

May 17, 1938.

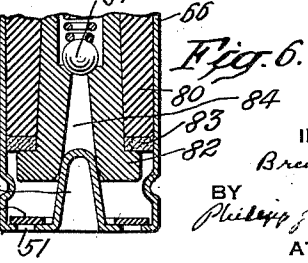
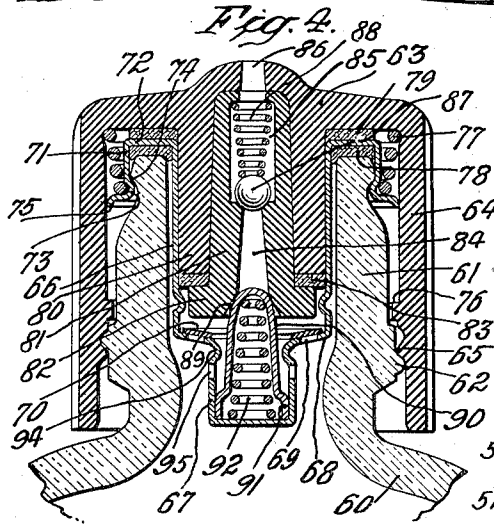
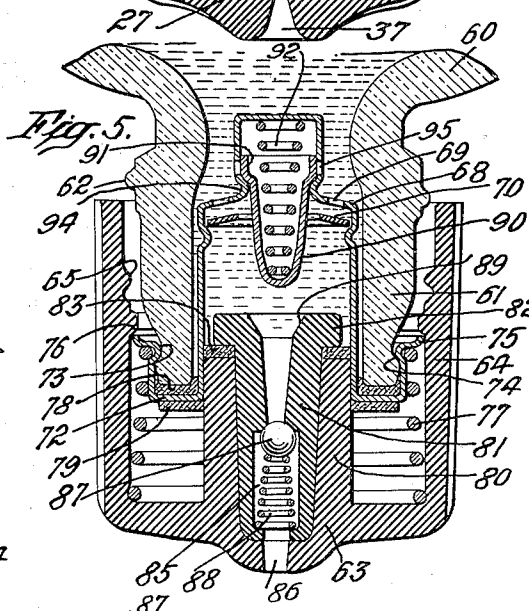
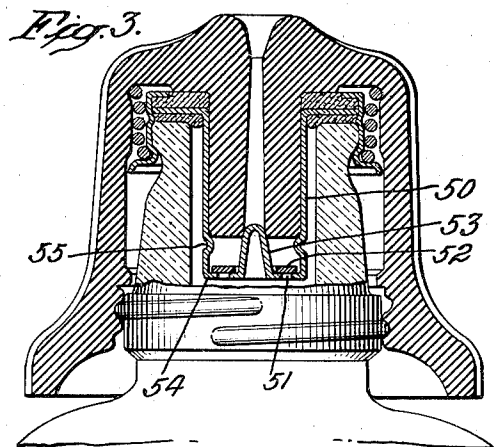
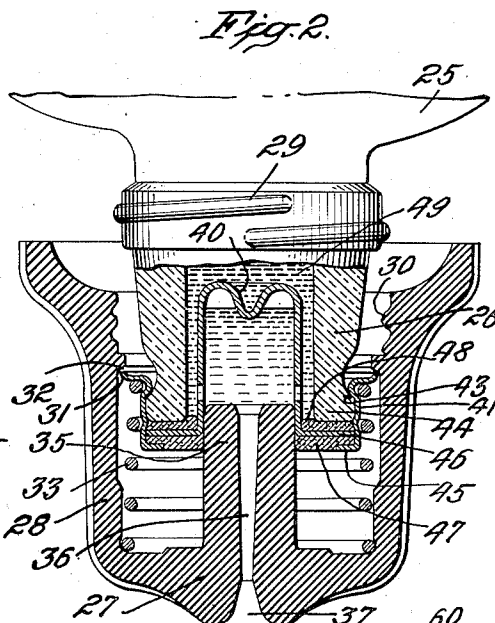
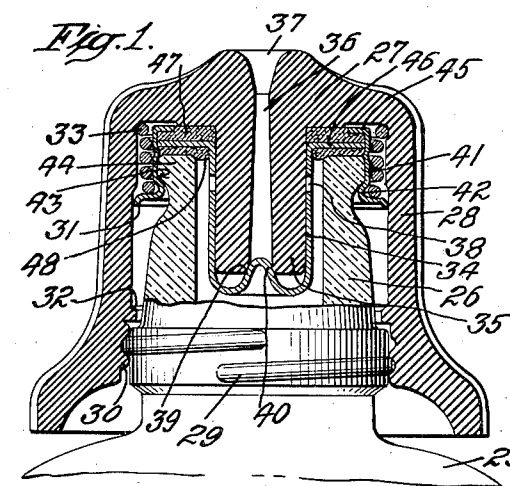
B. F. CAHOON

2,117,296

DISPENSING PACKAGE FOR LIQUIDS

Filed Sept. 16, 1936

4 Sheets-Sheet 1



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May 17, 1938.

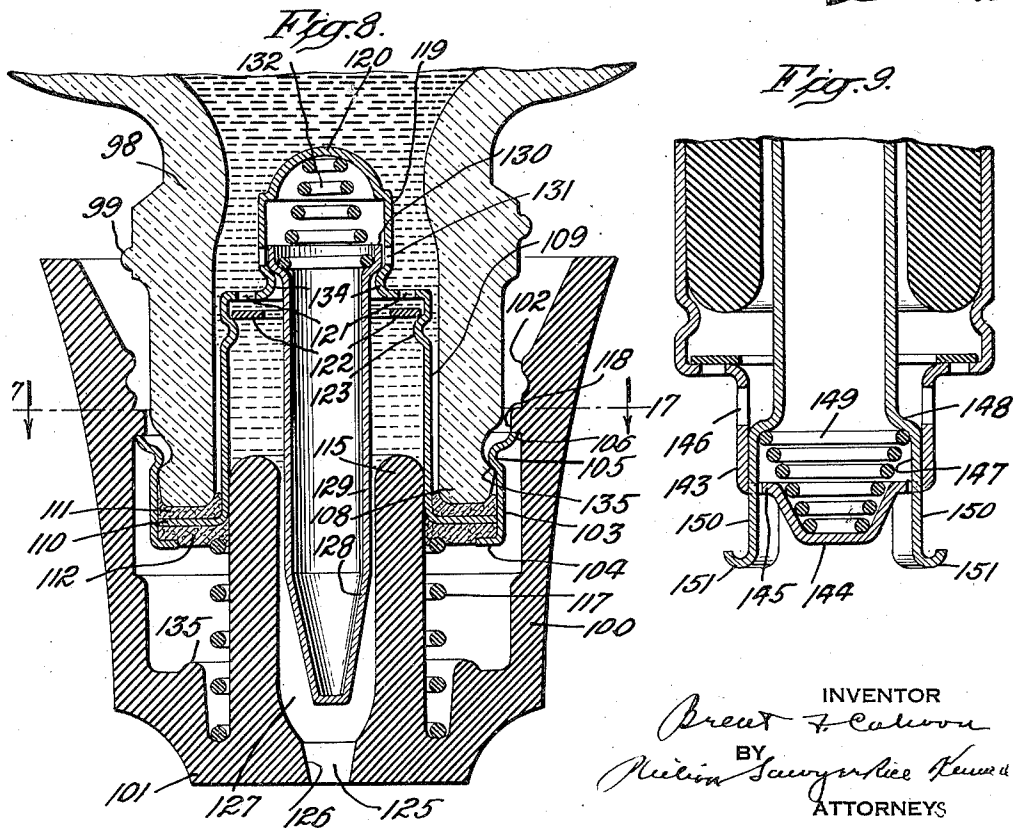
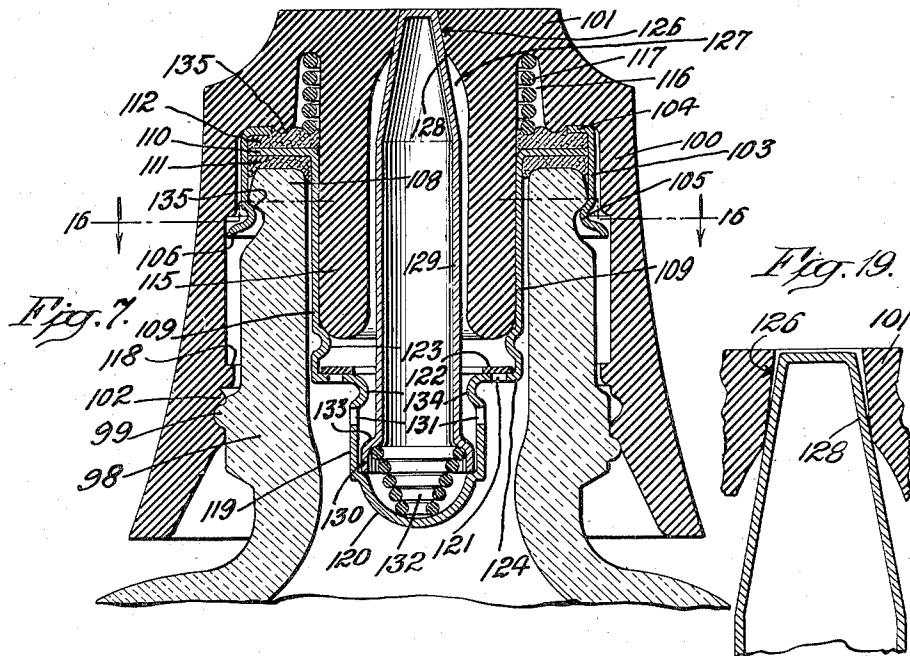
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DISPENSING PACKAGE FOR LIQUIDS

