

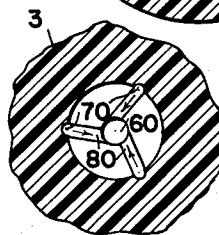
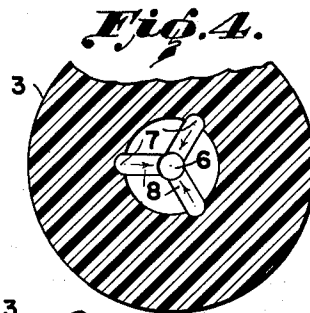
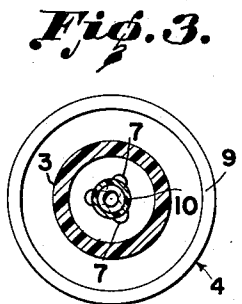
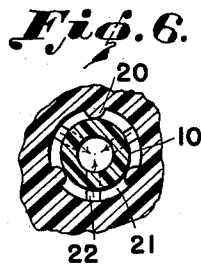
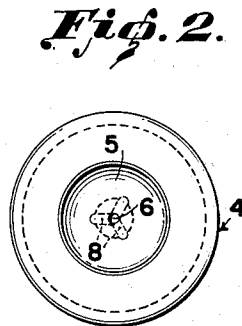
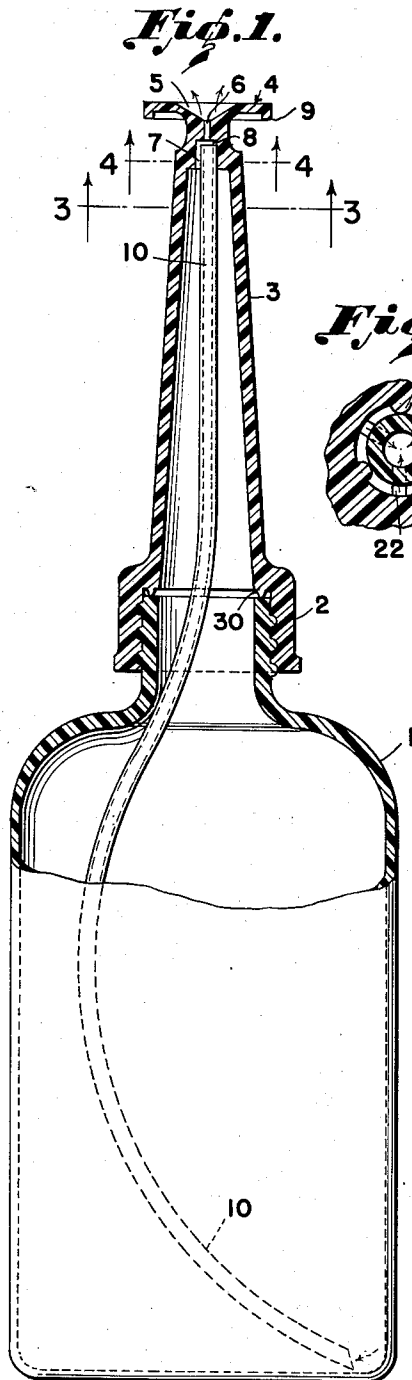
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ACID METERING AND ATOMIZING NOZZLE

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ACID METERING AND ATOMIZING NOZZLE

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The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes throughout the world without the payment to us of any royalty thereon.

This invention relates to a metering and atomizing nozzle for a squeeze bottle atomizer. It particularly relates to a squeeze bottle atomizer nozzle capable of being molded from acid resistant organic plastic molding powders in one piece, in one operation, and providing a uniform rate of delivery of acid throughout its life.

An object of this invention is to provide a sulfuric acid resistant squeeze bottle atomizer having a minimum number of parts, namely three, the bottle, the fluid tube, and the nozzle, which atomizer is capable of exposure of and quick clearing of clogged air and liquid metering passages, by removing and replacing the fluid tube alone.

