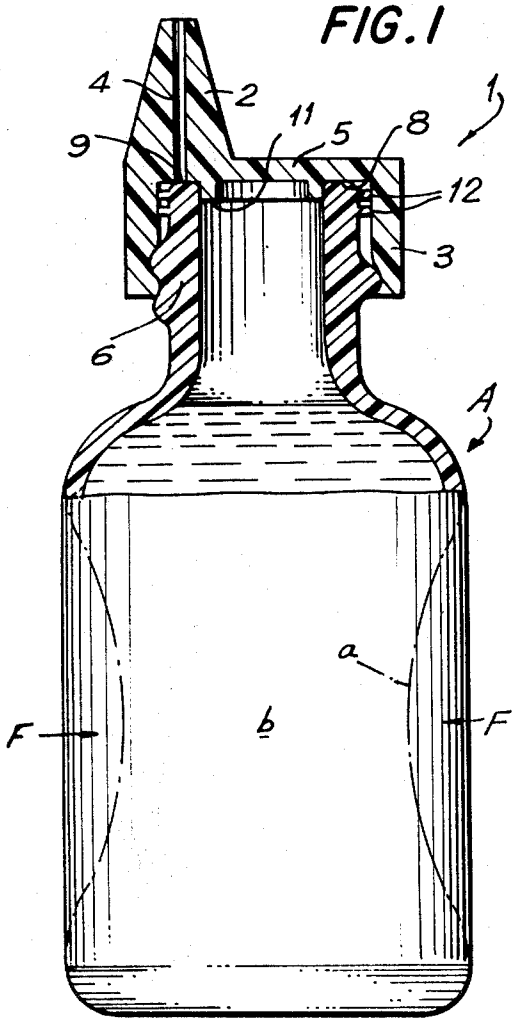
Sept. 20, 1971 A. SANTORE 3,606,105

MOVABLE ROTARY AND LONGITUDINALLY
CAP WITH AXIAL DISCHARGE
Filed Sept. 15, 1969

FIG. 1



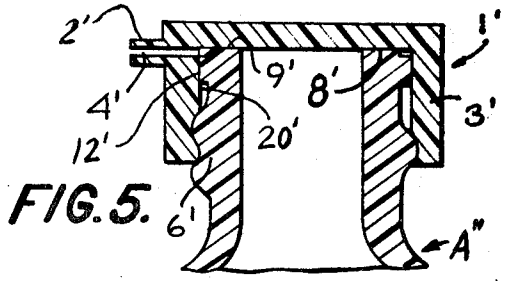


FIG. 5.

