

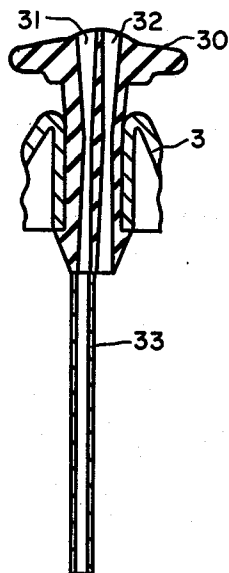
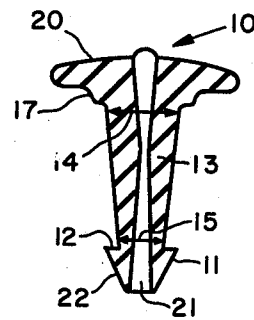
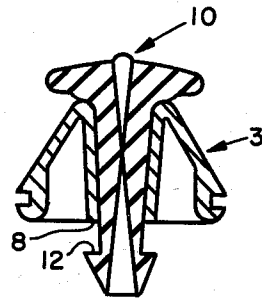
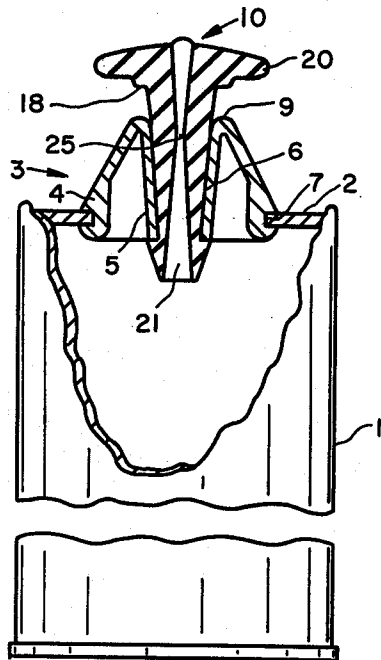
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CAPTIVE PLUG DISPENSING CLOSURE

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CAPTIVE PLUG DISPENSING CLOSURE

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This invention relates to a container closure, and more specifically to a closure which is held captive on the container yet enables the container contents to be dispensed as wanted.

An object of the invention is a container closure of simple construction that is easy to make and easy to assemble on the container.

A further object of the invention is a container closure that need not be removed to discharge material from the container and hence cannot be lost and yet is easy to use.

Still a further object of the invention is a container closure held captive on the container yet enabling the container contents to be dispensed in a metered manner.

Briefly speaking, these and other objects of the invention are obtained with my novel container closure which comprises a plug member of deformable, elastomeric material which sealingly but movably engages an opening in the container wall. Spaced regions of the plug are provided with means, such as projecting portions, adapted to engage spaced abutment portions on the container, enabling the plug to be moved a prescribed distance within the container opening but holding the plug captive and preventing the plug from being completely separated from the container in its normal operation. The plug contains a passageway running through it, and the plug body, or wall portions of the plug, has different dimensions, for example, tapered, or the container opening may be tapered, or both. Thus, with the plug in one position the passageway remains open and unblocked allowing the container contents to be dispensed as wanted. When the plug is moved to a different position, compression forces are exerted on the plug walls by the container causing a constriction of the passageway and a blocking of it by the deformed walls preventing any further discharge of its contents. Intermediate positions of the plug produces partially blocked passageways of controlled size enabling a metered flow or discharge of the container contents.

Other objects and advantages will be apparent from the following detailed description of a preferred form of the invention in conjunction with the accompanying drawing, in which:

FIG. 1 is a front view, partly in cross-section, of a container with one form of my novel closure in the opening position in which the container contents may be dispensed;

FIG. 2 is a cross-sectional view of the closure position of FIG. 1 in the closing position preventing the container contents from being dispensed;

FIG. 3 is a cross-sectional view of just the plug member of the embodiment illustrated in FIG. 1;

FIG. 4 is a cross-sectional view of a modification.

Referring now to FIG. 1, there is illustrated therein a typical container 1 with my novel closure in the opening position. The container 1 illustrated is a metal can of cylindrical form housing a liquid to be dispensed as wanted. My novel closure can also be employed with rectangular cans, bottles, collapsible tubes, squeeze bottles, and the like, containing liquid or fluid, semi-fluid, such as cream or paste-like, or particulate, e.g., powdery, materials which are dispensed by decantation or pouring out of the container or by squeezing the container. The embodiment illustrated is provided with a metal top wall 2 sealed to a neck portion 3 in the form of an annular, upstanding wall member 4 with a downturned edge 5 defining a central cylindrical bore 6 extending from the inside

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to the outside of the container. The neck portion or spout 3 is provided with an annular recess 7 for securement to the container wall 2. In the normal practice, the container is filled through the large opening afforded in the top wall 2 with the neck portion 3 absent, and the latter is then pressed into the wall 2 until it snaps into the recess 7 and locks in the position shown in FIG. 1.

