An important object of the present invention is the provision of an atomizer for a bottle or other suitable container for liquid in which the delicate portions of the mechanism are substantially enclosed within, and protected by, a sturdy cap which functions as a pressure member for actuating the moving parts of the device.

Another important object of the invention is the provision of improved means for locking said cap in position so that the device may not be operated unintentionally.

Another important object of the invention is the provision of improved means for more effectively atomizing liquid.

The foregoing, and other objects will become apparent from the following description and from the accompanying drawings, in which

Figure 1 is a central vertical sectional view of one embodiment of an atomizer according to the present invention.

Fig. 2 is an elevational view of said atomizer, partly cut away to show in section a cap-locking device, the latter being in non-locking position.

Fig. 3 is somewhat similar to Fig. 2, the cap-locking device, however, being in locking position.

Fig. 4 is an elevational view of the atomizer taken at a right angle to Figs. 2 and 3 and showing an opening in the cap with which the cap-locking device connects, the cap in this view being in raised position.

Fig. 5 is somewhat similar to Fig. 4, the cap, however, being in depressed position.

Fig. 6 is a central vertical sectional view of another embodiment of an atomizer according to the present invention.

Fig. 7 is a sectional view of an improved atomizing nozzle.

A bottle, jar, or other suitable container, indicated as A in Fig. 1, may serve as a holder for liquid to be dispensed and atomized. An atomizer according to the present invention may comprise a body 1 preferably substantially circular in horizontal section, the lower portion of which may be formed to provide a stopper 2 which may, either be screwed into, or otherwise suitably held within a neck A' of the container.

A suction tube 3 of sufficient length to extend nearly to the bottom of the interior of the container may terminate at its upper end in a bushing 3a, which may be screwed into or frictionally held within a cavity 4 in the body 1. The bushing may be provided with an annular shoulder 25 adapted to engage the lower edge of the stopper 2 whereby to limit the insertion of the bushing into the cavity 4, thus providing a space 4a as a part of the cavity 4 within which fluid may freely circulate.

The body 1 is also provided with an atomizing chamber 5 within which certain atomizing members are disposed, and a piston cylinder 6 within which a piston 7 is adapted to work in order to alternately draw liquid by suction into the cavity 4 from the container, and to force said liquid from said cavity into the chamber 5 from which it is expelled to the exterior of the device in atomized form.

The space 6a is connected with the piston cylinder 6 through a passage 6a, and with the chamber 5 through a passage 6a. The opening of the passage 6a into the cavity 4 should preferably be in alignment with the suction tube 3, and the lower end of said passage should preferably be enlarged to accommodate a distance piece 9b which is adapted to limit the displacement of a valve element 8 which constitutes a check valve with the upper end of the suction tube 3.

Another valve element numbered 10 is adapted to connect as a check valve with the passage 9a at the point where the latter enters the chamber 5.

The valve element 10 is preferably normally urged into a closing position with respect to the passage 9a by a compression coil-spring 11, one end of which engages said valve element and the other end of which engages an atomizing element 12.

The element 12 is disposed within a cylindrical thimble 12a which may be screwed into, or frictionally held within the chamber 5. The inner end of the thimble 12a is open, and the outer end of said thimble is at the exterior of the body 1 and is provided with a coaxial atomizing nozzle 17, through which atomized liquid may be discharged from the device. As best seen in Fig. 7 the outer end of the interior of said thimble is formed to provide a conical interior surface 16a, and the outer end of the atomizing element 12 is extended in the form of a cone 14, the side of which is of the same inclination as the conical surface 16a of the thimble. The atomizing element 12 should preferably fit snugly within the thimble and is provided with one or more helical channels 13 formed in the outside thereof. This channel or channels preferably extend from the inner to the outer end of the atomizing element and open at the outer end thereof into a small cone-shaped passage 16, the apex of which opens into the atomizing nozzle 17. The passage 16 is formed by making the base of the cone 14 of slightly smaller diameter than the body of the atomizing element 12 so that the outer end of said body portion may engage the base of the
conical surface 16a and thus maintain suitable spacing between the latter surface and the surface of the cone 14. This space should preferably be very slight. It will be understood that fluid moving under pressure from left to right through the thimble 12a as viewed in Fig. 7, will be given a pronounced swirling motion as it passes through the helical channels 13, and that swirling motion will continue as the fluid continues through the cone-shaped passage 16 and the orifice 17. Under this arrangement the fluid is delivered in a very fine swirling symmetrical sheet to the orifice 17, and the dimensions of the atomizing parts just described are such that the liquid is in a thoroughly atomized state as it is discharged from the device.

