Oct. 15, 1963 B. CHOLET 3,107,035

SQUEEZE CAP FOR DISPENSING LIQUIDS IN DROP UNITS

Filed Aug. 12, 1960

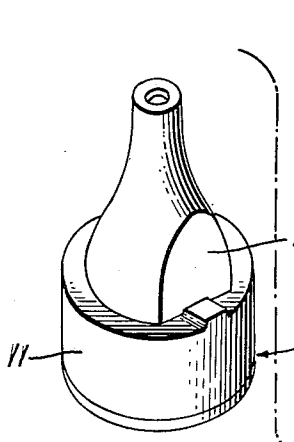


Fig. 1.

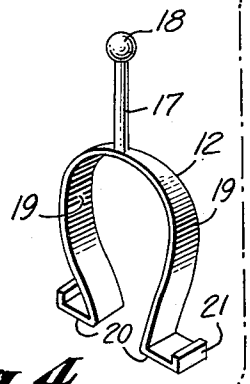


Fig. 2.

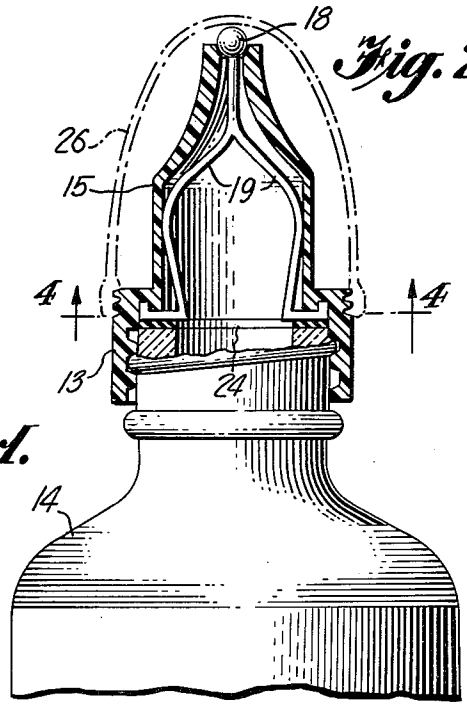


Fig. 3.

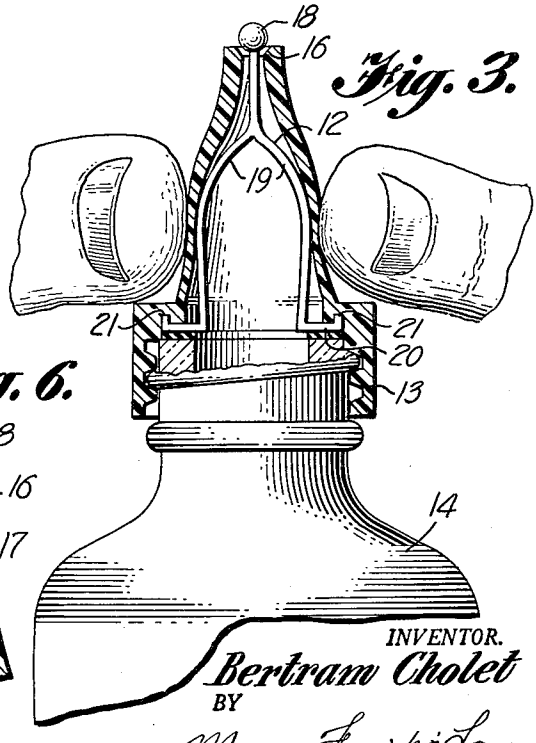


Fig. 4.

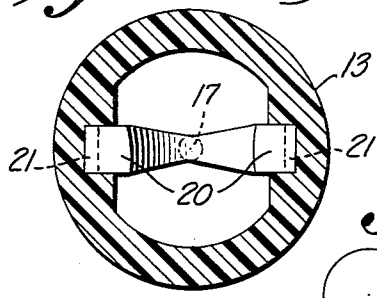


Fig. 5.

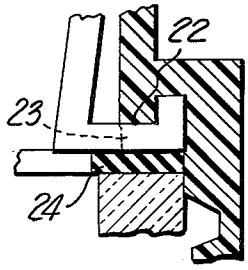
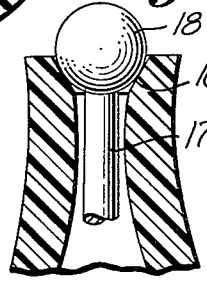


Fig. 6.



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SQUEEZE CAP FOR DISPENSING LIQUIDS IN DROP UNITS

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This invention relates to a self sealing squeeze cap for containers, having for its general object the provision of means for dispensing liquids in the form of drops.

More specifically regarded, it is an object of the invention to provide a valved cap of the type described so constructed as to be opened responsive to pulsatory squeezing of the cap to effect the controlled emission of drops.