Filed Sept. 16, 1936

4 Sheets-Sheet 2



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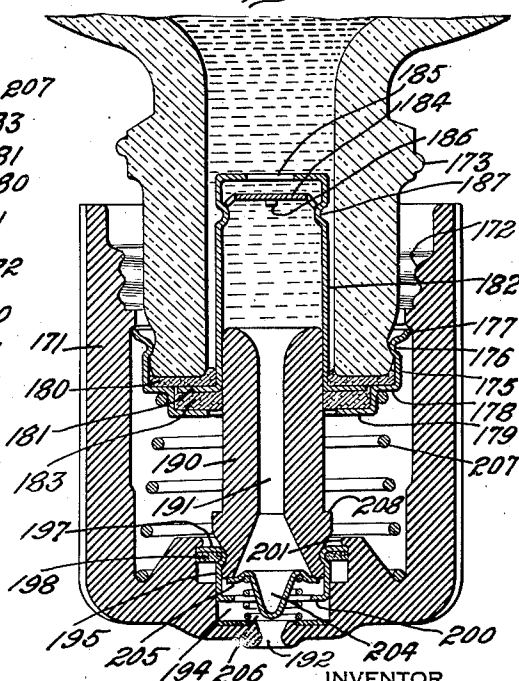
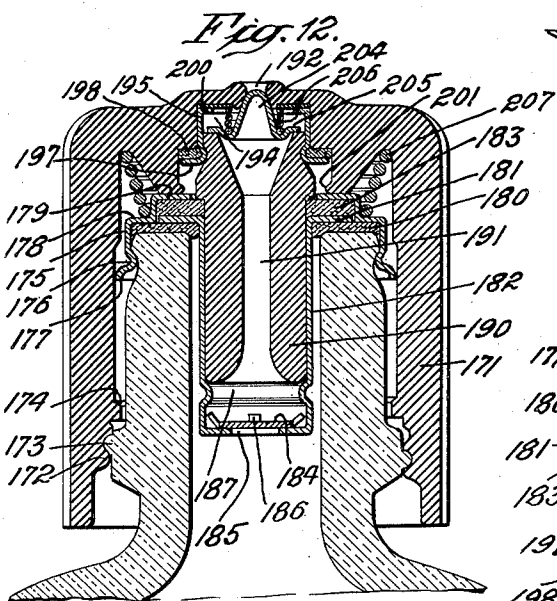
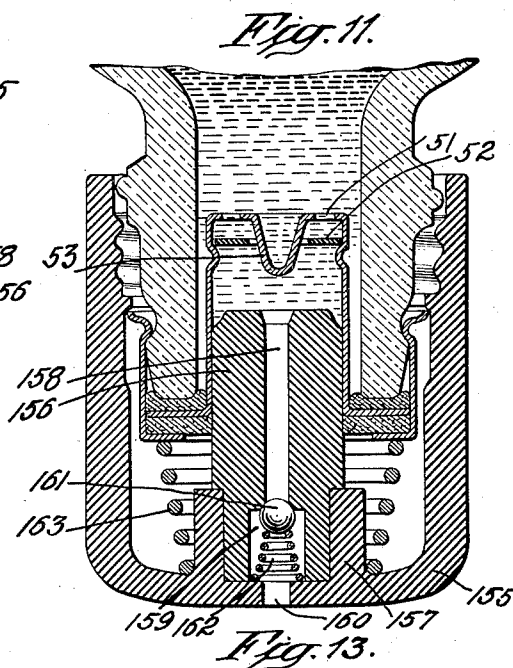
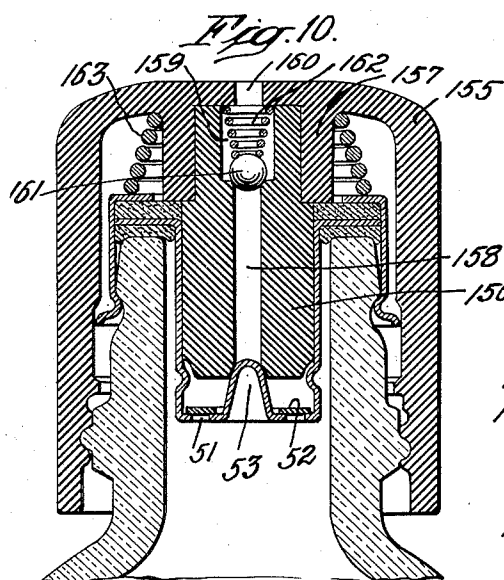
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DISPENSING PACKAGE FOR LIQUIDS

Filed Sept. 16, 1936

4 Sheets-Sheet 3



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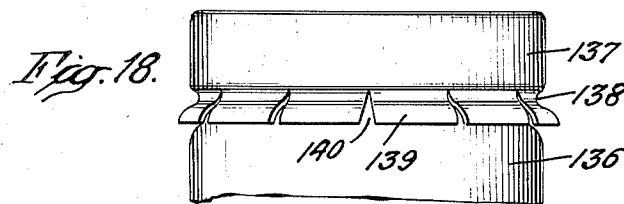
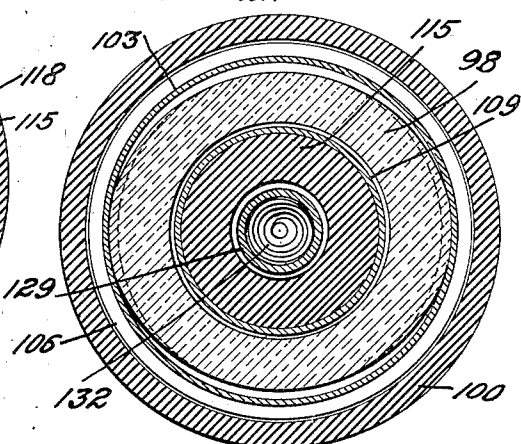
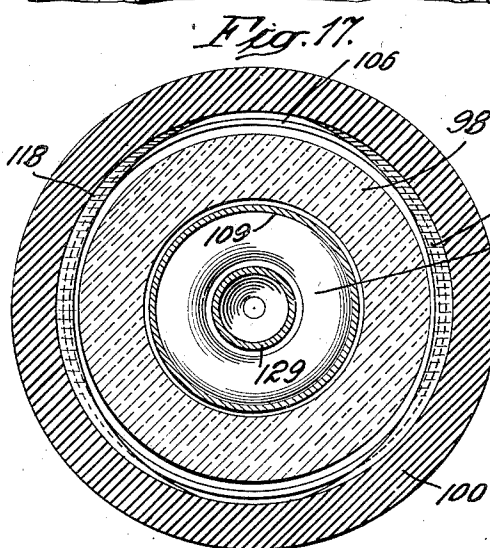
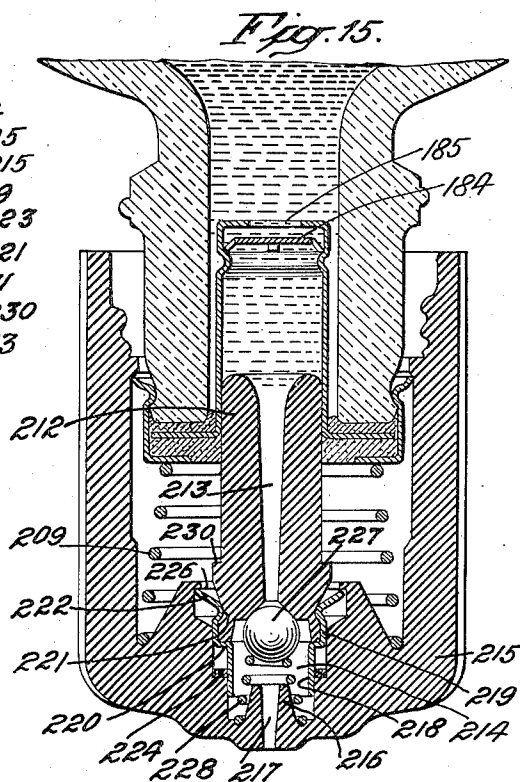
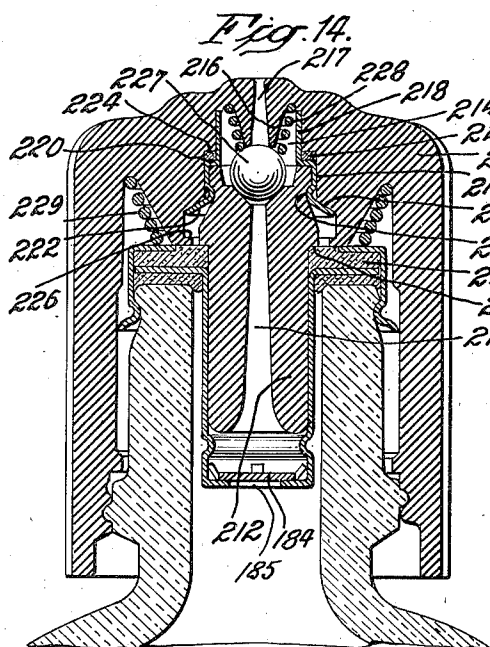
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2,117,296

DISPENSING PACKAGE FOR LIQUIDS

Filed Sept. 16, 1936

4 Sheets-Sheet 4



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2,117,296

DISPENSING PACKAGE FOR LIQUIDS

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Application September 16, 1936, Serial No. 101,046

38 Claims. (Cl. 221—147)

This invention relates to dispensing packages for liquids.

It has been proposed to package hand lotions and similar products in such a manner that the contents can be ejected in the form of jets by a pumping action. Such packages as heretofore known, however, have been subject to various objections and disadvantages. For example, in these previously known devices, the pump-actuating element has necessarily been an extraneous part of one sort or another, resulting in a rather unsightly or ungainly package. A further result of such extraneous pumping elements is that their asymmetrical shape or their unduly extended dimensions, make packing for shipment somewhat complicated and expensive.

It is an object of the present invention to provide an improved dispensing package of the type mentioned that avoids the objections and disadvantages above referred to and that is attractive in appearance, simple in construction and economical to pack.

More particularly it is an object of the invention to provide a dispensing package in which a container cap serves the double function of a closure and a pump-actuating element.

With these and other objects in view, the invention consists in the features, combinations, details of construction and arrangements of parts that will first be described in connection with the accompanying drawings and then more particularly pointed out.