FIG. 4

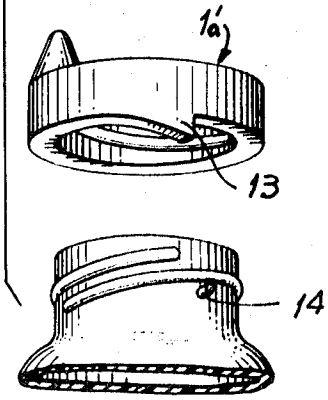


FIG. 2

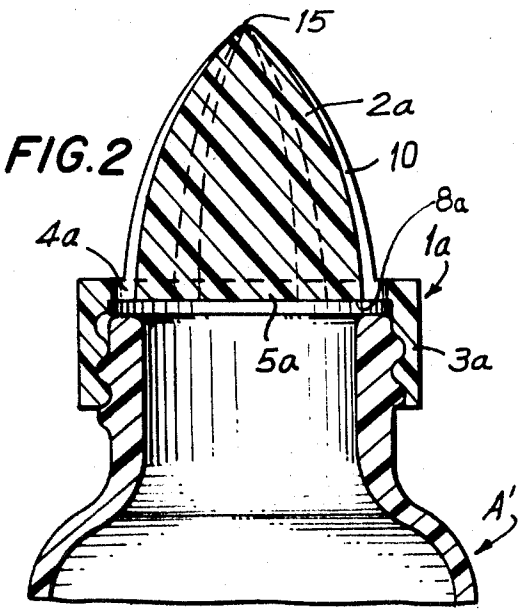
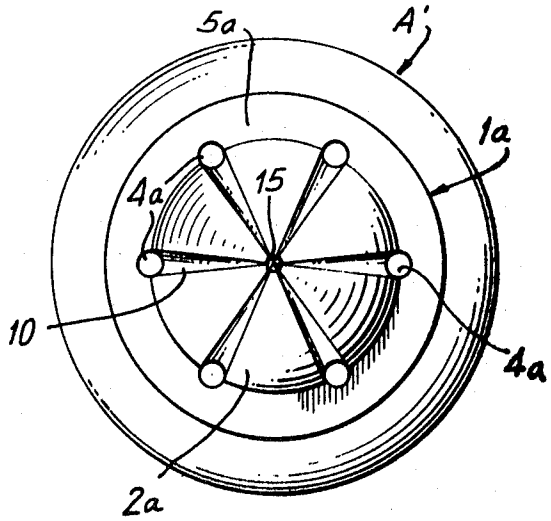


FIG. 3



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ROTARY AND LONGITUDINALLY MOVABLE CAP WITH AXIAL DISCHARGE

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ABSTRACT OF THE DISCLOSURE

A "squeeze-container" dispenser in which a cap, which is axially movable on the neck of the container between a sealing position and a dispensing position, has a first annular portion which, when said cap is in said sealing position thereof, is in engagement with the upper lip of the container for forming therewith a fluidtight circumferential seal, and said cap having a second annular portion which forms a substantially air-tight circumferential seal with the periphery of the neck of the container in both said positions. The cap is provided with at least one fluid passage located intermediate the aforesaid annular portions for permitting fluid to be dispensed therethrough when the cap is in said dispensing position thereof, and in response to squeezing the container.

The present invention relates to dispensers in general, and more particularly to a dispenser for liquids which is utilized for obtaining a controlled rate of discharge and which is of the type having a liquid-containing chamber of variable volume.

Variable volume dispensers having closures are generally known but have been found to have numerous disadvantages. Many of the known dispensers, for example, cannot be accurately regulated to insure a controlled discharge of the contents, while those which permit regulation are of complicated construction and expensive to manufacture. Still others require a separate sealing and a separate dispensing member, the latter being prone to clogging as a result of the accumulation of residue which may further result in the contamination of the liquid remaining in the dispenser.

It is an important object of the present invention to provide a very simple and inexpensive dispenser whose discharge characteristics are easily and accurately controllable.

It is another object of the invention to provide a dispenser whose discharge characteristics are, for a particular liquid, a function of two readily controllable variables, each of which may be regulated at the time of use.

It is a further object of the present invention to provide a dispenser of the above type which prevents the accumulation of residue in the discharge region thereof, thus preventing clogging and contamination of the material remaining in the dispenser.

It is still another object of the invention to provide a dispenser of the above type consisting of only two parts which cooperate to perform the sealing as well as the aforesaid controllable dispensing action.

With the above objects in view, one feature of the invention resides in the provision of a dispenser which comprises a receptacle preferably consisting of elastically deformable synthetic plastic material defining a liquid containing chamber of variable volume, and having a neck on which is mounted a closure including an axially reciprocable annulus surrounding the neck and a top wall at one end of the neck. The top wall of the closure has an annular section movable into and out of sealing engagement with the neck in response to movement of the closure between a sealing and a dispensing position. The

closure is arranged to define a liquid-dispensing passage located outside of the annular section and communicating with the chamber via the neck of the receptacle when the closure is moved to dispensing position whereby the liquid may escape through the aforesaid passage in response to movement of a portion of the receptacle from an end position corresponding to the maximum volume of the chamber to a position corresponding to a lesser volume of the chamber, said portion tending to remain in the end position corresponding to maximum volume.

