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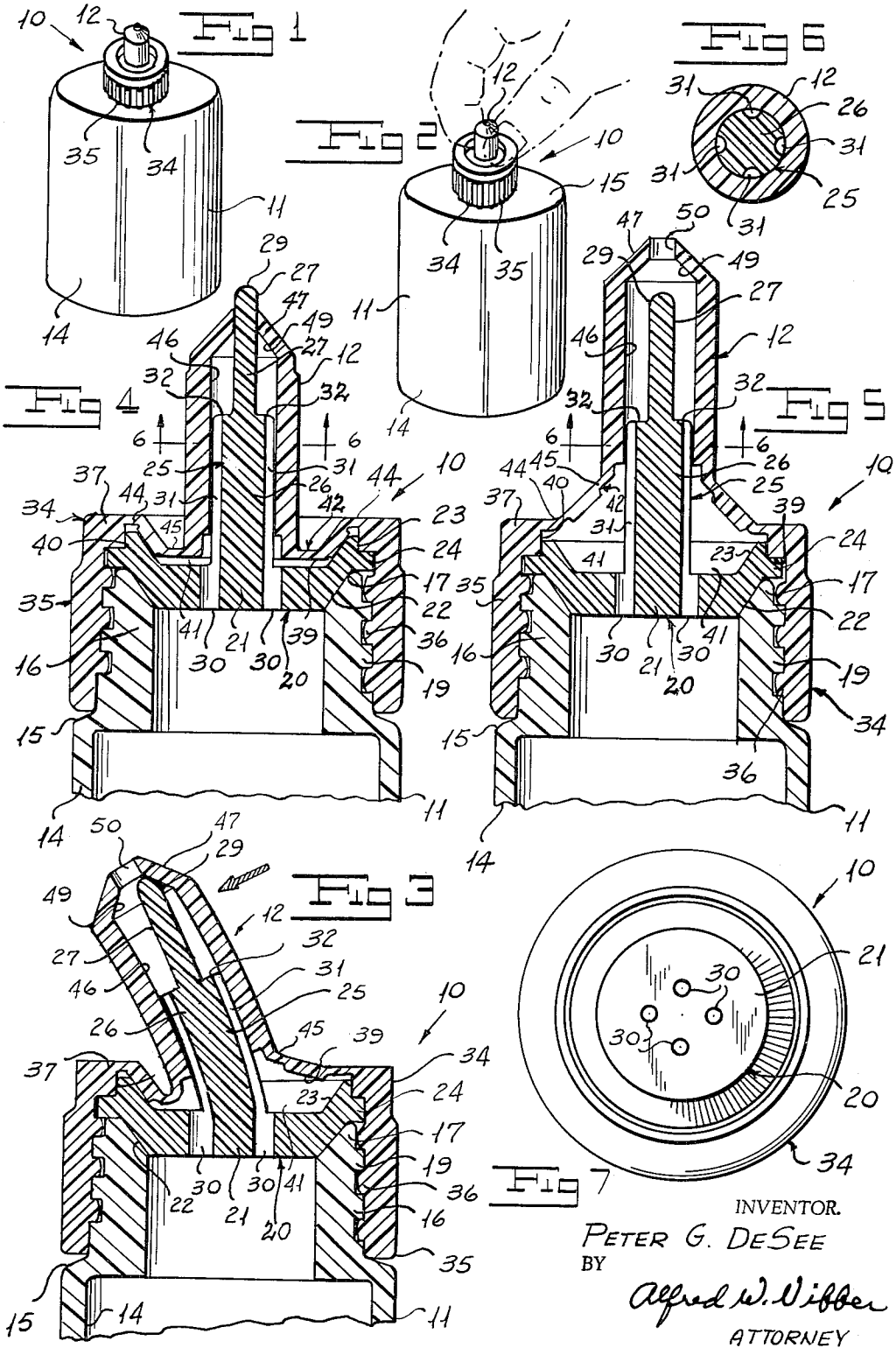

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DISPENSING CONTAINER CLOSURE

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This invention relates to a closure device for a container, and more particularly relates to a closure device for dispensing desired quantities of fluent material from a container provided with such closure device.