In the drawings,—

Figure 1 is a vertical sectional view, with parts in elevation, of a package, including container and cap, constructed in accordance with the invention;

Figure 2 is a similar view, showing the cap open and the container inverted for dispensing;

Figure 3 is a view similar to Figure 1, showing a modification;

Figures 4 and 5 are views similar to Figures 1 and 2, showing a further modification;

Figure 6 is a fragmentary sectional view showing still another modification;

Figures 7 and 8 are views similar to Figures 1 and 2, showing what is now considered the preferred embodiment of the invention;

Figure 9 is a fragmentary sectional view showing a modification of part of the construction shown in Figures 7 and 8;

Figures 10 and 11, 12 and 13, 14 and 15 are, respectively, views similar to Figures 1 and 2, showing three additional modifications;

Figure 16 is a sectional view taken on the broken line 16—16 of Figure 7;

Figure 17 is a similar view taken on the line 17—17 of Figure 8;

Figure 18 is a fragmentary view in elevation of one form of attachment, and

Figure 19 is a detail sectional view showing a plug valve and its seat in somewhat exaggerated form.

Referring to the drawings, the embodiment 10 illustrated as an example in Figures 1 and 2 comprises a container in the form of a glass bottle or flask 25 having a neck 26. Associated with this container, in forming the complete package, is a cap 27 having a skirt 28 which telescopes over the bottle neck. This cap may conveniently be formed of molded material.

The invention in its entirety includes interengaging elements on cap and container for releasably locking or holding the cap in closed position. This may conveniently be accomplished by complementary screw threads. To this end, as shown, near the base of the bottle neck is a short external thread 29 and near the bottom of the cap skirt is a corresponding internal thread 30.

In this connection, it is noted that although the package will ordinarily be inverted for dispensing, the terms "top", "bottom", "up", "down" and the like, will be used herein as referring to the upright position of the container, unless otherwise specified.

According to the invention in its entirety, the cap, upon disengagement of the threads, becomes a pump-actuating element. To this end, there is provided means whereby the cap is capable of a limited axial reciprocation with respect to the bottle neck when the threads 29, 30 are disengaged. In this connection, the term "axial" movement is used to distinguish from the helical movement during engagement of the threads. Although capable of various constructions, in that shown as an example in Figures 1 and 2, carried by the bottle neck, in a manner later described, is an outwardly and downwardly extending locking or limiting flange 31, located not far below the bottle mouth. Just above the cap thread 30 is an internal stop shoulder 32 arranged to engage flange 31 upon upward movement of the cap, to limit such movement and lock the cap against removal. The flange 31 and shoulder 32 and the method of assembling the same are hereinafter more fully referred to. Axial movement in the opposite direction is limited by the engagement of the threads 29, 30, which thus serve as stops.

Upon disengagement of the threads, the cap is free to be reciprocated between the limits specified, the cap movement being guided or steadied by the sliding contact of flange 31 with the inner wall of the cap skirt.

For convenience of description, the position of the cap when screwed down on the bottle thread, as in Figure 1, will be referred to as the "closed" position and the position of the cap when displaced axially until the stop shoulder engages the locking flange, as in Figure 2, will be referred to as the "open" position. This terminology also applies to the several modifications hereinafter described.

There is provided means for tending to keep the cap in open position when the threads 29, 30 are disengaged. To this end, in the present exemplification, a coiled spring 33 is confined between flange 31 and the top wall of the cap. As soon as the threads are disengaged, the cap being free, spring 33 moves the cap to the open position of Figure 2.

The invention in its entirety includes a barrel, in the nature of a pump barrel, carried by the container and a pump plunger operated by the cap. Although capable of various constructions, in that shown as an example in Figures 1 and 2, extending down into the bottle neck and supported therefrom as later described, is a metal barrel 34. Reciprocable in this barrel is a pump plunger 35. In the present exemplification, the operative connection between the plunger and cap is effected by making the plunger integral with the cap. The plunger has a central bore 36 which communicates with a port 37 in the top of the cap, bore and port constituting a discharge passage.

The barrel is provided with a plurality of controlled inlet ports. In the exemplification illustrated in Figures 1 and 2, the inlet ports are plunger controlled. To this end, the lower end of the barrel is closed and near the upper end are a plurality of inlet ports 38. These ports are so located as to be just cleared by the plunger when the cap is in open position (Figure 2).

The invention in its entirety includes means for closing the discharge passage when the cap is in closed position. While this may conveniently be accomplished in various ways, a convenient construction includes a plug valve cooperating with a valve seat formed as part of the defining wall of the discharge passage. To this end, as shown as an example in Figures 1 and 2, the lower mouth of bore 36 is tapered to form a frusto-conical valve seat 39. Cooperating therewith is a conical hollow plug valve 40 forming part of the bottom of barrel 34. The parts are so arranged that when the cap is screwed down to closed position, valve seat 39 is forced tightly against plug valve 40 to seal the discharge passage. The valve and valve seat and the sealing operation are more fully described hereinafter.

In the embodiment illustrated as an example in Figures 1 and 2, the locking flange 31 and the pump barrel 34 are parts of an attachment unit permanently secured to the bottle neck. As shown, the attachment unit includes a metal clamp ring 41 which embraces the mouth of the bottle. This ring has an inwardly extending V-shaped bend or bead 42 which locks under a shoulder 43 formed by a so-called lock ring 44 at the bottle mouth. This lock ring is similar to the lock ring provided on bottles sealed by closures of the crown cork type. The clamp ring 41 also has an intumed clamping flange 45 which

takes over the lip of the bottle. The pump barrel 34 is suspended by means of an outwardly extending supporting flange 46 clamped between clamp flange 45 and the bottle lip.

Clamped between supporting flange 46 and clamp flange 45 is a compressible gasket 47 of cork, felt or other suitable material. This gasket performs several functions. It serves to prevent leakage from the barrel. Its inner peripheral edge makes wiping contact with plunger 35 so that it serves as a pump packing. As the cap moves into closed position, the gasket is engaged and compressed by a shouldered portion of the top wall of the cap, as appears in Figure 1. This compression not only augments the sealing effect of the gasket but also has a relation with the sealing of the discharge passage, as more fully referred to hereinafter.

Compressed between flange 46 and the bottle lip is a second gasket 48 which serves to prevent leakage from the container up over the bottle lip.

Certain features of construction of the bead 42 and the bottle locking ring 44 and the method of assembling the same are hereinafter referred to. Once assembled, the combined gripping action of bead 42 and clamp flange 45 securely clamps the attachment unit to the container. This unit, in addition to the clamp ring itself, includes gaskets 47, 48, the pump barrel 34, and locking flange 31 which is formed as an extension of one leg of V-shaped bend 42.

Figure 1 illustrates the package closed for shipment, storage and when not in use. So closed, leakage is effectively prevented by the plug valve 40 and the gaskets 47, 48.

When it is desired to obtain an application of the hand lotion or other contents, the cap is unscrewed until the threads 29, 30 disengage, thus freeing the cap which thereupon becomes a pump-actuating element. Spring 33 causes the cap to move upwardly until shoulder 32 engages flange 31. During this opening movement, valve seat 39 moves away from plug 40, thus opening the discharge passage, and plunger 35 clears ports 38, thus opening communication between the pump chamber and the container.

It will be apparent that to dispense the contents, the bottle must be inverted. Whether the cap is opened before or after inversion is immaterial. If before, the opening stroke will ordinarily be an idle one and one or more reciprocations of the cap, in the nature of "priming" strokes, will be necessary after inversion. If the cap is opened after inversion, such priming operation may be found necessary. For the purposes of the present description, it will be assumed that the cap is unscrewed and opened after the bottle is inverted (Figure 2) and that no priming action is involved.

The movement of the cap to open position and the consequent movement of plunger 35 may be termed the suction stroke of the pump unit. In the embodiment of Figures 1 and 2, the discharge passage, during this stroke, is open to atmosphere. This would ordinarily mean that there would be no actual suction effect. But the bore 36 is, in practice, very small, for example, of the order of .050 of an inch in diameter, and it is believed that some suction exists. In any event, the stroke is analogous to the stroke in embodiments later described in which the discharge passage is closed to atmosphere. Consequently, the term suction stroke is used throughout.

As a result of this suction stroke with the bottle

inverted into some such position as shown in Figure 2, liquid 49 is drawn into the pump chamber of barrel 34 by gravity or suction or both. Since bore 36 is so small and since hand lotions and the like are thickish liquids, there will ordinarily be no flow through the discharge passage pending the action of the pump. In any event, the drawings, for simplicity show no liquid in the passage.

It will be apparent that the dispensing operation may be carried out in various ways. For example, the bottle may be held in one hand and the pump-actuating cap reciprocated by a finger of that hand. Or the cap may be actuated by the palm of the other hand. In any event, the cap is moved toward the bottle until thread 30 engages thread 29, the threads serving as stops. This is the compression or expelling stroke of the pump unit. The movement of plunger 35 first closes inlet ports 38 and then causes a charge to be forced out through the discharge passage 36, 37 in the form of a jet. As only a small quantity is delivered on each force stroke, the user will ordinarily give the pumping cap several rapid reciprocations. Each suction stroke causes or permits the intake of a charge and each force stroke ejects a charge. After use, the cap is rotated to engage the threads and is screwed down tight to seal the package, as in Figure 1.

Instead of having the bottle held in the hand it may be supported in a permanently inverted position. If supported by a holder which grips the cap, the relative rotary movement to disengage the threads and the relative axial movement to expel the charge are effected by moving the bottle instead of the cap.

With the construction described, there is no protruding or otherwise extraneous pumping element. As a result, the package is neat and attractive in appearance and can be readily and economically packed for shipment.

It will be noted that when the threads are disengaged, the cap is free to swivel and is operable as a pumping element in any angular position. This avoids the necessity of any positioning or the like on the part of the user, and any attempt to turn the cap results merely in an idle and harmless rotation.

Figure 3 illustrates a modification in which the inlet ports of the pump barrel are valve-controlled instead of being plunger-controlled. To this end, as here shown as an example, a pump barrel 50 is supported in the same manner as the barrel 34 of Figure 1. In the bottom of this barrel are a plurality of inlet ports 51. These ports are controlled by a valve in the form of a floating washer 52 which seats on the flat port 54 of the bottom of the barrel surrounding the ports 51. Rising from the bottom of the barrel, inside the row of ports 51, is a hollow plug valve 53. Movement of the floating valve is limited by nibs 55 struck in from the wall of the barrel. Except for the features mentioned, the construction is the same as that of Figures 1 and 2. When the bottle is inverted for use, valve 52 moves away from its seat by suction or gravity or both, thus opening the inlet ports and permitting the container contents to flow into the pump chamber. On the compression stroke of the plunger, the valve is forced back against its seat to close the ports. Otherwise, the operation is the same as that above described.

