

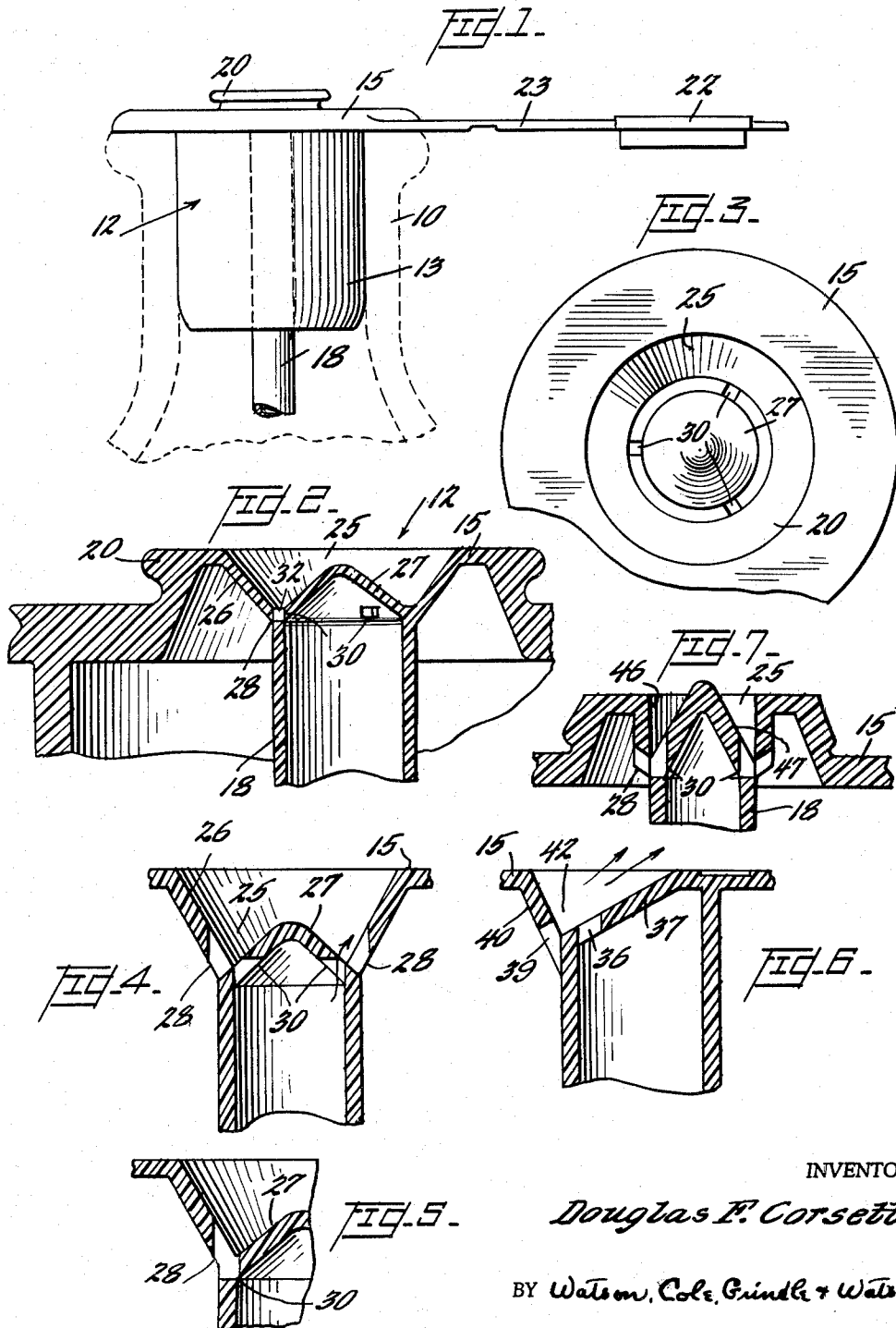
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ATOMIZING DEVICE HAVING AN ANNULAR ASPIRATING ZONE

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ATOMIZING DEVICE HAVING AN ANNULAR ASPIRATING ZONE

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This invention relates to an improved device for aspirating, atomizing and spraying liquids from containers of the resilient plastic type, commonly called "squeeze bottles," capable of collapsing on application of pressure to the container wall to expel the contents of the container.

It is the primary object of the invention to provide a device of the type described which may be molded at low cost, as an integral article in a high speed injection molding operation, and which is capable, when associated with a resilient container for liquid, of forming and discharging the liquid as a suspension in air of finely divided particles to provide a fine spray or mist.

Further objects and features of the invention will be apparent from the following description taken in connection with the following drawings, in which

FIGURE 1 is an elevation of a device illustrative of the invention, as applied to the mouth of a container for liquid;

FIGURE 2 is a fragmentary transverse section of the device embodying the invention;

FIGURE 3 is a plan view of the device shown in FIGURE 2; and

FIGURES 4 to 7 are fragmentary sectional views illustrating alternative forms of the device of the invention.