Sealingly engaging the central bore 6 in the neck portion 3 is my captive plug 10. The plug 10 is constituted of elastomeric, flexible or deformable material, such as rubber or synthetic resins, for example, neoprene, polyvinylchloride, polyethylene plastic or the like. In its non-compressed form illustrated in FIG. 3, it comprises an elongated tubular member symmetrical about a center longitudinal axis having at its bottom a flanged portion 11 projecting transversely and adapted with its upper surface 12 to engage the bottom edge 8 (FIG. 2) of the container neck 3 serving as an abutment or stop. In the opening position shown in FIG. 1, the axial portion 13 of the plug lying within the neck portion is generally cylindrical with a diameter slightly larger, say 2%-10% larger, than the internal diameter of the bore 6 of the neck and thus fits snugly therein sealing off the container contents yet allowing the plug to be vertically reciprocated. The plug body portion 13 preferably tapers outwardly or progressively increases in diameter from the bottom to the top. The dimension at the top of this tapered portion, indicated as 14, is about 5%-15% larger than the dimension, indicated as 15, at the bottom. Above it extends a second transverse flange portion 17 adapted with its lower surface 18 to engage an upper portion 9 of the neck serving as a second abutment or stop. The top portion 20 of the plug is enlarged and adapted to be readily grasped by hand to reciprocate the plug 10 within the neck bore. Running lengthwise through the plug is a generally cylindrical bore or passageway 21 (FIG. 3) having a diameter smaller than that of the central plug portion 13, say about $\frac{1}{8}$ - $\frac{1}{2}$ that of the latter.

The plug 10 may be easily formed or molded out of rubber or plastic in one piece and then forced through the neck bore 6 into the position shown in FIG. 1 within the container neck so that the central plug body portion 13 extending between the flange portions 11, 17 is engaged by the downturned edge 8 of the neck portion. To this end, the bottom end 22 of the plug from the lower flange tapers inwardly to the plug passageway, enabling the plug to be readily pushed through the neck portion until the lower flange 11 clears the lower abutment and snaps into place. In the opening position shown in FIG. 1, with the bottom flange 11 engaging the lower abutment 8, the slightly oversized plug is deformed causing a necking down of the passageway, which nevertheless remains open and unblocked. By inverting the container, its fluid contents can be dispensed through the open passageway 21. When the plug is pushed down within the neck portion so that the upper flange 17 engages the upper abutment 9, the increased plug diameter increases the compressive forces and wall deformation to the point where the passageway 21 constricts and becomes blocked by the inwardly forced plug wall portions, as shown in FIG. 2. The container interior then becomes sealed off. By grasping the handle end 20 and pulling the plug upwards, the container contents can again be dispensed. The cross-section of the passageway at the narrowest point, indicated at 25, can be accurately controlled between the sizes shown in FIGS. 1 and 2 by locating the plug at any intermediate position. If desired, horizontal indicia stripes can be painted or similarly marked on the outside wall of the plug body portion 13 to indicate positions of the plug where the passageway is, say $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ the size when fully opened. This enables the user to meter the flow of the container contents if desired. The elastic properties

of the plug enable it to recover its shape after deformation and allows the passageway opening to be uniformly dependent on the plug position.

It will be appreciated that, in order to produce the desired results, the plug dimensions 14, 15, those of the longitudinal passageway 21, and those of the neck bore 6 are related so that in the opening position, the passageway 21 is open allowing the container contents to be dispensed, and when the plug is pushed into its closing position, the passageway 21 becomes blocked. This result, which also depends upon the resilience, i.e., softness or hardness, of the plug, can be achieved in various ways. The neck bore 6 can be cylindrical, and the plug body 13 tapered sufficiently to block the passageway 21 when moved into the closing position. Preferably, however, the neck bore 6 has a small taper, about 2%-7%, to simplify installation of the plug 10, with the larger dimension at the top, and the plug 13 too is tapered outwardly, as shown in the drawing, which makes it easier to reciprocate in the neck and still adequately seal the contents. Again, the largest dimension 14 of the plug body is chosen so that in the closing position the passageway 21 is blocked. While the passageway 21 also may be cylindrical, I prefer the double taper illustrated in the drawing, with both ends of the passageway 21 being enlarged and tapering inwardly, e.g., about 2%-7%, to form a constricted orifice 25 at about the center of the plug. This construction has the advantage that the flow of the container contents is improved, due to the larger entrance and exit openings. Further, the passageway 21 is more easily and more tightly blocked when a constriction is already present in the passageway in the opening position. While some relative proportions have been described to achieve these ends, it will be understood that these are not intended to be limiting, and many proportions can be arrived at by simple computation or by simple experimentation by those skilled in this art to ensure the foregoing results.

FIG. 4 illustrates a modification in which the plug 30 contains two separated passageways 31, 32 running lengthwise through the body. One passageway 32 may serve the same function as the single passageway illustrated in the previous figures, namely, dispensing the container contents. To the plug portions adjacent the bottom opening of the second passageway 31 is secured or adhered an elongated air tube or dip tube 33 that depends therefrom extending downward deep within the container interior almost to its bottom. Similarly to what was described earlier, with the plug 30 in its closing, down position, both passageways are blocked. With the plug 30 pulled outwardly, both passageways are opened. The first 32 may serve to dispense the container contents by decantation. The second 31, exposed to the outside and connected to the dip tube 33, may serve as an air vent preventing a vacuum from building up in the container interior and limiting the flow from the container.