The invention in its entirety includes means for shutting off the discharge passage during at least part of the suction stroke. This may be

accomplished in various ways. For example, a shut off during the entire stroke may be conveniently accomplished by a check valve. Or, as a further example, the passage may be closed during the first part of the suction stroke by causing the valve which normally closes the passage to maintain its closing action during part of the suction stroke.

Figures 4 and 5 illustrate an embodiment of the invention in which both types of shut off are utilized. As there shown as an example, a bottle 60 has a neck 61 provided with a short thread 62. The cap 63 has a skirt 64 with an internal thread 65. Within the bottle neck is a barrel 66 having an extension 67 of smaller diameter and closed at the bottom. The annulus 68 connecting the two portions of the barrel serves as a valve seat and is provided with a plurality of intake ports 69. These ports are controlled by a floating valve washer 70 which functions in the same manner as the valve 52 of Figure 3.

In the exemplification of Figures 4 and 5, the barrel 66 is an integral part of the attachment unit. To this end, a clamp ring 71, generally corresponding to the clamp ring of Figures 1-3, is connected with the barrel by flat portion 72 which serves the dual function of a clamp flange for the attachment and a supporting flange for the barrel. The attachment unit has a V-shaped bend or bead 73 which locks under the bottle shoulder 74 in the same manner as previously described. One leg of the V is extended to form a locking flange 75 like the flange 31. On the cap skirt is a shoulder 76 for engaging flange 75 to limit axial movement of the cap. Confined between the flange 75 and the top wall of the cap is a spring 77 for moving the cap to open position. Between the clamp flange 72 and the lip of the bottle is compressed a sealing gasket 78 and between the top of the cap and clamp flange 72 is a compressible gasket 79. This gasket performs the same sealing function as the gasket 43 of Figure 1 but it is not used as a packing. In closed position of the cap, gasket 79 is engaged and compressed by the top wall of the cap.

In the embodiment of Figures 4 and 5, the pump plunger, for convenience of manufacture, is formed in two parts assembled as a unit. To this end, as here shown as an example, extending into the barrel and slidable therein is a tubular plunger element 80 intergral with the cap. Rigidly secured in this tubular element by a drive fit or otherwise, is plunger insert 81 having an outwardly turned flange 82 overlapping the lower end of tubular element 80. This insert may conveniently be formed of aluminum or other suitable metal. Compressed between flange 82 and the end of element 80 is a gasket 83, of felt or other suitable material, which makes wiping contact with the pump barrel and serves as a pump packing.

When assembled, the parts 80, 81 constitute a pump plunger which is, in effect, an integral part of the cap. The plunger and cap have a discharge passage comprising a lower bore 84, a chamber 85 and a port 86. The bottom of chamber 85, where it communicates with bore 84, is dishd to form a valve seat for a ball check valve 87. This valve is normally held to its seat by a spring 88.

As in the embodiments previously described, the discharged passage is closed, when the cap is in closed position, by a plug valve. In the present embodiment, however, the plug valve is movable during part of the cap movement, whereby it maintains its passage-closing action during part

of the suction stroke of the cap. To this end, as here shown as an example, the mouth of bore 84 is formed with a frusto-conical valve seat 89. Cooperating therewith is a hollow plug valve 90 the skirt of which extends downwardly into barrel extension 67 and terminates in an enlarged sleeve 91 having a sliding fit in the extension.

Housed within the plug 90 and bearing against the bottom of the barrel extension is a spring 92 which tends to hold the plug against the valve seat. When the cap moves to open position, that is, during the suction stroke of the plunger, plug 90 tends to follow the plunger by virtue of spring 92. This movement, however, is limited by the engagement of a shoulder 93, formed by enlarged sleeve 91, with nibs 94 struck in from the wall of barrel extension 67. The parts are so arranged that the plug is checked in its following movement prior to the end of the suction or opening stroke of the cap, whereby the discharge passage is opened in readiness for the expelling stroke.

The invention in its entirety includes means for preventing or tending to prevent the ejection of fluid during the latter part of the movement of the cap into closed position. This may be conveniently accomplished by a vent which is opened during the latter part of the closing movement of the cap and which by-passes liquid remaining in the barrel back to the bottle. In structures embodying the invention to what is now considered the best advantage, this vent will be controlled by the movable plug unit.

As shown as an example in Figures 4 and 5, formed in the wall of barrel extension 67 are a plurality of ports 95 located just below nibs 94. These ports are controlled by sleeve 91 which thus performs the additional function of a shutter. During the latter part of the suction stroke and the first part of the expelling stroke, plug 90 is in its advanced position, whereby sleeve 91 closes ports 95 (Figure 5). During the latter part of the movement of the cap toward closing position, the plunger 80, 81 engages plug 90 and forces it back against its spring, whereby sleeve 91 uncovers ports 95 (Figure 4). During the final movement of the cap into closing position, therefore, such movement including the thread-engaging rotation, any liquid remaining in the barrel is by-passed back into the bottle instead of being ejected. This does not necessarily mean that the pump chamber will be entirely emptied but that if, under the compression of the plunger's stroke, the liquid must be forced somewhere, it will be by-passed and not forced out the discharge passage. The construction described tends to prevent the accumulation of liquid on the cap following a dispensing operation.

The operation is generally like the operation of the embodiments already described. Figure 4 illustrates the cap in closed position. When the threads are disengaged, the cap is moved to open position by spring 77. During this suction stroke, ball valve 87, being held to its seat by its spring, shuts off communication between the pump chamber and atmosphere so that there is set up an increased suction effect. The bottle having been inverted, floating valve 70 is moved away from its seat by gravity or suction or both and liquid is drawn into the pump chamber by gravity or suction or both (Figure 5). During the unscrewing of the cap and the earlier part of the suction stroke, plug valve 90 follows the plunger, keeping the discharge passage closed. But as soon as shoulder 93 engages nibs 94, the plug unit

is checked and the valve seat moves away, opening the discharge passage. In this checked position of the plug unit, sleeve 91, functioning as a shutter, closes ports 95 (Figure 5).

The cap is then moved toward the bottle to effect the forcing or expelling stroke of the pump unit. The compression thus set up causes floating valve 70 to re-seat and close the inlet ports. It also causes a charge to be ejected through the discharge passage, ball valve 87 being forced away from its seat, against its spring, to permit passage of the charge.

During the latter part of the compression stroke, the plunger picks up plug valve 90 and moves the plug unit back against its spring, uncovering ports 95. During the end of this stroke and, if the bottle is being closed, during the screwing down of the cap, any charge remaining in the pump chamber will be by-passed back into the bottle via ports 95. As the plunger thus picks up the plug 90 and moves it back, the contact is a more or less loose one. By the time the threads start to engage, if the cap is to be closed, the plug unit has bottomed in the barrel extension so as to be, in effect, stationary during the screwing down of the cap.

If desired, the check valve 87 may be omitted. In that case, a certain amount of suction effect is still attained, inasmuch as the discharge passage is closed to atmosphere during the first part of the suction stroke by the plug valve.

It will be apparent that a check valve may be utilized with a stationary plug valve. Figure 6 illustrates an example of such a modification, the plunger being the same as that of Figure 4, including a ball check valve, and the barrel and plug being the same as in the construction of Figure 3.

In each of the embodiments previously described, the discharge passage is closed, in closed position of the cap, by a plug valve at the lower or inner end of the passage. It is to be understood that other positions for the plug valve are possible and that other forms of valve may be used. Figures 7 and 8 illustrate, by way of example, an embodiment in which the discharge passage is closed by a plug valve at the discharge port. This embodiment is now considered the preferred form of the invention.

In the construction there shown, bottle neck 98 has a short thread 99 and the skirt 100 of cap 101 has a corresponding thread 102. Secured to the container neck is an attachment unit comprising a clamp ring 103, a clamp flange 104, a V-shaped bend 105 and a locking flange 106. The V-shaped bend 105 takes under the shoulder 107 of a bottle locking ring 108 and the clamp flange 104 takes over the bottle lip to secure the attachment in place in the manner previously described.

The attachment unit also includes a pump barrel 109 having a supporting flange 110 by which it is suspended in the neck of the bottle. Between this flange and the bottle lip is compressed a sealing gasket 111 and between the clamp flange 104 and supporting flange 110 is a compressible gasket 112 of cork, felt or other suitable material. This latter gasket, like the corresponding gasket 47 of Figure 1, serves to prevent leakage from the barrel and has a wiping contact with the pump plunger, thus serving as a packing.

Integral with the cap and extending into the barrel with a sliding fit is a pump plunger 115. Surrounding the upper end of this plunger is an

annular recess 116 in which is housed a coiled spring 117 which bears against washer 112. This spring performs a dual function. It tends to move the cap to open position when the threads are disengaged and it also tends to compress washer 112 and squeeze it radially inwardly.

On the interior of the cap skirt is a shoulder 118 which engages flange 106 to limit axial movement of the cap.

The barrel 109 has an extension 119 of smaller diameter, closed by a rounded bottom 120. The annulus 124 connecting the two portions of the barrel forms a valve seat and is provided with a plurality of inlet ports 121. These ports are controlled by a floating washer valve 122 the movement of which is limited by struck-in nibs 123.

Centrally located in the flat top of the cap is a discharge port 125 the defining wall of which is tapered to form a frustro-conical valve seat 126. Port 125 is in communication with the internal bore 127 of the plunger 115, bore and port constituting the discharge passage. Cooperating with valve seat 126 is a hollow frustro-conical plug valve 123 carried on the end of a tube 129. This tube extends down through the bore 127 into the barrel extension 119 and terminates in an enlarged sleeve 130 slidable in the extension. This sleeve, in addition to guiding the plug unit in its movement, also serves as a shutter to control ports 131 formed in the barrel extension 119. A spring 132, confined between the shoulder 133, formed by the conjunction of tube 129 and sleeve 130, and the bottom of the barrel extension, tends to hold the plug valve to its seat 126. Movement of the plug unit is limited by struck-in nibs 134 which are engaged by shoulder 133.

In the closed position of the cap, as appears in Figure 7, plug 123 closes the discharge passage by plugging port 125. In this position, the top of the plug valve is substantially flush with the top of the cap. As a result of this construction, the closed cap presents a neat appearance; the user has visual evidence that the passage is closed; the entrance of dirt or foreign matter into the passage during non-use is prevented; and the exclusion of air during non-use tends to prevent the drying out of any liquid that may accumulate in and around the discharge passage.