In order that the principles of the invention may be readily understood, the improved devices shown in the drawing will now be specifically described. It will be appreciated, however, that no limitation of the scope of the invention is thereby intended, and that the invention embraces such other and further modified structures as would occur to those skilled in the art.

Referring first to FIGURE 1, there is shown in broken lines the neck or mouth 10 of a container for liquid formed of resilient plastic material, for example, polyethylene, often called a "squeeze bottle." When supplied with a suitable discharge fitting for dispensing liquid or flowable material, the contents of such bottles may be discharged by applying pressure to the walls of the container to deform and collapse the same. Aqueous liquid may be dispensed in the form of a spray or a stream; viscous material, such as toothpaste, may be dispensed as a ribbon. In accordance with the instant invention, the dispensing device is designed to aspirate and atomize a liquid material of relatively low viscosity, such as an aqueous solution or suspension.

The device, indicated generally at 12, is seated in the mouth 10 of the resilient container, as shown in FIGURE 1. To this end the device 12 is formed to provide a generally disk-shaped top portion 15, which overlies and seats on the upper end of the mouth 10 of the container. An annular skirt portion 13 depends from the top portion 15 and is dimensioned for reception in the container mouth with a snug fit against the inner surface of the container mouth so as to prevent leakage of liquid when the container is inverted or laid on its side.

For convenience in describing and defining the structural details of the device, it will be assumed that the container occupies an upright position as shown in FIGURE 1, although in use the device will usually be held at an angle to the vertical to direct the discharging spray laterally.

Within the depending skirt portion 13, and preferably centrally located in the device 12, is a generally vertical tubular portion 18 which depends from the top portion 15, and has a length sufficient to reach to a point near the bottom of the container, and well below the level of liquid in the container. This portion corresponds generally to the element commonly referred to as a "dip tube" in sprayers of the pump type, in which liquid is discharged from a container by a reciprocation of a pump plunger.

The top portion 15 of the device is also formed to provide a raised central portion having at its periphery an annular rim or bead 20 serving to retain a closure cap 22, which snaps onto the bead 20. The details of the cap 22 form no part of the instant invention, and the cap may be constructed generally as shown in the U.S. patent to Tupper No. 2,690,861, granted October 5, 1954. As in the aforesaid patent, the closure cap is attached to the top portion 15 by a flexible retainer strip 23, the strip 23 and the closure cap 22 being formed integrally with the atomizing device 12, preferably in an injection molding operation. It will be appreciated that all of the parts to which reference has been made are formed in one piece and as an integral structure in a single injection molding step. Consequently there are no problems of assembly, the cost of production is minimized, and failure of poorly fitting parts resulting from nonuniform shrinkage on cooling is avoided.

A preferred embodiment of the invention is shown more particularly in FIGURE 2, in which the parts of the atomizing device are essentially symmetrical about a central vertical axis. In this embodiment, the top portion of the device is formed to provide a depressed channel 25 of generally annular shape, the walls 26, 27 defining the channel converging in a downward direction toward and into proximity with the depending tubular portion 18, at which point walls 26, 27 merge with the upper end of tubular portion 18 to provide an aspirating zone.

At this zone the walls 26, 27 are provided with openings 28, 30 respectively, opening 28 communicating with the exterior of the tubular portion 18 and opening 30 communicating with the interior thereof. It will be observed that these openings are formed by the emergence of a single passage 32, having a width slightly greater than the thickness of the wall of tubular portion 18, into the interior and exterior respectively of the tubular portion. Consequently, in forming the device by an injection molding operation, the openings 28 and 30 can be formed by a single axial projection on the mold part which defines or shapes the upper face of the top portion of the device; such mold part can readily be withdrawn in an axial direction without interference and with no disruption of the shape of the passage 32. Preferably a plurality of pairs of proximate openings 28, 30 are provided at points spaced circumferentially of the annular channel 25. In the drawing, the openings are located at three equally spaced points, each establishing an aspirating zone, as shown in FIGURE 3, but a greater or less number of aspirating zones may readily be provided.

In the operation of the device, the resilient container or squeeze bottle may be held in the hand and compressed, whereupon liquid is forced upwardly in the tubular portion 18 and through the openings 30 into the aspirating zone at the base of channel 25. At the same time, air in the space above the liquid in the container is expelled through openings 28, establishing reduced pressure in the aspirating zone as the result of high velocity of airflow, thereby aiding the escape of liquid through the openings 30 and breaking up the escaping liquid into minute droplets or particles which are entrained and suspended in the air stream, so that the liquid is discharged from the container in the form of a mist or fine spray.