The piston 7 is shouldered at the upper end thereof as at 1a, and a compression coil-spring 8 engages said shoulder and seats within an annular channel 20 which encircles the cylindrical wall forming the piston cylinder 6. By this arrangement the stroke of the piston 7 is not interfered with in any way by the spring 8, so that a relatively long stroke may be imparted to the piston in the operation of the device. A suitable gasket 19 may be affixed to the lower end of the piston 7 by means of a screw 19a to provide a closure between the piston and the wall of the piston cylinder 6.

The upward movement of the piston 7 is limited by a cup-shaped cap 18 within which the body 1 of the device is proportioned to fit. The fit between these two parts should preferably be such that there will be little play between them, but that the cap may slide freely over said body portion. The cap 18 is provided with an opening 18a which registers with the nozzle 17 and is large enough to so register in any position in which the cap 18 might be moved in the operation of the device so that atomized fluid discharged from the device may pass freely into the open air. It will be understood that the cap 18 may be pressed manually so that it will slide downwardly and will carry with it the piston 7 against the compression of the spring 8, and that when the user of the device desires to release the manual pressure upon the cap 18 the latter and the piston 7 will automatically rise in response to the compression of said spring.

The movement of the cap 18 relatively to the body 1 is controlled by a cap-locking device which may be best understood from Figs. 2, 3, 4 and 5. This locking device may preferably comprise a plunger 28 having on its outer end a button 29 extending through a slotted opening 26 in the side of the cap 18, thence into a horizontal bore 25b in the body 1 of the device. Toward the inner end of the plunger 28a the latter is provided with an annular groove 26a which projects the upper end of a set-screw 25 suitably inserted in the body 1. A second annular groove numbered 24 is provided on the plunger 28a. The diameter of the plunger at this second groove is slightly less than the width of the slot 26 in the cap, and the cap is not intended to work in this last-mentioned groove when the device is in operation. This last-mentioned groove is defined at its outer end by the base of a frusto-conical portion 27, the base of which is slightly smaller in diameter than the diameter of an enlarged circular hole 28 which communicates directly with the slot 26. The outer end of the said frusto-conical portion merges into the button 29 hereinbefore referred to. The plunger 28a is urged outwardly by a compression coil-spring 22, the outer end of which seats against the inner end of said plunger, and the inner end of said spring seats against the inner end of the bore 25b. When the cap-locking device is as shown in Fig. 2, the cap 18 may be moved up and down freely in order to operate the atomizer. However, if it is desired to set the cap-locking mechanism as shown in Fig. 3, the cap 18 is first pressed downwardly as far as it will go, in which position the frusto-conical portion 27 will be in alignment with the circular hole 28 of the slot 26. Then the button 29 is pressed to move the plunger 28a inwardly to the position shown in Fig. 3. While the button is held in said position against the compression of the spring 22 the cap is released, permitting the latter to rise slightly in response to the compression of the spring 8 so that the edge of the surface of the frusto-conical portion 27 near the base thereof will be locked underneath the edge of the upper end of the slot 26, and will be held in that position by the tension of the spring 8 until released by the user of the device.