Dispensing containers are now frequently provided with closure devices which combine the function of captive caps and selectively operated closure means. Such devices are of advantage since there is no separate cap which might become lost, and since the dispensing orifice can be quickly opened and closed as desired.

Prior closure devices for use with containers such as squeeze bottles have employed an elongated cylindrical sleeve and a hollow elongated stem-like member which is mounted for reciprocation with respect to the sleeve, one of the sleeve and stem-like members being fixedly secured to the container. The sleeve and stem-like member are provided with cooperating formations whereby the closure device is open at one terminal position of the stem-like member relative to the sleeve and closed at the other terminal position of such members.

The above described construction of closure device requires that there be a sliding connection between the stem-like member and the sleeve, in addition to the seal between the cooperating closure opening and closing formations. Thus such prior closure devices inherently present at least one zone, the sliding connection, at which leakage of the container contents can take place. Such tendency to leakage is apt to become particularly bothersome when the contents of the container are either wholly volatile, such as lighter fluid, or are partially volatile, as in the case of glue and the like containing volatile solvents.

The dispensing closure of the present invention overcomes the above outlined difficulties with prior closures of the type described by making the closure in such manner that one of the parts thereof is a sleeve which forms, in effect, an integral conduit which leads from the interior of the container to the dispensing orifice of the closure. Such integral conduit is lengthened and shortened, respectively, to open and close the closure by telescoping one portion of the conduit within another portion thereof. Such lengthening and shortening of the conduit permits the portion thereof containing the dispensing orifice to be spaced from an inner fixed plug-like member, thereby opening the closure and to be telescoped over such plug-like member, thereby closing the dispensing orifice in the sleeve. Further, since the sleeve portion of the conduit is an integral part of the conduit, such portion can not be inadvertently removed by the user by pulling the sleeve outwardly too hard upon opening the closure; with the described prior closures, on the other hand, the slidable part of the closure is sometimes accidentally completely removed from the closure.

In the preferred disclosed embodiment of closure device the sleeve inherently seeks its retracted, closed position, once it has been thrust inwardly past a predetermined intermediate position. The closure of such preferred embodiment may also be opened by thrusting the sleeve sidewise to unseat the plug-like member from the dispensing orifice in the sleeve.

The invention has among its objects the provision of a novel dispensing closure which is free from sliding joints or connections other than that at the dispensing orifice itself.

Another object of the invention is the provision of a dispensing closure which presents an integral conduit free from sliding joints and leading from the interior of the container to the outer dispensing orifice of the closure.

Yet another object of the invention is the provision of a dispensing closure of the type indicated which is simple in construction, positive in its positioning in both its open and closed positions, and which is readily and easily manipulated.

A further object of the invention lies in the provision of a novel dispensing closure which is easily and economically made, easily assembled, and readily disassembled, if necessary.

A still further object of the invention, in the illustrative embodiment thereof, is the provision of a closure device which may be opened by a lateral thrust applied to its outer, dispensing end, and which automatically closes upon the removal of such thrust thereupon.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

FIG. 1 is a view in perspective on a small scale of a squeeze bottle provided with an illustrative closure device in accordance with the invention, the closure device being shown in closed position;

FIG. 2 is a view similar to FIG. 1 of a squeeze bottle and closure device shown therein, the closure device being in the act of being opened by pulling the sleeve of the closure device axially outwardly;

FIG. 3 is a view similar to FIG. 1 of a squeeze bottle and closure device of FIGS. 1 and 2, with the closure device opened by sidewise pressure applied to the sleeve of the closure device;

FIG. 4 is a view in vertical axial section of the illustrative closure device in closed position, the neck and a portion of the sidewall of the squeeze bottle on which the device is mounted being shown in section;

FIG. 5 is a view similar to FIG. 4 but with the closure device in open position;

FIG. 6 is a view in transverse section through the upper portion of the closure device, the section being taken along the line 6—6 of both FIGS. 4 and 5; and

FIG. 7 is a view in bottom plan of the illustrative closure device.