Walls 26, 27 provide an expansion chamber for the discharging atomized liquid, controlling the form of the spray.

The atomizing device 12 may be formed of any moldable plastic material, such as a thermoplastic resin, and a wide selection is available inasmuch as there are no moving parts involved. Preferably, however, the material should be somewhat elastic while hot to permit withdrawal of the mold part from the annular recess below the rim or bead 20. Polyethylene or polypropylene resins are satisfactory.

In FIGURE 4 is shown a variant of the embodiment of FIGURES 2 and 3, differing therefrom only in the shape of the openings 28, 30, and similar reference characters are employed to designate the several parts. Thus in FIGURE 4, the openings 28 and 30 are formed by studs or projections on opposing mold parts, withdrawn in opposite directions on separation of the mold. Again, the shape of the openings is such as to facilitate the withdrawal of the mold parts without interference, so that no damage is caused and the desired contour and dimensions of the openings may be predetermined with exactness. As in FIGURE 3, the channel 25 defined by walls 26, 27 is of generally annular shape, allowing expansion of the gaseous suspension of liquid as it emerges from the aspirating zone.

FIGURE 5 is illustrative of a further modification, substantially similar to that of FIGURE 2, but in which the axial length of the opening 28 is considerably greater than that of opening 30 through which the liquid is aspirated. As in FIGURE 2, the openings may be formed by a projection on the core of the upper mold part only. A plurality of pairs of proximate openings may be provided, as in the previously described modifications.

FIGURE 6 illustrates a further modification, in which the two openings are not in direct communication, the opening 36 which communicates with the interior of the tubular portion 18 being formed in the wall 37 at one side of the wall of the tubular portion and the opening 39 to the exterior of the tubular portion 18 being formed in the wall 40. Again, the walls 37, 40 define a downwardly converging channel 42, but the channel need not be, and is not represented as being annular in shape. The air stream discharging through opening 39 flows in a lateral direction across the opening 36 through which the liquid is aspirated. Thus it is possible with this form of the invention to tilt the bottle to the right to an extent sufficient to direct the spray or mist downwardly without causing liquid to flow into opening 39 and thereby preclude atomization.

FIGURE 7 illustrates another preferred embodiment of the invention, generally similar to that shown in FIGURE 4, but involving a reversal of direction of the core parts which form the openings 28, 30 respectively. Thus in FIGURE 7, the opening 28 is formed by the lower core part and the opening 30 by the upper core part. Again, the shape of the openings is such as to facilitate withdrawal of the core parts on separation of the mold. The channel 25 defined by the walls 46, 47 in FIGURE 7 is annular, but the inner face of the wall 46 is substantially cylindrical, producing a slightly different spray pattern from that produced in the preceding embodiments, in which both walls are generally conical.

In all of these modifications, openings are provided at the lowest point in the depressed channel in the top

portion of the device. Consequently any liquid in the channel which is not atomized and discharged is sucked back into the container by the inspiration of air on release of pressure, or drains back into the container when the same is returned to an upright position.

It will be appreciated that many other variants of the embodiments specifically described may readily be evolved by those skilled in the art, and that the details may be altered as desired to provided different degrees of atomization and varying spray patterns, as well as to accommodate liquids differing in viscosity.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. As an article of manufacture, an integral atomizing device for liquid, said device being molded in one piece from moldable plastic material and having a top portion and, depending from said top portion, an annular skirt portion dimensioned for reception in the mouth of a resilient deformable container for liquid, said device having within said skirt portion and depending from said top portion a tubular portion having a length sufficient to extend to the lower part of the container and beneath the level of liquid therein, said top portion having a depressed channel therein, the walls defining said channel converging downwardly toward and merging with the upper end of said tubular portion to provide thereat an annular aspirating zone, said converging walls having at their junction proximate openings therein leading from said channel into (a) said tubular portion and (b) externally of said tubular portion at said aspirating zone, whereby on application of pressure to said resilient container, liquid is forced upwardly in said tubular portion, and is atomized in said aspirating zone on passage through openings (a) into said channel by air discharge through openings (b) into said channel.

2. An article of manufacture as claimed in claim 1 in which said proximate openings are located at each of a plurality of points in spaced relation circumferentially of said channel.

3. An article of manufacture as claimed in claim 1 in which said top portion is provided outwardly of said channel with a closure receiving annular bead, and said device includes, molded integrally therewith, a closure member dimensioned for reception on said bead, and a flexible retainer strip connecting said closure member to said top portion of said device.

4. An article of manufacture as claimed in claim 1 in which the walls of said proximate openings are axially directed and so shaped that core parts employed in their formation may readily be withdrawn from at least one face of said top portion in the axial separation of the mold at the completion of the molding operation.

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