Another object of the invention is the provision of a squeeze cap of the type described, in which the discharge of drops is controlled, one drop for each impulse imparted to the cap, so that the drops may be accurately counted.

Still another object of the invention is the provision of a squeeze cap for dispensing liquids in drop form, in which the volume of the drops is constant.

A further object of the invention is the provision of a valved squeeze cap as described, which closes under pressure when released, being thus adapted to retain in the container volatile components of the liquid, which may otherwise continually diminish the potency of the liquid.

Other objects of the invention will appear as the following description of a practical embodiment thereof proceeds.

In the drawing which accompanies and forms a part of the following specification, and throughout the several figures of which the same reference characters have been used to designate identical parts:

FIGURE 1 is a view in perspective of a valved squeeze cap embodying the principles of the invention, the inner and outer members being shown separated along a longitudinal axis;

FIGURE 2 is a sectional view in an axial plane of the valved squeeze cap in operative association with a bottle, the squeeze cap being closed;

FIGURE 3 is a sectional view complementary to FIGURE 2, showing the squeeze cap in open position;

FIGURE 4 is a view in cross-section, taken along the line 4—4 of FIGURE 2, looking upward;

FIGURE 5 is a detail view in section, disclosing on large scale the interlocking anchorage of the inner with the outer member;

FIGURE 6 is a detail view in section on an enlarged scale, showing the nozzle end of the cap in closed position.

Referring now in detail to the several figures, the reference numeral 10 designates the squeeze cap as a whole, which comprises fundamentally two parts, the body member 11 and the valve member 12. Both members are ordinarily of the same type of material, plastic, and specifically polyethylene. However, the invention does not rule out the use of other materials, and the valve assembly in particular may be made of metal.

The body member includes a hard, that is to say, rigid, base portion 13 internally threaded to screw on the mouth of a container which as illustrated is the bottle 14, and a flexible nozzle portion 15 preferably integral therewith having an annular valve seat 16 at its outer end. The valve member comprises a stem 17 which occupies an axial position within the nozzle member and at its outer end has a spherical valve 18 which cooperates with the valve seat 15. The valve member

is bifurcated at the lower end portion of the stem forming the outwardly bowed legs 19. The legs terminate in outwardly directed feet 20, having short upturned flanges 21 at their ends. In the illustrative embodiment the valve member is integrally molded from a strip of polyethylene, the stem being round in cross-section and the legs and feet being flat strips, as shown, the legs in their upper arc converging toward the stem. The valve member in repose is self shape retaining.

The nozzle portion 15 comprises a circumferential wall forming a cylindrical chamber about the legs, and which tapers upwardly above the upper arc of the legs. Said nozzle portion is smaller in diameter than the base portion 13, so that it forms with the base portion both an exterior and interior annular shoulder, the interior shoulder 22 at diametrically opposite points being formed with transverse channels 23 with upwardly directed end recesses, complementary to the flanged feet, which channels fit over the feet and unite the body and valve members. The bottoms of the feet are in a common transverse plane and rest against a washer 24, which when the squeeze cap is mounted upon the bottle, is clamped between the squeeze cap and bottle mouth, anchoring the valve member in place. This feature is best shown in FIGURE 5. Exteriorly the nozzle member is formed with opposite facets 25, in vertical planes which register with the adjacent portions of the legs, indicating the points at which squeeze pressure is to be applied and affording pressure areas for the thumb and cooperating finger in the act of squeezing.

The relative axial lengths of the body member and valve member are such that when in repose position the valve is in closed position under pressure. The principle of operation is that when the bowed legs are pressed toward one another, they tend to straighten and become longer; therefore, they move the valve away from the valve seat. Although the opposite sides of the nozzle portion are correspondingly pressed toward one another, no elongation of the nozzle portion takes place, for the portions of the latter which lie circumferentially between the facets 25 are not subject to squeezing, and consequently, hold the nozzle portion against elongation, the squeezing pressure of the fingers resulting in localized deformation or dimpling of the nozzle portion at the pressure points.

From the above description it is readily understandable that when the cap is squeezed, the valve rises from its seat, and when the cap is released the valve closes against its seat under pressure.

The spherical valve 18 and the outwardly flaring coaxial valve seat define a discharge orifice, the internal geometry of which is such that the drop automatically hangs between the wall of the orifice and the valve by surface tension, until dislodged through displacement by a succeeding drop. Thus, by repetitive squeezing of the cap the number of drops dispensed may be precisely determined. The small amount of inward deformation imparted to the nozzle portion 15 by the act of squeezing plays a negligible part in expelling the drops. A liquid which is designed to be dispensed manually, drop by drop, will usually be packaged in small bottles rarely exceeding three or four ounces in capacity. Such a bottle when inverted will have some air in its uppermost portion and it is the head of liquid between the plane upper surface of the body of liquid in the bottle and the end of the squeeze cap that causes gravitational discharge of the liquid. The slight displacement caused by squeezing reacts throughout the body of liquid but is so minor as to be disregarded as an assist to the discharge of the liquid, until the body of liquid becomes substantially depleted.