While the locking flange 106 and the cooperating shoulder 118 may be constructed and assembled in various ways, in the embodiment shown as an example in Figures 7 and 8, the flange is substantially circular. The shoulder 118 is so formed, as appears more fully in Figure 17, that its inner edge defines an oval or ellipse. The major axis of this oval is somewhat greater than the diameter of the lower, contacting edge of flange 106; the minor axis is somewhat less than such diameter. Since this inner edge of the shoulder substantially vanishes at two diametrically opposite points, the shoulder is, from one point of view, composed of two sections. These sections may be further described as thin crescents. For convenience of description, however, the shoulder may be considered as a single shoulder.

In the assembly of the parts, the attachment unit may be inserted in the cap before attachment to the bottle or the cap may be applied after the attachment unit is in place on the bottle. In either event, when the flange and shoulder make engagement during assembly, application of the necessary force or pressure causes the somewhat yieldable metal flange to be deformed to oval shape. As this oval is slightly smaller than the

oval defined by the shoulder, the shoulder can pass the flange. Thereupon, the flange returns to its circular form by virtue of its inherent resiliency. Once assembled, the parts are so arranged that enough shoulder underlies the edge of the flange to perform the locking or limiting function. Moreover, it will be apparent that the locking contact is effective regardless of the relative angular position of cap and attachment since the shoulder crescents need not engage any particular part of the flange.

Once assembled, there is no danger of a disassembly under any normal circumstances. In the first place, the force normally exerted is insufficient to deform the flange. In the second place, what pressure there is, is exerted, as respects the flange, from below rather than, as in assembling, from above. This upward pressure tends, if anything, to bend the flange outwardly, thus augmenting rather than diminishing the degree of overlapping contact.

In the several embodiments illustrated in Figures 1 and 2, 3, 4 and 5, 10 and 11, 12 and 13 and 14 and 15, respectively, no detailed views of the corresponding locking flange and stop shoulder have been shown. It is to be understood, however, that these elements, in each case, are constructed as in the embodiment of Figures 7 and 8.

While the flange and shoulder arrangement just described are considered particularly advantageous, it will be understood that other constructions and methods of assembly are possible and a further example is referred to hereinafter.

The attachment unit and bottle neck may also be constructed and assembled in various ways. In the exemplification illustrated in Figures 7 and 8, the V-shaped bend 105 of the attachment is pre-formed and is substantially circular. The bottle neck is so formed that the bottle locking ring 108 is oval or elliptical in outline. The major axis of this oval, as appears in Figure 16, is slightly greater than the diameter of the apex of V-shaped bend 105; the minor axis is somewhat less than such diameter.

In the assembly of the bottle and the attachment unit, when the V-shaped bend and bottle locking ring make engagement, application of the necessary force or pressure causes the somewhat yieldable metal of the V-bend to be deformed to oval shape. As this oval is slightly larger than the oval of the bottle locking ring, the bend can pass the ring. Thereupon, the V-bend returns to circular form by virtue of its inherent resiliency and snaps under shoulder 107. While the overlap vanishes at two opposite points, there is sufficient overlap to hold the attachment in place. It is to be noted, moreover, that since this overlap can take effect with respect to any part of the V-bend, the attachment unit may be assembled in any relative angular position with respect to the bottle.

In the several embodiments illustrated in Figures 1 and 2, 3, 4 and 5, 10 and 11, 12 and 13 and 14 and 15, respectively, no detailed views of the corresponding V-shaped bend and bottle locking ring have been shown. It is to be understood, however, that these elements, in each case, are constructed as in the embodiment of Figures 7 and 8.

While the arrangement just described is considered particularly advantageous, it will be understood that other constructions and methods of assembly are possible. For example, the V-bend may be formed during assembly by a

spinning operation. In that case, the shoulder of the bottle locking ring may be circular.

A further example is illustrated in Figure 18. On the bottle neck 136 is an attachment comprising a clamp ring 137 having a V-shaped bend 138 which takes under the shoulder of the bottle locking ring (not shown). This shoulder, in this case, is preferably circular, as is the attachment. The lower leg of the V of bend 138 is extended to form a locking flange 139. The attachment is provided with a series of V-shaped cuts or slits 140 which extend from the edge of the locking flange into the V-bend as appears in Figure 18.

In the assembly of the attachment unit and bottle, when the V-bend and bottle locking ring make engagement, application of the necessary force or pressure causes the slitted V-bend to expand sufficiently to pass the locking ring. Thereupon, the bend returns to initial form by virtue of its inherent resiliency and snaps under the shoulder of the bottle locking ring.

When the attachment unit of Figure 18 is used, the shoulder on the cap which engages flange 139 to limit the cap movement may be circular in form, its inner diameter being less than the diameter of the rim of flange 139. During assembly, the application of sufficient force between the shoulder and flange causes the slitted flange to contract sufficiently to permit the shoulder to pass. Thereupon, the flange returns to normal condition by virtue of its inherent resiliency and so overlaps the cap shoulder.

It is to be understood that the modification of Figure 18 may be substituted in any of the embodiments above described or hereinafter described.

In the use of the package illustrated in Figures 7 and 8, the operation is generally like that previously described. When the cap is closed, leakage is effectively prevented by plug valve 128 and gaskets 111 and 112. When the cap is unscrewed to disengage the threads, spring 117 causes the cap to be moved to open position, this position being fixed by the engagement of shoulder 118 with flange 106. During the first part of this opening movement of the cap, spring 132 causes the unit comprising plug valve 128 to follow the cap, thus maintaining the discharge passage closed and effecting a suction action. As soon as shoulder 133 of the plug unit engages nibs 134, movement of the plug is checked, sleeve 130 closing ports 131. Continued movement of the cap causes valve seat 126 to be moved away from plug 128, thus opening the discharge passage. The bottle being then or previously inverted, valve 122 moves away from its seat by suction or gravity or both, opening inlet ports 121. Liquid is drawn into the pump chamber by suction or gravity or both (Figure 8). Upon reverse movement of the cap for the forcing stroke, the compression set up causes valve 122 to close and forces a charge out through the discharge passage. As soon as the cap engages plug 128 during this stroke, the plug unit is forced back against spring 132, closing the discharge passage and opening ports 131. During the latter part of the forcing stroke, therefore, and, if the cap is to be closed, during the final helical cap movement, any of the charge remaining in the pump chamber is by-passed back to the bottle via ports 131.

Figure 9 illustrates a modification of part of the constructions shown in Figures 7 and 8. The barrel extension 143 has a dished bottom 144, surrounding which is an annular portion 145. The extension has ports 146 but nibs corresponding to

the nibs 134 are omitted. The plug unit comprises a tube, like tube 129, terminating in an enlarged sleeve 147 slidable in the barrel extension. Between the bottom 144 of the extension and tube shoulder 148 is confined a spring 149. Sleeve 147 has a plurality of tongues 150 which extend downwardly through suitable openings in the annular portion 145 of the barrel extension and terminate in hooked ends 151. Upward movement of the plug unit is limited by the engagement of hooked ends 150 with the barrel extension. Otherwise the construction is the same as that of Figures 7 and 8.

In the embodiment of Figures 3-6, a portion of the plunger unit is formed as a separate part but is so assembled as to constitute, in effect, an integral part of the cap. Figures 10 and 11 illustrate, by way of example, a modification in which the plunger as a whole is similarly associated with the cap.

As there shown, the attachment unit, including the pump barrel, is substantially the same as in the embodiment of Figure 3. While the cap 155 is of different shape and form, the threaded engagement with the bottle and the stop shoulder for engaging the locking flange to limit opening movement of the cap are substantially the same as in the Figure 3 construction.

Slidable in the pump barrel is a cylindrical pump plunger 156 formed of a suitable metal such as aluminum. The upper end of this plunger, which is a slightly reduced diameter, is secured by a driving fit or in other suitable manner in a socket 157 formed as an integral part of the cap. Thus, the plunger is, in effect, integral with the cap. The plunger 156 has a central vertical bore 158 communicating with a chamber 159 which, in turn, communicates with a port 160 in the top of the cap, bore, chamber and port constituting the discharge passage.

At the junction of bore 158 and chamber 159 is a dished valve seat for a ball check valve 161. This valve is normally held to its seat by a spring 162 housed in chamber 159. The lower mouth of the bore 158 is formed as a tapered valve seat for receiving the plug valve of the attachment unit. A spring 163 confined between the top wall of the cap and the clamp flange of the attachment unit serves to move the cap to open position when the threads are disengaged.

It is believed that the operation of the embodiment of Figures 10 and 11 will be clear from the above without further description.

In the embodiments previously described, the pump plungers are, in fact or in effect, integral with the cap. Figures 12 and 13 illustrate, by way of example, an embodiment in which the operative connection between cap and plunger is non-rigid or impositive. These figures also illustrate a construction in which a single valve unit performs the dual function of a check valve and a sealing closure for the discharge passage.

Referring to Figures 12 and 13, the cap 171 has a thread 172 engaging a thread 173 on the bottle. Above the thread 172, the cap has a stop shoulder 174 like the corresponding shoulders in the other embodiments. The attachment unit comprises a clamp ring 175 having a V-shaped bend 176 and a locking flange 177 like the corresponding elements in the other embodiments. In the present embodiment, the attachment has a stepped clamp flange 178, 179 which takes over the bottle lip. Between the lower step 178 and the bottle lip is compressed a sealing gasket 180. Between upper step 179 and the supporting flange 181 of the

pump barrel 182, is a compressible sealing gasket 183.

The bottom of the barrel 182 constitutes a valve seat for a floating disk valve 184. This valve controls an inlet port 185. Movement of the valve is limited by the engagement of a series of lugs 186 with a bead 187 formed by pressing in the wall of the barrel. Slidable in the barrel 182 is a plunger 190 having a central bore 191. In the top of the cap is a discharge port 192 the wall of which is tapered to form a valve seat 193. Port 192 communicates with a chamber 194 which, in turn, communicates with bore 191, port, chamber and bore constituting the discharge passage.