In accordance with a more specific feature of the invention, the closure may be provided with a bullet-shaped projection extending outwardly from the top wall and defining a plurality of circumferentially spaced peripheral grooves communicating with corresponding passages through the top wall and merging at the apex of the bullet-shaped projection so as to direct the liquid issuing from the passages into a single stream.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved dispenser itself, however, both as to its construction and its method of operation, together with additional features and advantages thereof, will be best understood from the following detailed description of certain specific embodiments with reference to the accompanying drawing, in which:

FIG. 1 is a partly sectional front elevational view of a dispenser embodying one form of the invention and illustrating two volume-conditions of the fluid-containing receptacle;

FIG. 2 is a fragmentary axial section through a modified dispenser whose closure is arranged to dispense from an axial location;

FIG. 3 is a top plan view of the modified dispenser illustrated in FIG. 2;

FIG. 4 is a perspective view of a closure modified still further to include a self-locking feature and a fragmentary perspective view of a correspondingly modified receptacle with which the modified closure may be assembled; and

FIG. 5 is a fragmentary axial section through another embodiment of the present invention in which the closure is arranged to dispense in radial direction.

Referring now in greater detail to the illustrated embodiments, and first to FIG. 1, there is shown a receptacle A consisting of elastically deformable synthetic plastic material in the form of a "squeeze-bottle" and defining a liquid containing chamber *b* of variable volume. The particular material used for receptacle A does not form a part of this invention. The material need only possess the properties of ready deformability in response to finger pressure and sufficient elasticity to return to its original shape when the pressure thereon is released. A satisfactory result may be obtained with any one of a variety of known materials as, for example, low-density polyethylene. In FIG. 1 there is illustrated by dot-dash line *a* the deformed condition of receptacle A in response to the application of a squeezing force F—F applied in the direction of the arrows. As a result of the deformation from the solid line condition to the condition illustrated by phantom line *a*, the volume of the chamber *b* decreases from its maximum value to some lesser value, respectively. As noted above, the material and/or the construction of receptacle A is such that the deformed portion of the latter always tends to assume its initial undeformed condition which corresponds to the maximum volume condition of chamber *b*. It will be readily understood that receptacle A need not consist entirely of elastically deformable material, it being sufficient that some portions thereof defining the chamber *b* are elastically deformable.

Alternatively, the receptacle may consist of two or more fluidtightly telescoping rigid members which together define an internal chamber of varying volume and which are permanently biased apart from each other, i.e., into maximum volume position, by a resilient means as, for example, a spring member.

The receptacle A as seen in FIG. 1 includes a neck **6** having an externally threaded portion and an upper lip **9**. The closure **1** is shown in sealing position on the neck **6** with the internal threads of the skirt or annulus **3** threadedly engaging the threads on the neck **6** so as to be axially reciprocable with respect thereto. The top wall **5** of the closure **1** has an internal surface including an annular section **8** which, in the illustrated sealing position, is in sealing engagement with upper lip **9**, so that liquid from chamber *b* is prevented from escaping into the liquid-dispensing passage **4**, extending through top wall **5**, outwardly of annular section **8**, and through the annular extension **2** projecting from top wall **5**. In the preferred embodiment the closure **1** consists of a rigid material. Thus, the preferred closure may be formed of metal or of rigid synthetic plastic as, for example, polystyrene, and as seen in FIG. 1, may be provided with an annular projection **11** extending downwardly from top wall **5** to engage the internal surface of the neck **6** when the closure is moved into sealing position. Additional sealing means in the form of one or more annular projections **12** are preferably provided on the receptacle neck **6** surrounding the latter above the threaded portion thereof. The annular sealing projections **12** are arranged to maintain continuous circumferential sealing engagement with a smooth internal surface portion, in the interior of annulus **3** and located intermediate the threads thereof and top wall **5**, not only in the sealing position of the closure but also in the dispensing position, i.e., when annular section **8** has been moved out of engagement with the upper lip **9** and passage **4** can communicate with the interior of chamber *b* via the neck **6**. Thus, when it is most needed, namely, during storage and shipping, the projections **11** and **12** may cooperate to provide a multiple sealing action. Furthermore, the annulus **11** may be formed with a slight taper so that the engagement thereof with the internal surface of neck **6** will urge the material of the latter to expand at least slightly outwardly thus urging the projection **12** into even better sealing engagement with the closure **1**. During dispensing, sealing projections **12** are active also to prevent liquid from escaping around the neck **6** anywhere other than through passage **4**. While, after release of the force F—F, sealing means **12** acts to prevent air from entering chamber *b* thus insuring that all entering air passes through passage **4**, entraining any residual fluid therewith. Alternatively, of course, the closure **1** may itself be provided with one or more annular sealing projections extending inwardly from the skirt and engaging a smooth peripheral portion on the neck of the receptacle (not shown).