The squeeze cap may be built with different sized

orifices for liquids having markedly different characteristics of viscosity, stickiness, etc. For a given liquid, the volume of the individual drops is substantially constant. The ordinary glass tube dropper with squeeze bulb is lacking in these advantages, due to the uncertainty as to the quantity of liquid drawn up into the tube, and as to the amount of air in the bulb available for explusion of the liquid, so that the drops may be discharged in a squirt faster than they can be counted. Also, the gauge of the glass tubing is variable, so that there is no precision or uniformity in the volume of the drops produced in supposedly identical packages. It has been a constant complaint from the manufacturers of liquid medicaments, the dosage of which is by drops, that the presently employed dropping devices waste a great deal of the medicament, as well as making it impossible to administer accurate doses.

Another advantage of the squeeze cap of the present invention is that it closes under pressure resulting from the inherent resiliency of the valve member, so that it is able to seal the container under some pressure, thus retaining volatile constituents of certain liquids, limiting the loss of the volatiles to that which may escape into the bottle, thus lengthening the shelf life of the liquid and its life between uses when the package has passed to the consumer.

FIGURE 2 indicates the use of an additional cover cap **26** to protect the squeeze cap in the vicinity of the orifice from dust, and to discourage the drying of liquid with incident accumulation of residue, about the valve. This auxiliary cap may be screwed to the squeeze cap to form an auxiliary seal, guarding against the loss of volatile constituents which might develop enough pressure in the bottle to lift the spherical valve.

It is in contemplation that the squeeze cap may be sold and distributed in the same package with the bottle or other container of liquid, but unattached thereto, the container being closed by an ordinary screw cap, and it being left to the consumer to substitute the squeeze cap. In such case, it may be of advantage to have the parts of the squeeze cap made unitary. This may be done by cementing the feet **20** to the walls of the channels **23** in which they fit, or cementing the washer against the interior shoulder **23**. The offsetting advantage of leaving the body portion, valve portion and washer **24** separate is that the squeeze cap can be readily disassembled for cleaning, by pulling the valve member downward, forcing the valve through the opening in the end of the body portion **11**, which is sufficiently stretchable to permit this procedure.

While I have in the above description described and disclosed a practical embodiment of the inventive principle, it will be understood by those skilled in the art that the specific details of construction and arrangement of parts, as disclosed, are by way of example and not to impose any limitations upon the scope of the invention.

What I claim is:

1. Squeeze cap for dispensing liquids in drop by drop sequence from a container while the latter is so positioned as to maintain a gravitational head of the contained liquid above the cap, the latter comprising a base portion constructed to be coupled to the mouth of the container, and a tubular nozzle portion integral therewith having an inwardly yieldable resilient side wall and provided with an opening in its outer end, a valve member wholly carried by said cap including a valve positioned exteriorly of said opening, of larger size than said opening so as normally to seat against said nozzle portion on the exterior rim of said opening, a valve stem extending through said opening connected to said valve, and resilient legs debouching from the inner end of said valve stem, having spaced foot portions anchored in said base and having intermediate salient portions in operative proximity to the side wall of said nozzle portion to be contacted by said side wall and deflected when said side wall is squeezed, thereby opening said valve, the designed amplitude of deflection of said nozzle portion being such as solely to open the valve, permitting the gravitational head of liquid in said container to discharge the drops, one at each opening of the valve.

2. Squeeze cap for dispensing liquids in drop by drop sequence from a container while the latter is so positioned as to maintain a gravitational head of the contained liquid above the cap, the latter comprising a base portion constructed to be coupled to the mouth of the container and a tubular nozzle portion integral therewith having a yieldable resilient side wall and being provided with an opening in its outer end, a valve member carried wholly by said cap including a valve positioned exteriorly of said opening, of larger size than said opening so as normally to seat against said nozzle portion on the exterior rim of said opening, a valve stem extending through said opening connected to said valve, and resilient legs debouching from the inner end of said valve stem, having spaced foot portions anchored in said base and having intermediate salient portions in operative proximity to the side wall of said nozzle portion to be contacted by said side wall and deflected when said side wall is squeezed, thereby opening said valve, the designed amplitude of deflection of said nozzle portion being such as solely to open said valve, permitting the gravitational head of liquid in said container to discharge the drops, one at each opening of the valve, said valve and the rim of the opening upon which it is seated being so shaped and sized as to detain a drop between them through surface tension until displaced by a succeeding drop.

3. Squeeze cap as claimed in claim 1, said nozzle portion being formed about said opening with a flared valve seat, said valve being spherical, said valve seat and valve being correlated in shape and size so as to maintain a drop between them through surface tension until displaced by a succeeding drop.

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