Assuming now that the cap-locking mechanism is in the position indicated in Fig. 2, the operation of the atomizer may be as follows: The container 5 contains a suitable quantity of liquid to be dispensed and atomized. The cap 18 is first pressed down as far as it will go, carrying the piston 7 with it, thus forcing air from the piston cylinder 6 into the cavity 4, thence through the passage 8a and the atomizing chamber 9, and through the atomizing nozzle 17 into the open air. While this is taking place, the valve element 5 is held in a closed position over the suction tube 3 by the air pressure within the cavity 4. After the down stroke of the cap 18 is completed it is then released, whereupon the piston 7 and the cap 18 rise in response to the compression of the spring 8. As the piston rises, a suction is created in the piston cylinder 6 and also in the cavity 4. This suction causes the valve element 5 to rise and draws fluid from the container upwardly through the suction tube 3 into the cavity 4 and the piston chamber 5 through the passage 8a into the atomizing chamber 9, thence in a swirling motion the liquid passes through the helical channel 13 and the cone-shaped passage 16, thence through the orifice 17 and out of the device in finely divided or highly atomized form. Upon the cap 18 again being released, it moves with piston 7 to a raised position, after which the cap and piston may be repeatedly moved up and down to continue dispensing and atomizing of the fluid from the container.

It will be seen from the foregoing description that the cap 18 completely protects all delicate parts of the device; that because of the disposition of the spring 8 the stroke of the piston 7 is not interfered with by said spring, and that the end of the said frusto-conical portion provided at the outer end of the atomizing chamber 5, a smooth, symmetrical flow of liquid is achieved so that atomizing thereof is more effectively accomplished.

The embodiment shown in Fig. 6 is fundamentally the same as that shown in Fig. 1 to 5, the disposition of the parts, however, in the embodiment of Fig. 6 is such that the cap is operated horizontally instead of vertically.
The general contour of this embodiment may, like Fig. 1, be substantially in the form of a cylinder having a vertical axis, but the cylinder may be somewhat higher and smaller in diameter. Under this arrangement the dispensing device may be conveniently held within the hand of the user and may be operated simply by closing, or partly closing the fingers, thus literally squeezing the cap into a sliding movement over the body of the device and imparting the necessary reciprocating movement to the piston. Because of the somewhat different disposition of parts, the passage of liquid is somewhat longer than in the embodiment of Fig. 1, and the distance piece is quite remote from the passage leading to the atomizing chamber. Although no cap-locking device is shown in Fig. 6, it is obvious that one may easily be provided in the embodiment illustrated therein.

It should be understood that the embodiments described herein and illustrated in the accompanying drawings are used for illustrative purposes only in describing the present invention, and that the inventive concept may be employed in various ways not necessarily shown herein, without departing from the invention as defined in the following claims.

What I claim is:

1. In an atomizer comprising a body and a spring-pressed cap adapted for sliding reciprocation relatively to said body, means for locking said body and cap against relative reciprocation, comprising a reciprocating plunger extending from the exterior of said cap, through a slot in the latter and into said body, means for limiting the reciprocating movement of the plunger, and yieldable means normally urging said plunger outwardly, the said slot extending parallel to the line of reciprocating movement of the cap and being enlarged at one end thereof to form an enlarged opening, the said plunger having a frustro-conical portion the base of which is adapted to enter said enlarged opening and to be capable of partly underlying portions of the edges of said opening and slot when said plunger is pressed inwardly and the tapered portion of said frustro-conical portion being of greater diameter than said slot, whereby to prevent substantial relative reciprocation of the body and cap when said plunger is in such pressed position.

2. An atomizer for liquids, comprising a body member adapted for attachment to a container for liquid, atomizing means carried by said body member and adapted to withdraw liquid from said container and discharge it in atomized form from the atomizer, a manually reciprocable operating member adapted to contact with and operate said atomizing means, and a locking mechanism comprising an adjustable locking element, carried by one of said members and adapted for movement into locking position in engagement with a portion of the other of said members whereby to restrict the reciprocating movement of said operating member to an extent sufficient to prevent material operation of said atomizing means, the said atomizer being further characterized in that the locking element is reciprocable, between the mentioned locking position and a non-locking position, in a direction perpendicular to the line of reciprocation of the said operating member; in that the atomizer includes means adapted to yieldably urge said locking element toward its non-locking position and means adapted to yieldably urge said operating member toward one extreme position; in that the said locking element is manually movable to its locking position when the said operating member is in one extreme position; and in that the operating member, in response to the mentioned urging applied thereto, is adapted to engage the locking element when the latter is in locking position and to hold it in said locking position.

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