When it is desired to dispense the contents of the dispenser, the closure **1** is rotated with respect to neck **6** in a direction to unscrew the former thereby moving the same axially with respect to the neck a distance corresponding to the flow rate desired.

Rotation of the closure **1** in a direction to unscrew the same from neck **6** causes the annular section **8** to move away from lip **9**, into any desired dispensing position, depending on the amount of rotation. With annular section **8** spaced from lip **9** and the annular projection **11** no longer in contact with the internal surface of neck **6**, the passage **4** can communicate with the chamber *b* via the interior of neck **6**.

Even when closure **1** is in dispensing position, however, and the dispenser is inverted, no substantial amount of liquid will escape through the passage **4** until a force such as force F—F is applied to the elastically deformable receptacle A so as to reduce the volume of chamber *b* and force the contained liquid to escape. Thus, the discharge flow characteristics of the liquid being dispensed are controllable not only by the preset dispensing opening, as determined by the amount of rotation imparted to closure **1** and limited, of course by the cross-sectional size of passage **4**, but also by the amount and speed of the application of squeezing force F—F. It is intended that the term "liquid" as used herein include also, in addition to other fluids, very viscous materials such as pastes and creams.

When the applied force is terminated, the elastic nature of the receptacle A, or at least a portion thereof, urges the walls of chamber *b* back to their initial state corresponding to the maximum volume condition of the receptacle. In returning to this initial state, the negative pressure in chamber *b* (as a result of the substantially airtight seal formed by the means **12**) draws back into the chamber any liquid remaining in or near the passage **4**, which latter passage may be tapered in the direction toward the discharge end of the extension **2** so as to facilitate such "draw back"; thus assuring that the passage **4** remains unclogged and free of contaminating residue.

The dispenser, therefore provides a self-cleaning action for its dispensing passage **4**.

It will be readily understood that the projection **2** of closure **1** need not extend axially as illustrated in FIG. 1, but may extend at any desired angle with respect to the axis of the closure so long as the passage **4** originates outside of the annular section **8** and within some sealing means such as for example, the projections **12** or at least the threaded connection between closure **1** and neck **6**.

Thus, for example, according to the embodiment illustrated in FIG. 5, the projection **2'** of the closure **1'** extends radially with respect to the axis of the closure and passage **4'** is located intermediate the annular sealing portions **8'** and **12'**. When the closure **1'** is in the sealing position thereof (FIG. 5) fluid in the interior of the container A'' is prevented from escaping to passage **4'** as a result of the circumferential seal formed by the annular portions **8'**, **9'**. When, on the other hand, the closure **1'** is in dispensing position (not shown—but similar to the relative closure-container positions illustrated in FIG. 2) a substantially airtight circumferential seal is achieved with the annular means **12'**.

The aforesaid substantially airtight circumferential seal accomplished by the sealing means **12'** insures the "drawback" into the container of any residue fluid remaining in the passage **4'** after dispensing is completed. In other words the aforesaid seal insures that substantially all the air entering the chamber *b* after release of force F—F, enters through the passage **4'** and not around the threaded region of the neck **6'**. The radial nozzle **2'** permits accurate and convenient dispensing control particularly for hand lotions and similar fluids.