The dip tube modification illustrated in FIG. 4 lends itself to other modes of operation. For instance, the two passageways can be dimensioned such that, with the plug in the opening position, both passageways are unblocked. Thus, as described, one passageway 32 can be used as a discharge orifice and the other 31 as a vent. With the plug pushed, say, half-way down, the side passageway 32 becomes blocked but the passageway 31 coupled to the dip tube 33 remains open. Thus, the container, if a squeeze bottle, when compressed, can be caused to discharge its contents via the dip tube 33. With the plug pushed all the way down to the closing position, both passageways are blocked. Alternatively, the passageway 32 can be blocked by the operator positioning his finger over the orifice. The application of pressure to a fluid in the container as by squeezing, will force the fluid up through the dip tube 33 and out through the passageway 31.

My novel closure offers a number of advantages. It is inexpensive to construct, and easy to assemble by simply

forcing it into the container neck. It is easily manipulated by the user to control the flow from the container, and can be used to meter that flow. It is held captive within the container by the abutments and thus can never be lost or misplaced.

While the plug is preferably cylindrical, other shapes are also suitable, such as elliptical or square or rectangular in cross-section. The neck portion of the cooperating container need not be of the form illustrated, though this is preferred, but any construction providing a bore of suitable length with a cross-section generally matching that of the plug is satisfactory. Thus the plug can be readily mounted in various types of containers. Similarly, the central passageway 21 need not have the circular cross-section illustrated; satisfactory results will also be obtained with diamond, rectangular and triangular cross-sections. Also, the passageway 21 need not be straight. For example, above the constricted region at 25, the passageway need not continue to the top of the plug but may bend sideways, if desired, to terminate at a side portion of the plug for lateral dispensing of the container contents. Still further, it is also possible within the scope of the invention to translate the plug from its opening to its closing position and back by a screw motion. To this end, the bore wall 5 of the neck portion is provided with a screw thread, and the central portion 13 of the plug provided with a matching thread, which may be provided by molding. Rotation of the plug in one direction will move it inward to its closing position. Rotation in the opposite direction will screw it outwards to its opening position.

Other changes and modifications can be employed without departing from the intended spirit and scope of the present invention. Therefore, it is to be understood that the invention is not to be considered as being limited or in any way restricted by or to the preferred embodiments thereof which are included in the foregoing description as exemplary thereof.

What is claimed is:

1. A captive plug dispensing closure for a container, comprising a generally tubular plug of elastomeric material having a longitudinal axis, said plug having integral generally transverse upper and lower flanged portions spaced apart along the said axis and adapted each to engage correspondingly arranged abutments of the container spaced apart a distance smaller than that separating the said flanged portions, whereby said plug is axially movable over a predetermined distance, said plug containing a bore extending completely through it in its axial direction, the bore orifices at the top and bottom of the plug being enlarged and the bore tapering inwardly from both orifices to form a constricted region in the proximity of the plug center, the plug portion extending between the flanged portions progressively increasing in diameter toward the upper flange, the plug portion extending below the lower flange progressively decreasing in diameter away from the lower flange, the plug portion extending above the upper flange being enlarged to serve as a handle for reciprocating the plug within the container between the abutments.

2. In combination, a container having a body portion and an integral neck portion open to its interior at both ends, said neck portion having abutment surfaces spaced apart a given distance along its length; a plug of flexible elastomeric material sealingly and slidably engaging the open neck portion, said plug having transversely extending flanged portions of a size adapted to engage the abutment surfaces and being spaced apart a distance greater than said given distance whereby said plug may be moved within the neck portion from a first position where it extends deeper within the container and the top flange engages the top abutment to a second position where it extends higher outside the container and the bottom flange engages the bottom abutment, said plug containing a passageway completely therethrough extending from the in-

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side to the outside of the container, the portion of said plug engaging the neck portion having a tapered formation which progressively increases toward the top thereof, the dimensions of said passageway, said neck opening and said tapered portion being related such that when the plug occupies the first position, compression forces exerted by the neck portion so deform the plug as to block the passageway and prevent the container contents from being dispensed, and when the plug is moved to the second position, the reduced compressive forces cause the passageway to become unblocked and the container contents may be dispensed, and means at the top of the plug for grasping same and moving same between the first and second positions.

3. The combination set forth in claim 2 wherein the central plug portion has a transverse dimension about 2%-10% larger than that of the container neck portion,

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and the largest dimension of the taper is about 5% to 15% larger than the smallest dimension of the taper.

4. The combination set forth in claim 2 wherein the neck opening has a slight outward taper.

5. The combination set forth in claim 2 wherein the plug passageway tapers inwardly from both ends producing a constriction at about its center.

6. The combination set forth in claim 2 wherein the plug contains a second passageway, and an air tube is connected to the plug at one of the passageways.

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