A further object of this invention is to provide an atomizer acceptable for use by unskilled labor in spraying sulfuric acid upon the faces of freshly wounded pine trees, to increase the flow of oleoresin. An atomizer for these purposes, to be acceptable to the industry and to the operator, must be cheap, accurate in spray pattern, rugged, require little or no servicing, non-clogging, quickly cleanable if clogged, and provide adequate safety guards against acid splash and drip.

Several embodiments of the invention are disclosed in the drawings in which:

Figure 1 is a vertical section of atomizing nozzle and bottle;

Figure 2 is a top view of the tip of the nozzle;

Figure 3 is a sectional view on plane 3—3;

Figure 4 is a sectional view on plane 4—4;

Figure 5 is a sectional view on a plane similar to 4—4 but illustrating a modified and preferred form employing three lateral air metering slots or passages directed tangentially to the vertical air-liquid mixture exit passage; and

Figure 6 is a sectional view on a plane similar to 4—4 but illustrating a modified form employing three ridges to hold the liquid tube.

The apparatus shown in Figure 1 includes a flexible, acid-resistant, self sustaining bottle preferably made of polyethylene plastic. This bottle is filled to two-thirds of its volume with acid. The conical nozzle 3 is screw-threadedly mounted, by nozzle cap 2, on the top of the bottle. Nozzle 3 is made of flexible or rigid acid resistant organic plastic material. Polyethylene plastic may be used for the nozzle, or one having greater rigidity. The nozzle is screwed on

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until integral V-shaped ridge or rim 30 is firmly seated against the top of the mouth of the bottle. This V ridge forms a high pressure line at the place of contact with the flat surface on the bottle tip. This causes deformation of the plastic of the ridge and the bottle, providing a good seal and eliminating the need for a sealing gasket.

The conical shape of the barrel 3 provides an additional air chamber, thereby increasing the duration of the spray period per squeeze. The increase in air capacity is considerable and adds to the utility of the device. This feature makes it possible for the widest wounded faces of pine trees to be treated in a single pass. The importance of this feature will be more readily understood when it is realized that the time required for the bottle to reinflate is much greater than the squeezing time. It is highly desirable for the unit to spray long enough to be able to treat a complete streak in a single pass. The bottle will reinflate while walking to the next tree.

The nozzle 3 is provided at its upper end with an integral anti-splash plate or shield 4. This anti-splash shield, although it appears to be small, protects against splash-backs from the surface being sprayed. For instance, when the apparatus is used to spray sulfuric acid upon freshly wounded pine trees, to increase the flow of oleoresin, the shield is placed in close proximity to the target and therefore provides protection against splashing back of acid over a wide angle. The under side of the shield is provided with a downwardly projecting rim 9 which may be in the shape of a bead. The rim 9 is an anti-drip device to prevent the acid from running down the nozzle to the operator's hand. A flick of the wrist is sufficient to dislodge drops of acid adhering to the rim. The upper face of the shield is provided with a conical cup or depression 5 which has a drop swallowing function. Release of pressure on the bottle provides the necessary suction needed to swallow the drop.

The nozzle is provided with three lateral air metering slots or grooves 8 (Figures 1 and 4) which communicate at one end with the central air-liquid mixture passage 6. Slots 8 communicate with longitudinal slots 7. These slots or grooves are superior for our purpose than bores. Upon removal of liquid pipe 10 the open grooves are exposed for cleaning. The grooves are readily and accurately formed in the molding operation, which is simpler and more economical than drilling bores. For tight fit of the tube 10, the hole into which the top of 10 fits tapers upwardly.

Tube 10 is flexible and is sufficiently long to provide the curved portion shown in the bottle, to prevent movement of the tube by the sloshing liquid and to hold the top of the tube firmly in place. With the liquid intake at the edge of the bottle as shown, the operator can expel the last drop of acid.

In the preferred form the lateral air slots or grooves enter the air-liquid passage tangentially. This is shown in Figure 5. Three lateral slots 80 receive air from longitudinal grooves 70 and introduce the air tangentially into vertical air-liquid exit passage 60. This provides a whirling action in the tip which results in a uniform and complete atomization of the fluid.