FIG. 2 illustrates a centrally-dispensing dispenser having a closure **1***a* shown in dispensing position on the neck of a receptacle A' which is in all respects identical to receptacle A illustrated in FIG. 1 and described above, except that receptacle A' is provided with sealing means which differ from the sealing means **12** of the embodiment of FIG. 1. While sealing means such as means **12** may be employed with the dispenser construction shown in FIG. 2, the particular embodiment there illustrated may attain a proper sealing action by constructing the interior of the closure skirt or annulus **3***a* so as to provide a tight sealing fit with the peripheral surface of the neck of receptacle A'. Thus, accurately mating threads can provide a satisfactory sealing action. Further sealing may be obtained with engagement between a smooth interior peripheral surface portion of annulus **3***a*, above the threaded portion thereof, and an accurately mating smooth exterior surface portion surrounding the neck of the receptacle above the threads thereof, similar to the arrangement shown in FIG. 5.

Closure **1***a* is provided with a bullet-shaped extension **2***a* located substantially axially with respect to, and pro-

jecting upwardly from, top wall 5*a* to an apex **15**. Extension 2*a*, while shown solid, may, of course, be formed with a hollow interior. It will be seen that the extension 2*a*, need not be "bullet-shaped" but could be conical, pyramidal, or of any other similar shape displaying a substantially centrally located apex. Outwardly of the annular sealing section 8*a* in the interior of top wall 5*a*, and circumferentially distributed thereabout, are a plurality of preferably equally spaced passages 4*a* extending through the top wall. A plurality of grooves **10**, equal in number to the passages 4*a* and each communicating with one of these passages, are distributed about the outer surface of projection 2*a* and extend from the respective passage to the apex **15** which latter is preferably slightly flattened at its uppermost portion. The grooves **10** decrease in depth and width as they approach the apex but maintain their grooved shape throughout. As best seen in FIG. 3, each of the grooves is arranged to form an extension of a portion, preferably about one-half, of the peripheral surface of the corresponding passage 4*a*. Thus, when closure 1*a* is in dispensing position, as shown, liquid which is caused to escape through passages 4*a* in response to deformation of receptacle A', as described above, is compelled to flow along the grooves **10** toward apex **15** when the dispenser is inverted for pouring. Liquid forced through the passages 4*a*, as aforesaid, flows by gravity along the grooves **10** tending to adhere to the surface of the latter until reaching apex **15**. The grooves **10** preferably lie in axial planes and converge toward each other at the flattened apex **15**, so that bodies of liquid flowing along the individual grooves converge at the apex where they are consolidated into a single discharge stream. The single discharge zone at apex **15** is, of course, located within the confines of the annular section 8*a* and preferably along the axis thereof. Annular section 8*a*, it will be noted, need not be very wide, so long as some sealing surface is provided thereby inwardly of passages 4*a*.

When the dispenser is righted after dispensing, the liquid remaining in the grooves **10** flows back toward the respective passage 4*a* where it is drawn back into the receptacle A' by the elastic action of the walls of the receptacle as previously described. Grooves **10** and passages 4*a* will therefore, remain substantially free of any contaminating residue and unclogged. Tightening of closure 1*a* on the neck of receptacle A', of course, seals the openings 4*a* from further communication with the interior of the receptacle neck.

Thus, with the embodiment illustrated in FIGS. 2 and 3, an accurately controllable single stream of liquid may be dispensed from a centrally located zone, in a simple and economical manner. The dispenser of FIGS. 2 and 3 preferably consists of only two, readily constructed, pieces, namely, the relatively rigid one-piece closure 1*a* and the relatively elastically deformable one-piece receptacle A'. The cooperation between members 1*a* and A' for sealing and for controlling the discharge characteristics is substantially the same as that described above for the dispenser of FIG. 1.

The dispenser according to the present invention may, optionally, be provided with locking or indicating means such as means **13**, **14** as seen in FIG. 4. The closure 1*a* is in all respects identical to the closure **1** except for the extension **13** which has a camming surface projecting downwardly from the skirt thereof and terminating abruptly along a substantially axial plane. The receptacle illustrated in FIG. 4, may be identical in all respects with the receptacle A of FIG. 1, except that the former is provided with an axially, elastically, deformable protrusion **14** located on the neck in the region of the threads thereof.