The plunger 190 is secured to a unit comprising a ring 195 having a sliding contact with the wall of chamber 194. To this end, ring 195 has a turned in bead 196 which takes into a circumferential groove formed in the wall of the plunger. The ring 195 terminates, at the bottom, in an outwardly turned flange 197 which underlies a shoulder 198 formed in the cap. A sealing gasket 199 is carried by flange 197. Ring 196 terminates, at the top, in an inwardly turned flange 200. Spaced from shoulder 198 is an oppositely facing shoulder 201.

In chamber 194 is a valve unit which performs the dual functions of a check valve and a sealing closure. To this end, as here shown as an example, there is provided a valve unit comprising a hollow conical plug 204 having a surrounding flange 205. This flange normally seats on the upper rim of plunger 190, being held to its seat by a spring 206. The flange is of such diameter that liquid can pass the same when the valve lifts from its seat. In closed position of the cap, plug 204 engages valve seat 193 to serve as a sealing closure for the discharge passage.

When the cap is unscrewed to disengage the threads, it is moved to open position (Figure 13) by spring 207. Since the pump plunger is not positively connected to the cap and since the plunger, through valve unit 204, 205, is held down by spring 206, the plunger remains relatively stationary during the first part of the cap movement. During this early cap movement, valve seat 193 moves away from plug 204 to open discharge port 192 for subsequent discharge of the liquid. Valve flange 205, however, remains seated, thus serving as a check valve and permitting the creation of a suction effect. As soon as the cap has moved far enough for cap shoulder 201 to engage flange 197, the plunger unit is picked up thereby and moved upward with the cap to the end of the suction stroke, spring 206 still holding valve flange 205 to its seat.

When the cap is moved toward the bottle for the compression stroke, the plunger moves with it through the intervention of spring 206, it being noted that because of the creamy character of hand lotions and the like, for which this package is particularly designed, there is practically no frictional resistance between plunger and barrel.

On the plunger is a shoulder 208 which overlies the inner rim of gasket 183. In closing the cap, as soon as plunger 190 has been displaced inwardly far enough for this shoulder 208 to engage gasket 183, the plunger movement is checked and thereafter the cap moves down alone, the closing movement, of course, being a helical threading-engaging movement. During this closing final movement of the cap, the plunger and hence the plug 204 are, in effect, stationary, whereby the valve seat 193 moves into sealing relation with the plug, spring 206 being re-compressed.

Upon the suction stroke, the bottle having been inverted, valve 184 moves away from its seat by gravity or suction or both to open the inlet port 185 and liquid is drawn into the pump chamber by suction or gravity or both. Upon the compression stroke, valve 184 is reseated and a charge is expelled through the discharge passage, valve unit 204, 205 yielding against its spring to permit the charge to pass.

Figures 14 and 15 illustrate, by way of example, a modification similar in general to the construction of Figures 12 and 13, but in which the discharge passage is closed, in closed position of the cap, by a valve other than a plug valve and in which such valve also serves as a check valve.

As there shown, the bottle and the skirt of the cap are the same as in the construction of Figure 12. The attachment unit is also the same as in Figure 12 except that instead of a stepped clamp flange, the unit has a simple clamp flange like that of Figure 10 and the compressible washer 211 differs from washer 183 in size.

Extending into the barrel with a sliding fit is a pump plunger 212 having a central bore 213. This bore communicates with a chamber 214. At the top of the cap 215 is a downwardly extending boss 216 having a central bore 217. This bore, the chamber 214 and plunger bore 213 constitute the discharged passage.

The plunger is secured to thimble unit comprising stepped rings 218, 219 connected by a flat flange 220, upper ring 218 being slidable in chamber 214. Lower ring 219 has an intumed bead 221 which takes into circumferential groove formed in the wall of the plunger, to connect the parts. Beyond this bend, the thimble unit terminates in an outwardly and downwardly extending flange 222. This flange underlies a slanting shoulder 223 on the cap and flange 220 underlies a shoulder 224 on the cap. Between the latter shoulder and flange 220 is a compressible gasket 225. Spaced from shoulder 222 is an oppositely facing shoulder 226.

The upper end of the plunger 212 and the lower end of boss 216 are dished to form valve seats for receiving a ball valve 227. This ball is normally pressed against the plunger seat by a spring 228 housed in chamber 214. In the closed position of the cap (Figure 14), the ball valve seats against both the plunger seat and the boss seat. This closes both bore 213 and bore 217 and provides a sealing closure for the discharge passage.

When the cap is unscrewed to disengage the threads, it is moved to open position by spring 229. During the first part of this cap movement, the plunger unit remains stationary. The boss 216 thus moves away from ball 227, which is held down against the plunger by its spring, to open bore 217. As soon as shoulder 226 engages flange 222, the plunger unit is picked up thereby and is carried upward with the cap to the end of the suction stroke. Spring 228 still holds ball 227 to the plunger seat, the ball functioning as a check valve to shut off communication to atmosphere during the suction stroke.

When the cap is moved toward the bottle for the compression stroke, the plunger moves with it through the intervention of spring 228.

In closing the cap, as soon as the plunger has been displaced inwardly far enough for shoulder 230 to engage gasket 211, the plunger movement is checked and the cap moves down alone, spring 228 being compressed. During this final closing movement of the cap, the plunger and hence ball

valve 227 are, in effect, stationary, whereby the mouth of boss 216, constituting the valve seat, moves into engagement with the ball valve, whereby the discharge passage is again sealed.

5 Except as stated, the construction and operation are the same as in the case of the embodiment of Figures 12 and 13.

An important feature of the invention in its entirety is the means by which, when the cap is screwed down to closed position, there is effected, simultaneously, an effective closing of the discharge passage and an effective seal between cap and container. The closing of the passage is accomplished, in constructions embodying the invention to what is now considered the preferred form, by a tapered plug valve which engages a tapered valve seat, the plug and seat having a different degree of taper. The seal between cap and container is accomplished by compressing an intervening gasket as the cap moves into closed position. This not only assures a proper sealing effect but, in addition, the non-rigid contact thus set up cooperates in obtaining a proper closing of the passage.

25 Since the difference in the degree of taper of valve and valve seat need be and should be but slight, it has been deemed impractical if not impossible to illustrate this difference in the various views above referred to. It is illustrated, however, in Figure 19, the showing being somewhat exaggerated for purposes of illustration. It is to be understood that the construction shown in Figure 19, except for its exaggeration, is the construction of the valve and valve seat of the embodiment of Figures 7 and 8.

35 As shown in Figure 19, the plug valve 125 is tapered at a greater angle with respect to the vertical than is the valve seat 126. In practice, the plug valve may be suitably tapered at an angle of about 13° and the valve seat at an angle of about 10°.

Extending downwardly from the upper part of the cap (Figure 7) is an annular bead 135. It will be seen that as the cap moves into closed position, the initial engagement or contact between cap unit and container unit is the engagement between this bead 135 and gasket 112. The parts are so arranged that bead 135 engages the gasket and compresses the same prior to any rigid stopping contact of the cap and container, such as that between the cap shoulder and clamp flange 104. In fact, the latter contact may or may not take place to any real extent. While Figure 7 shows or appears to show such contact, it will be understood that clearances and tolerances in devices of this kind are so small it is difficult to illustrate exact relations. In any event, the desired advance contact of bead 135 can be regulated by suitably dimensioning the depth of the bead and, if desired, the bead-to-gasket contact can be made the sole contact by cutting back the cap adjacent the bead.

When the cap is to be closed, there is no fixed stopping position of the cap as far as the threads are concerned. That is, the cap may be screwed down on the container thread to any position within the limits of the thread engagement. During such closing, sealing contact is made at two points, namely, between the valve seat and the plug valve and between bead 135 and gasket 112. As the cap moves down, the lower edge of the tapered valve seat engages the plug somewhere along its length. Thereafter, continued helical movement of the cap causes this lower edge to be brought against the plug with a grinding, wedg-

ing action whereby the lower edge or lower portion of the valve seat is wedged firmly against the plug and may even bite into the metal of the plug to a slight extent. The result is an extremely tight engagement between valve seat and plug over a limited but indefinite area that effectively seals the discharge passage against leakage, the further the cap is screwed down, the tighter the seal.

During this sealing engagement, bead 135 engages the compressible gasket 112. As the cap is tightened on the thread, gasket 112 is compressed. This not only insures a proper sealing effect between cap and container but the engagement being non-positive, the compressibility of the gasket compensates for any variations, irregularities etc. in the valve-seat-to-valve engagement.

The construction described avoids the necessity of a tight fit between plug and valve seat throughout their lengths, which would be necessary if the valve seat and valve were of like degree of taper and which is difficult of attainment, in commercial practice, with the materials and dimensions involved in devices of this nature. It also avoids the necessity of co-ordinating two rigid contacts, which would be necessary if the plug and seat were of like taper and the cap-to-container contact were positive and which is also difficult of attainment in commercial practice.

There is a further advantage of having the plug tapered at a greater angle than the valve seat in the case of constructions like Figures 7 and 8. Since the necessity for a tight fit between the top of the plug and the upper rim of the valve seat is eliminated, any tendency of this rim to chip under closing engagement is largely if not entirely avoided.

It is to be understood that the plug valves and tapered valve seats of the other embodiments above described (except that of Figures 14 and 15 which has no plug) are correspondingly formed with tapers of unlike degree. In all these embodiments, also, there is a non-rigid cap-to-container sealing contact complementing the valve seat-to-valve contact.

In the embodiments of Figures 1-3, the gasket 47 is engaged and compressed by a shouldered portion of the top wall of the cap. As appears in the drawings, this is the only stopping contact between cap and container.

In Figures 4-6, the only stopping contact is between the top wall of the cap and gasket 79.

In Figures 10 and 11, the only stopping contact is between the outer rim of cap socket 151 and a gasket.

In Figures 12 and 13, the initial contact is between plunger shoulder 208 and gasket 183. This last embodiment also has a supplemental non-rigid contact between cap shoulder 198 and gasket 199.

While the device illustrated in Figures 7 and 8 may be assembled in various way, it is to be noted that the construction is such that the attachment unit and the cap unit may be assembled together at the factory, thus constituting an assembly unit which can be shipped as such to the packager and which includes everything but the bottle or other container. The parts carried by the barrel are enclosed thereby. And while the supporting flange 110 and gaskets 111, 112 will be loose, V-shaped bend 105 serves as a stop to prevent these parts from dropping out. After the container is filled, the assembly unit is simply applied to the container. This avoids the necessity

of several assembly operations at the filling plant and also avoids the necessity of shipping a considerable number of separate parts.