In the form shown in Figure 6, the top of tube 10 is held in place by three ridges 20. The three lateral air grooves or slots 22 communicate with the longitudinal air passages 21 and with the central air-liquid passage. The tangential arrangement of Figure 5 can be employed in Figure 6. The three ridges 20 have a slight taper toward the mouth of the nozzle to provide a tight fit for the tip of tube 10.

The plastic nozzle unit 3 is readily formed or cast from molding powders. No drilling of transverse bores is necessary. This molding operation is simpler and cheaper than turning the nozzle from a solid plastic billet or drilling holes in tubing.

In operation, pressure is applied by squeezing the bottle at the sides. The pressure developed inside the bottle forces acid upwardly in the tube 10. Simultaneously air is forced into air metering slots 8 or 80 and escapes into passage 6 where it meets the acid rising in tube 10.

Since the air is introduced tangentially from three symmetrically placed passages, it imparts a whirling and mixing action to the fluid. Upon being released to atmospheric pressure the compressed air expands, tending to separate the droplets even more, thus reducing the tendency of the tiny droplets to coalesce. The dual action of whirl-mix and expansion operates to produce a finely atomized spray of uniform quality. In experiments with a single air passage a non-uniform spray pattern is produced, with a concentration of large droplets in the center of the pattern. This results in uneven application, with over-treatment in some parts of the streak and under-treatment in other parts. Two air passages placed in opposition to each other tend to correct this condition, but the three air passage system shows a much improved pattern. Further, we know of no commercial means of drilling economically three exactly symmetrically spaced holes of such small diameter and depth. This is of no consequence in molding because slots are easily produced on the external surface of a mandrel and identically reproduced on each molding.

A wire or bracket, sharpened to form a spur or unsharpened, can be secured to the neck of the bottle to provide a means of hanging the unit from fixtures on the tree or sticking into the substance of the tree.

A shorter nozzle of the same fundamental design can be used and a baffle can be inserted between the bottle and nozzle at 30 or farther up in the cone. This baffle tends to reduce or eliminate surging, and effect separation of air and liquid.

Having thus described our invention, we claim:

1. A three piece atomizer comprising a self-sustaining acid resistant pliable hand squeeze bottle, a liquid tube, and a molded atomizer nozzle unit screw threadedly mounted upon the mouth of the bottle, the nozzle unit being conical and tapering upwardly from the mouth of the bottle to provide an extensive air chamber in the nozzle unit supplementing and serving as extension of the air chamber in the top portion of the bottle, the nozzle unit including an anti-splash plate integrally mounted on its upper end, the periphery of the splash plate having a depending anti-drip rim, a central drop swallowing depression in the plate, an air-liquid mixing passage terminating in the depression, a bore in the nozzle tip communicating with the mixing passage, the nozzle being provided with at least three air metering slots tangential to the air-liquid mixing passage, the slots being in the end wall of the bore and facing toward the air chamber in the nozzle, the liquid tube extending downwardly into the bottle and upwardly through the nozzle air chamber and terminating in and being held in the bore in the nozzle tip, the upper end of the tube being at least closely adjacent to the slots, the bore providing longitudinal air passages communicating with the squeeze bottle and the slots.

2. An atomizer comprising a pliable hand-squeeze bottle, a liquid tube, and a spraying nozzle unit mounted upon the mouth of the bottle, the nozzle unit having an air chamber therein which communicates with the mouth of the bottle, the nozzle unit comprising a casting molded from an organic plastic material, the nozzle having a narrow air liquid mixing passage terminating in its spraying tip, a larger bore in the nozzle tip communicating with the mixing passage, the nozzle being provided with at least two symmetrically positioned air metering slots tangential to the air liquid mixing passage, the slots being in the end wall of the bore, and facing toward the air chamber in the nozzle, the liquid tube extending downwardly into the bottle and upwardly through the nozzle air chamber and terminating in and being fastened in the bore in the nozzle tip, the upper end of the tube being at least closely adjacent to the tangential slots, the bore being provided with longitudinal slots in its side walls serving as air passages communicating with the squeeze bottle and the tangential slots, whereby upon removing the liquid tube the surfaces of the tangential and longitudinal slots are exposed.

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