The extension **13** and the protrusion **14** are respectively arranged on the closure and on the neck of the receptacle in such a manner that protrusion **14** is deformed by the lower camming surface of extension **13** when closure 1*a* approaches sealing position and snaps behind the axially extending edge of extension **13** when the closure has approached, in the direction of the sealing position, sufficiently to have reached the preferred dispensing position. In the illustrated embodiment of FIG. 4, the closure 1*a* is screwed onto the neck in clockwise direction. Preferably one-half revolution before reaching sealing position the protrusion **14** snaps behind the axial edge of extension **13**. The latter position represents the preferred dispensing position. Further clockwise turning of the closure places the same into sealing position since after the aforesaid axial edge has passed protrusion **14**, the closure is free to move clockwise without further interference until sealing position is reached. When it is next desired to dispense liquid, however, counterclockwise movement toward the dispensing position will, when the preferred dispensing position is reached, cause the protrusion **14** to abut squarely against the axial edge of extension **13** to prevent further movement of the closure past the preferred dispensing position, or at least indicate to the user that such position has been reached. A predetermined preferred dispensing position may, therefore, be accurately achieved each time the dispenser is used to dispense liquid. The protrusion **14** may be relatively small and flexible so that it acts merely as an indicator when the desired position is reached, or it may be larger and somewhat less flexible so as to act as a lock making the closure 1*a* "captive" on the neck of the receptacle by preventing an unscrewing thereof beyond the preferred dispensing position.

Alternately, of course, the neck of the receptacle may be provided with a protrusion having a peripheral camming surface arranged to engage an elastically deformable downwardly extending flap extending below the lower edge of the closure and being deformable outwardly, i.e., away from the axis of the closure, when the camming surface of the neck mounted protrusion engages therewith and snapping in behind a radially extending edge of the protrusion to constitute locking means similar to those described above.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. A dispenser, comprising a receptacle having a liquid-containing chamber and including a neck; and a one-piece closure including an axially reciprocable annulus surrounding said neck, an inwardly extending wall portion at one end of said neck having an annular section movable into and out of sealing engagement with said neck in response to axial movement of said annulus between a sealing and a dispensing position, at least one liquid dispensing passage extending through said wall portion outside of said annular section, and said closure further comprising a top portion projecting upwardly from said wall portion and having substantially along the center line of said closure an apex portion spaced from said wall portion, said top portion having an outer surface defining at the exterior thereof an outwardly open channel tapering from said passage to said apex so that liquid issuing from said passage when said annulus is moved to said dispening position flows along said open channel to said apex to be dispensed therefrom in a single stream issuing substantially from said apex.

2. The dispenser according to claim **1**, wherein said top portion is in the form of a bullet-shaped nose tapering upwardly substantially coaxially with said annular section.

3. The dispenser according to claim **1**, wherein said top portion of said one-piece closure defines a plurality of liquid dispensing passages circumferentially distributed

around said annular section and a corresponding plurality of circumferentially spaced outwardly open channels each communicating with a corresponding one of said passages and tapering to said apex so that bodies of liquid issuing from said passages flow along the respective channels and merge at said apex to form a single stream issuing substantially coaxially with respect to said closure.

4. A dispenser as set forth in claim **1**, further comprising stop means having cooperating portions on said neck and on said annulus for normally preventing said closure when being moved from said sealing to said dispensing position thereof to be moved beyond said dispensing position so that said closure is accurately adjustable to the same dispensing position each time it is moved from its sealing position.

5. A dispenser as set forth in claim **1**, wherein said spaced channels are in the form of substantially axially extending grooves each extending along the outer surface of said nose portion from the respective passage to the apex, said grooves and said passages being uniformly distributed about the axis of said nose and all of said grooves merging at the apex so that bodies of liquid issuing from said passages and flowing in said grooves merge

into a single stream which may be dispensed from a location within the confines of said annular section.

6. The dispenser according to claim **1**, wherein said receptacle is elastically deformable for varying the volume of said liquid containing chamber in response to deformation of said receptacle.

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