As will be apparent, the various other embodiments may be similarly shipped as assembly units.

While the present invention relates particularly to dispensing packages of the pump type, it will be apparent that various features of the invention are applicable to devices not necessarily of this type.

Certain features above referred to are disclosed and claimed in a co-pending application Serial No. 714,069.

What is claimed is

1. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a barrel extending into the container neck and having a controlled inlet port, a plunger operating in said barrel, an operating connection between said plunger and the cap, whereby the plunger is reciprocated upon axial reciprocation of the cap, said cap and plunger having a discharge passage for the expulsion of the liquid, and means for closing said discharge passage when the cap is in closed position.

2. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, the cap being capable of a reciprocating axial movement with respect to the container when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger operating in said barrel, an operating connection between the cap and said pump plunger, whereby the cap, upon disengagement of said inter-engaging elements, becomes a pump-actuating element, the cap and plunger having a discharge passage, said passage having a valve seat, and a plug valve for engagement with said valve seat when the cap is in closed position, thereby to close said passage.

3. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, the cap being capable of a reciprocating axial movement with respect to the container when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having an inlet port, a floating valve for controlling said inlet port, said barrel having a portion of its wall struck inwardly to serve as a stop for limiting movement of said floating valve, a pump plunger operating in said barrel, an operating connection between the cap and said pump plunger, whereby the cap, upon disengagement of said inter-engaging elements, becomes a pump-actuating element, the cap and plunger having a discharge passage, said passage having a valve seat, and a plug valve for engagement with said valve seat when the cap is in closed position, thereby to close said passage.

4. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, the cap being capable of a reciprocating axial movement with respect to the container when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger operating in said barrel, an operating connection between the cap and said pump plunger, whereby the cap, upon disengagement of said inter-engaging elements, becomes a pump-actuating element, the cap and plunger having a discharge passage, said passage having a valve seat, a plug valve for engagement with said valve seat when the cap is in closed position, thereby to close said passage, and a movable check valve normally closing said passage.

5. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging screw threads on the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said threads are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger carried by the cap and operating in said barrel, whereby the cap, upon disengagement of said threads, becomes a pump-actuating element, the cap and plunger having a discharge passage, said passage having a tapered valve seat, and a conical plug valve for engagement with said valve seat when the cap is screwed down on the container neck, thereby to close said passage.

6. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger carried by the cap and operating in said barrel, whereby the cap, upon disengagement of said inter-engaging elements, becomes a pump-actuating element, the cap and plunger having a discharge passage including a vertical bore in said plunger, the lower mouth of said bore being tapered to form a valve seat, and a conical plug valve for engagement with said valve seat when the cap is in closed position, thereby to close said passage.

7. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging screw threads on the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said threads are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger carried by the cap and operating in said barrel, whereby the cap, upon disengagement of said threads, becomes a pump-actuating element, the cap and plunger having a discharge passage including a vertical bore in said plunger, the lower mouth of said bore being tapered to form a valve

seat, the bottom of said barrel being dished upwardly to form a conical plug valve for engagement with said valve seat when the cap is screwed down on the container neck, thereby to close said passage.

3. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger carried by the cap and operating in said barrel, whereby the cap, upon disengagement of said inter-engaging elements, becomes a pump-actuating element, the cap and plunger having a discharge passage including a tapered opening in the top of the cap constituting a valve seat, and a conical plug valve for engagement with said valve seat when the cap is in closed position, thereby to close said passage.

9. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having a controlled inlet port, a pump plunger operating in said barrel, an operating connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, and means for closing said passage when the cap is in closed position and for shutting off the same during at least the first part of the opening movement of the cap.

10. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger operating in said barrel, an operative connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, said passage having a tapered valve seat, a movable conical plug valve for engagement with said valve seat when the cap is moved down to closed position, thereby to close said passage, a spring tending to move the cap away from the container to open position upon disengagement of said inter-engaging elements, means for limiting such movement, a spring tending to hold said plug valve to its seat as the cap moves to open position, and means for checking such following movement of the plug valve before the cap-plunger unit reaches the end of said opening movement, whereby the discharge passage remains closed during the first part of the opening movement of the cap-plunger unit and thereafter the valve seat moves away from said plug valve.

11. In a dispensing package for liquids, and in combination, a container having a neck, a

skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger operating in said barrel, an operative connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, said passage having a tapered valve seat, a movable conical plug valve for engagement with said valve seat when the cap is moved down to closed position, thereby to close said passage, a spring tending to move the cap away from the container to open position upon disengagement of said inter-engaging elements, means for limiting such movement, a spring tending to hold said plug valve to its seat as the cap moves to open position, means for checking such following movement of the plug valve before the cap-plunger unit reaches the end of said opening movement, whereby the discharge passage remains closed during the first part of the opening movement of the cap-plunger unit and thereafter the valve seat moves away from said plug valve and means for limiting the movement of said plug valve in the opposite direction, whereby the plug is relatively stationary when the cap is moved down to closed position.

12. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having an extension of smaller diameter, the annulus connecting the main barrel and said extension having an inlet port, a control valve therefor, a pump plunger carried by the cap and operating in said barrel, the cap and plunger having a discharge passage, said passage having a tapered valve seat, a movable unit comprising (a) a plug valve for engaging said valve seat when the cap is moved down to closed position, thereby to close said passage, and (b) a sleeve slidable in said barrel extension, said sleeve engaging the bottom of the extension in closed position of the cap, a spring tending to move the cap to open position upon disengagement of said inter-engaging elements, means for limiting such movement, a spring tending to move said movable unit to hold said plug valve to its seat as the cap moves to open position, and means for checking such following movement of said unit before the cap reaches open position, whereby the discharge passage remains closed during the first part of the opening movement of the cap and thereafter the valve seat moves away from said plug valve.

13. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a pump barrel extending into the container neck, said barrel having

an inlet port, a valve for controlling said inlet port, a pump plunger carried by the cap and operating in said barrel, whereby the cap, upon disengagement of said inter-engaging elements, becomes a pump-actuating element, the cap and plunger having a discharge passage, means for closing said passage when the cap is moved down to closed position, the barrel having a by-pass port communicating with the interior of the container, a valve for said port, and means whereby said valve takes port-closing position during the latter part of the movement of the cap to open position and port-opening position during the latter part of the movement of the cap to closed position.

14. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having an extension of smaller diameter, the annulus connecting the main barrel and said extension having an inlet port, a control valve therefor, a pump plunger carried by the cap and operating in said barrel, the cap and plunger having a discharge passage, said passage having a tapered valve seat, a movable valve unit comprising (a) a plug valve for engaging said valve seat when the cap is moved down to closed position, thereby to close said passage, and (b) a sleeve slidable in said barrel extension, said sleeve engaging the bottom of the extension in closed position of the cap, a spring tending to move the cap to open position upon disengagement of said inter-engaging elements, means for limiting such movement, a spring tending to move said movable valve unit to hold said plug valve to its seat as the cap moves to open position, and means for checking such following movement of said valve unit before the cap reaches open position, whereby the discharge passage remains closed during the first part of the opening movement of the cap and thereafter the valve seat moves away from said plug valve, the barrel extension having a by-pass port so located that the sleeve of said movable valve unit, functioning as a shutter, closes said port when the valve unit is advanced by its spring and opens the same when the valve unit is moved back by the cap-plunger unit.

15. In a dispensing package for liquids, and in combination, a container having a neck and a shouldered locking ring, a skirted cap associated therewith, interengaging threads on the cap skirt and container neck respectively, said cap being capable of a reciprocating axial movement with respect to the container neck when said threads are disengaged, an attachment unit carried by the container and comprising (a) a clamp ring having a V-shaped bend taking under the shoulder of said locking ring, (b) a clamp ring taking over the lip of the container, and (c) a pump barrel suspended in the container, said barrel having a controlled inlet port, a pump plunger operating in said barrel, an operating connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, and means for closing said passage when the cap is screwed down to closed position.

16. In a dispensing package for liquids, and in combination, a container having a neck and a shouldered locking ring, a skirted cap associated therewith, inter-engaging threads on the cap skirt and container neck respectively, said cap being capable of a reciprocating axial movement with respect to the container neck when said threads are disengaged, an attachment unit carried by the container and comprising (a) means for securing said attachment unit to said locking ring, (b) a stop flange and (c) a pump barrel suspended in the container neck, said barrel having an inlet port, a pump plunger operating in said barrel, an operating connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, a stop shoulder on the cap skirt for engagement with said flange to limit axial movement of the cap, and means for closing said discharge passage when the cap is screwed down to closed position.

17. In a dispensing package for liquids, and in combination, a container having a neck and a shouldered locking ring thereon, a skirted cap associated therewith, inter-engaging threads on the container neck and cap skirt respectively, the cap being capable of axial reciprocation with respect to the container neck when said threads are disengaged, an attachment unit comprising (a) a clamp ring having a V-shaped bend taking under the shoulder of said locking ring, (b) a clamp flange taking over the lip of the container, (c) a stop flange formed as an extension of one leg of said V, (d) a supporting flange and (e) a pump barrel connected to said supporting flange and suspended thereby in the container, said barrel having a controlled inlet port, a spring confined between said attachment unit and the cap tending to move the cap to open position, a stop shoulder on the cap skirt above the thread for engagement with said stop flange to limit such movement, a pump plunger connected to the cap and operating in said barrel, the plunger and cap having a discharge passage, said passage having a tapered valve seat, and a conical plug valve, carried by said barrel, for engagement with said valve seat when the cap is screwed down to closed position, thereby to close said passage.

18. In a dispensing package for liquids, and in combination, a container having a neck and a shouldered locking ring thereon, a skirted cap associated therewith, inter-engaging threads on the container neck and cap skirt respectively, the cap being capable of axial reciprocation with respect to the container neck when said threads are disengaged, an attachment unit comprising (a) a clamp ring having a V-shaped bend taking under the shoulder of said locking ring, (b) a clamp flange taking over the lip of the container, (c) a stop flange formed as an extension of one leg of said V, (d) a supporting flange, (e) a gasket compressed between said supporting flange and the lip of the container, (f) a compressible gasket between said clamp flange and said supporting flange and (g) a pump barrel connected to said supporting flange and suspended thereby in the container, said barrel having a controlled inlet port, a stop shoulder on the cap skirt for engagement with said stop flange to limit axial movement of the cap, a pump plunger connected to the cap and operating in said barrel, the plunger and cap having a discharge passage, means for closing said passage

and means for compressing said compressible gasket when the cap is screwed down to closed position.

