shall be above the liquid's level when the atomizer is held horizontal as in FIG. 3, and squeezed to the greatest extent possible to make the liquid level rise.

After the bottle 15 is filled with liquid to the extent mentioned as indicated by the level L, and the stopper 17 is tightly fitted so the atomizer device 33 is in condition as shown in FIG. 1, its operation is as follows:

Holding the bottle erect in hand, it is pinched to collapse, and released to expand back to normal. The air within the bottle is thus compressed, and an airflow is caused to flow upward through the air tube 18, and its velocity is increased as it passes through the reduced upper portion 23, from which it impinges against the ceiling 22 of the chamber 20, which deflects it to move across the upper open end of the liquid tube 19, creating a vacuum condition in the liquid tube. The pressure differential causes the liquid to rise up the liquid tube 19, and the continuance of the air flow caused by a repeated pinching action, will cause the liquid coming to the top of the liquid tube, to be atomized, in which state it will discharge upward through the orifice 22 as a finely divided spray. If the atomizer 33 is tilted, as for example to the position shown in FIG. 2, the level of the liquid will be at L'. When operated in this position, the spray discharged from the orifice 22, will be tilted. The extent of tilt may be at any angle in relation to vertical, up to horizontal position as shown in FIG. 3. When the position is true horizontal, the liquid housed in the liquid tube 19, will be atomized upon squeezing the bottle and discharged horizontally. The unsteadiness of the hand, will cause enough oscillations to bring more liquid into the liquid tube, for continued operation. The tilt may be to the right or to the left.

Squeezing the bottle when it is held in hand in inverted position as in FIG. 5, where the liquid level is at L''', liquid is drawn into the the liquid tube 18, through its branch 27, whose intake opening 29 in is the liquid. Discharge will be due downward. If the atomizer is tilted, as for example to the position shown in FIG. 4, the level of the liquid will be at L''''. When operated in this position, the spray discharged through the orifice 22, will be tilted. The extent of tilt may be at any angle in relation to vertical, up to horizontal position. The tilt may be to the right or to the left.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiments illustrated shall be deemed merely illustrative and not restrictive.

I claim:

1. In an atomizer of the character described, a resilient squeeze bottle closed by an elongated stopper structure which extends downwardly therein; said stopper structure, at its upper end region being provided with a slight mixing chamber having a ceiling wall and a central, upward discharge orifice through said wall, communicative with said chamber; said stopper structure also having a longitudinal air duct and a longitudinal liquid duct; the upper ends of said ducts being closely adjacent to each other and communicative respectively with said chamber; the lower end of the air duct being communicative with the bottle above a predetermined level from the bottom of the bottle; the lower end of the liquid duct being communicative with the lowermost region of the bottle; said liquid duct having a branch communicative with the uppermost region of the bottle; the upper end of the air duct being to one side of said discharge orifice and farther than the upper end of the liquid duct from said orifice, whereby air caused to flow in the air duct upon squeezing the bottle, will discharge into said chamber against said ceiling and thereby be deflected to proceed across the upper end of the liquid duct; said air flow being adapted to effect atomization of liquid in the liquid tube and force the atomized liquid through said discharge orifice.

2. An atomizer as defined in claim 1, wherein when the bottle is squeezed to maximum possible extent, the volume of the space within the atomizer, from said level to the bottom of the bottle is no greater than one-half the volume of the total space within the atomizer when the bottle is in its normal extended condition, and wherein the volume of the space within the atomizer when the latter is held in any position where the stopper structure is horizontal and the bottle squeezed to its maximum possible extent, the volume of the space in the bottle then below the said lower end of the air duct, is no greater than said volume from said level to the bottom of the bottle.

3. An atomizer as defined in claim 1, wherein the stopper structure is provided with an external head at its upper end which rests on the bottle, whereby the extent of the stopper structure is limited to have the lower end of the air duct above said level.

4. An atomizer as defined in claim 1, wherein the liquid duct and the discharge orifice are in alignment.

5. An atomizer as defined in claim 1, wherein the branch of the liquid duct is elongated.

6. An atomizer as defined in claim 1, wherein the upper end portion of the air duct is of reduced dimension.

7. An atomizer as defined in claim 1, wherein the discharge orifice is vertical when the bottle is in erect position.

8. An atomizer as defined in claim 1, wherein the part of the stopper structure which is below the lower end of the air duct, includes a downwardly extending elongated rigid openwork; the lower part of the liquid duct being a tubular extension from that part of said structure having the air duct; said openwork being along said tubular extension.

9. An atomizer as defined in claim 8, wherein said openwork is a perforated tube; said tubular extension being within said perforated tube.

10. An atomizer as defined in claim 1, wherein the bottle has a neck, and said stopper structure comprises an inverted cup of material having some resilient quality tightly fitted in said mouth and having an external flange spaced from the mouth of said cup; said flange resting on the mouth rim of said neck; the discharge orifice being through the bottom wall of said cup; said orifice having a slight counterbore within the cup; two identical elongated rod pieces, each having a flat longitudinal face; said faces being against one another in the same direction and said rod pieces held assembled; said pieces having channels in their said flat surfaces; said channels being in a predetermined arrangement; the channels in one of said faces being right, and the channels in the other of said faces being left; the channel arrangements being such that on the assembly of said pieces, the channels form the air, liquid and branch ducts; the upper ends of said air and liquid ducts being through the upper surface of said assembled pieces; the upper end of said assembly being tightly fitted in said cup and against the bottom inner wall of said cup whereby said counterbore is formed into said chamber; the lower ends of said air and liquid ducts formed by said channels being at the lower end of said two assembled pieces, and a tubular extension from the lower end of the liquid duct formed in said pieces by said channels, constituting the lower portion of the liquid duct which reaches close to the bottom of the bottle.