19. In a dispensing package for liquids, and in combination, a container having a neck and a shouldered locking ring thereon, a skirted cap associated therewith, inter-engaging threads on the container neck and cap skirt respectively, the cap being capable of axial reciprocation with respect to the container neck when said threads are disengaged, an attachment unit comprising (a) means for securing the unit to said locking ring, (b) a supporting flange, (c) a gasket compressed between said supporting flange and the lip of the container, (d) a compressible gasket above said supporting flange and (e) a pump barrel connected to said supporting flange and suspended thereby in the container, said barrel having a controlled inlet port, a pump plunger operating in said barrel, the inner periphery of said compressible gasket making wiping contact with said plunger, an operating connection between said plunger and the cap, the plunger and cap having a discharge passage, and means for closing said passage and means for compressing said second-named gasket when the cap is screwed down to closed position.

20. An assembly unit for attachment to a container to form therewith a dispensing package, comprising a clamp ring having a V-shaped bend, a clamp flange, and a stop flange, a supporting flange, a barrel connected thereto, said barrel having a controlled inlet port, a skirted cap having an internal thread, a stop shoulder on the cap skirt located above the thread and underlying said stop flange, thereby to limit relative axial movement of the cap, a plunger connected to the cap, said plunger and cap having a discharge passage, said passage having a tapered valve seat, and a conical plug valve carried by the barrel for engagement with said valve seat.

21. In a package for liquids and the like, and in combination, a container having a neck, a skirted cap associated therewith and relatively movable thereto, a substantially circular metallic stop element carried by the container neck, and a stop shoulder on the inner wall of the cap skirt, the inner periphery of said shoulder defining an oval, the minor axis of said oval being less than the outer diameter of said stop element, whereby, upon assembly, said shoulder underlies part of the stop element to engage the same and limit relative movement of the cap, the major axis of said oval being slightly greater than said diameter, whereby said stop element can be distorted to oval shape and pass said shoulder during assembly of the cap with respect to the stop element.

22. In a package for liquids and the like, and in combination, a container having a neck, a skirted cap associated therewith and relatively movable thereto, a substantially circular metallic stop element carried by the container neck, and a stop shoulder on the inner wall of the cap skirt comprising a plurality of crescent shaped segments, the inner periphery of the shoulder formed by said segments defining an oval, the minor axis of said oval being less than the outer diameter of said stop element, whereby, upon assembly, said shoulder underlies part of the stop element to engage the same and limit relative movement of the cap, the major axis of said oval being slightly greater than said diameter, whereby said stop element can be distorted to oval shape and pass said shoulder during assembly of the cap with respect to the stop element.

23. In a package for liquids and the like, and in combination, a container having a neck and a shouldered locking ring thereon, a skirted cap associated therewith and relatively movable thereto, an attachment on the container neck comprising a metallic clamp ring having a V-shaped bend taking under the shoulder of said locking ring, the lower leg of the V being extended to form an outwardly and downwardly extending stop flange, said flange being substantially circular, and a stop shoulder on the inner wall of the cap skirt, the inner periphery of said shoulder defining an oval, the minor axis of said oval being less than the diameter of the edge of said stop flange, whereby, upon assembly, said shoulder underlies part of the flange to engage the same and limit relative movement of the cap, the major axis of said oval being slightly greater than said diameter, whereby said flange can be distorted to oval shape and pass said shoulder during assembly of the cap with respect to the flange.

24. In combination with a container having a neck, a shouldered locking ring on said neck, the outer periphery of said locking ring being an oval, and a metallic attachment on the container neck comprising a clamp ring having a V-shaped bend for engagement with the shoulder of the locking ring, said bend being substantially circular, the major axis of said oval being greater than the inner diameter of said bend, whereby, upon assembly, the bend underlies part of said shoulder, the minor axis of said oval being less than said diameter, whereby said bend can be distorted to oval shape and pass the locking ring during assembly of the attachment with respect to the container.

25. In a package for liquids and the like, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated respectively with the cap skirt and container neck for releasably holding the cap in closed position, a discharge passage associated with the cap, a tapered valve seat in said passage, and a tapered plug valve for co-operating with said valve seat to close said passage when the cap is in closed position, the taper of the plug valve being at a greater angle, with respect to the vertical, than the taper of the valve seat.

26. In a package for liquids and the like, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated respectively with the cap skirt and container neck for releasably holding the cap in closed position, a discharge passage associated with the cap, a tapered valve seat in said passage, and a tapered plug valve for co-operating with said valve seat to close said passage when the cap is in closed position, said valve seat and valve having a different degree of taper, and means for effecting a seal between the cap and container comprising a compressible gasket between the lip of the container and the cap and a part for engaging said gasket to compress the same when the cap is moved to closed position.

27. In a package for liquids and the like, a container having a neck, a skirted cap associated therewith, inter-engaging screw threads on the container neck and cap skirt respectively, a discharge passage associated with the cap, and means for simultaneously effecting a closing of said passage and a seal between the cap and container when the cap is screwed down to closed position, said means comprising (a) a tapered

plug valve for engagement with a tapered valve seat formed in said discharge passage, said valve and valve seat having a different degree of taper, and (b) a compressible gasket above the lip of the container and a part for engaging said gasket to compress the same prior to the engagement of any mutually rigid parts.

28. In combination with a container having a neck, a skirted cap movable relatively thereto, the top of the cap having a tapered discharge port constituting a valve seat, a conical plug valve supported by the container for engaging said valve seat when the cap is moved to closed position, a compressible gasket between the cap and the lip of the container neck, the cap having a part for engaging said gasket to compress the same when the cap is moved to closed position.

29. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger integral with said cap and operating in said barrel, a discharge passage, and means for closing said passage when the cap is in closed position.

30. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger carried by the cap and operating in said barrel, said plunger having a bore and a valve chamber communicating with each other, the cap having a discharge port communicating with said chamber, port, chamber and bore constituting a discharge passage, a spring-pressed ball check valve in said valve chamber normally shutting off communication with said bore, and means other than and in addition to said check valve for closing said discharge passage when the cap is in closed position.

31. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger operating in said barrel, a supporting element to which the plunger is secured and which has a slidable relation with the cap, the cap having a recess constituting a valve chamber and communicating with a bore in said plunger, the cap having a discharge port communicating with said chamber, port, chamber and bore constituting a discharge passage, a valve elements in said chamber having a portion for engaging the upper end of the plunger to close said bore and a portion for closing said port when the cap is in closed position, a spring in said

chamber for normally holding said valve unit to its bore-closing duty, and a shoulder on the cap underlying a portion of said supporting element and arranged to engage the latter during the latter part of the movement of the cap to open position and cause the plunger unit to move with the cap.

32. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger operating in said barrel and relatively movable with respect to the cap, the cap and plunger having a discharge passage, an intervening spring between the cap and said plunger, means for causing the plunger to move with the cap, on opening movement of the cap, after a partial cap movement, said spring tending to cause the plunger to move with the cap when the cap is moved toward closed position, means for checking such movement of the plunger prior to the end of such closing movement of the cap, and means for closing the discharge passage when the cap is in closed position.

33. In a dispensing package for liquids, and in combination, a container having a neck, a shouldered locking ring on said neck, an attachment unit comprising a part for taking under said locking ring to secure the attachment to the container and a pump barrel suspended in the container neck, said barrel having a controlled inlet port, a skirted cap movable relatively to said container neck, a pump plunger carried by said cap and operating in said barrel, the cap and plunger having a discharge passage, and means for closing said passage in one position of the cap.

34. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a barrel extending into the container neck and having a controlled inlet port, a plunger operating in said barrel, an operating connection between said plunger and the cap, whereby the plunger is reciprocated upon axial reciprocation of the cap, said cap and plunger having a discharge passage for the expulsion of the liquid including a bore through said plunger, the lower end of said bore being fashioned to form a valve seat, and a plug valve in the lower end of said barrel for engaging said valve seat to close said passage when the cap is closed.

35. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements respectively associated with the cap skirt and the container neck for releasably holding the cap in closed position, said cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, means for limiting such movement, a barrel extending into the container neck and having a controlled inlet

port, a plunger operating in said barrel, an operating connection between said plunger and the cap, whereby the plunger is reciprocated upon axial reciprocation of the cap, said cap and plunger having a discharge passage for the expulsion of the liquid including a bore through said plunger, the lower end of said bore being fashioned to form a valve seat, a plug valve in the lower end of said barrel for engaging said valve seat to close said passage when the cap is closed, and said plug valve being relatively movable in said barrel.

36. In a dispensing package for liquids, and in combination, a container, a cap capable of a reciprocating movement with respect thereto, a pump barrel supported in the container, a pump plunger operating in said barrel, an operating connection between said plunger and said cap, whereby the plunger is operated upon reciprocation of the cap, said cap and plunger having a discharge passage, a valve seat in said passage, and a plug valve for engaging said valve seat to close said passage when the cap is in closed position.

37. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled

inlet port, a pump plunger operating in said barrel, an operative connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, said passage having a valve seat, and a movable conical plug valve for engagement with said valve seat when the cap is moved down to closed position, thereby to close said passage.

38. In a dispensing package for liquids, and in combination, a container having a neck, a skirted cap associated therewith, inter-engaging elements associated with the container neck and the cap skirt respectively, the cap being capable of a reciprocating axial movement with respect to the container neck when said inter-engaging elements are disengaged, a pump barrel extending into the container neck and having a controlled inlet port, a pump plunger operating in said barrel, an operative connection between said plunger and the cap whereby the plunger is reciprocated upon axial reciprocation of the cap, the cap and plunger having a discharge passage, said passage having a valve seat, a movable conical plug valve for engagement with said valve seat when the cap is moved down to closed position, thereby to close said passage, and means for limiting the movement of said movable plug valve, the range of movement of such valve being less than the range of reciprocating movement of said plunger.

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