The closure device shown, which is generally designated by the reference character 10, is shown as being mounted upon a flexible walled squeeze bottle 11. When so used the device may be used to dispense a great variety of fluent materials, including relatively thick liquids such as glue and the like. It is to be understood that the closure device of the present invention may be used to advantage with other containers such as rigid walled bottles and cans when the material to be dispensed is fluid enough to pour satisfactorily under the influence of gravity alone The device may also be employed with suitable design of orifice sizes, passages, etc. to dispense freely fluent powders and the like.

In FIG. 1 the closure device 10 is shown in closed position, the reciprocable outer sleeve 12 of such device, which is made of flexible plastic material such as polyethylene, being shown in its inner or retracted position in which the dispensing orifice through the outer end of the sleeve is closed by a central plug member in a manner to be described. The annular zone of the diaphragm between zones 44 and 45 is thus markedly more resistant to bending than are zones 44 and 45. The closure device

may be opened, in the manner illustrated in FIG. 2, by pulling the sleeve **12** outwardly of the container. When the sleeve is thus extended, the dispersing orifice at the outer end of the sleeve will have been freed from the inner plug-like member, thereby opening the dispensing orifice. As will be apparent hereinafter, the sleeve **12** remains stably in both of its open and closed positions. To close the device **10** it is merely necessary to press inwardly upon the sleeve member **12** until the collapsible diaphragm at the base of the sleeve has reached a position slightly past its "dead center." Thereafter, the sleeve will be forcibly urged into its retracted closed position by the action of the diaphragm alone. As will appear hereinafter, the closure device **10** may also be opened by the application of a laterally directed force to the outer end of sleeve **12**, as shown in FIG. 3.

In the embodiment shown the ilosure device **10** is made as a part of a separately applied cap device for use on a conventional container, such as a squeeze bottle, provided with a screw threaded neck. It is to be understood that, in some instances, at least a part of the device **10** may be made integral with the container rather than as a part separate from it. Thus, for example, the inner, stem-containing portion **20** of the closure device, to be desired, may be made integral with the body of a blow molded bottle which is to be filled through the initially open bottom, the bottom of the bottle then being sealed. The bottle **11** here shown has a flexible sidewall **14** which is integrally connected at its top with a shoulder **15** and with a thickened upright neck portion **16**. Neck portion **16**, which is provided with external threads **19**, has a rounded lip **17** at its upper end.

The above mentioned insert member **20** of the closure device is made of resilient plastic material such as polyethylene. Member **20** has a base **21** which is generally of disc-shape, the central lower surface of base **21** being flat. Outwardly of such flat central portion the base is provided with a downwardly converging frusto-conical surface **22**, surface **22** being of such configuration that it accurately interfits with the inner surface of the rounded lip **17** at the upper end of the bottle. At the upper end of the frusto-conical surface **22** the base **21** is provided with a radially outwardly directed annular flange **24** which overlies the upper end of the lip **17** of the bottle and has a diameter substantially equal to that of the unthreaded portion of the neck **16**. Above and radially inwardly of flange **24** the base **21** is provided with an upstanding circular cylindrical portion **23** coaxial of the flange. An annular space **41** is provided at the upper surface of base **21** of the insert, for the purpose apparent in FIG. 4 and to be described hereinafter. Space **41** is defined by a flat annular surface about the root of the member **25**, and by an outer, downwardly converging frusto-conical surface above and generally parallel to the surface **22**.

Centrally of base **21** there is an upstanding central stem-like member **25** which has a lower larger diametered portion **26**, which extends for about one-half its total height, and an upper smaller diametered plug-like end **27** coaxial of the stem and joined to portion **26** at a shoulder **32**. The upper or outer end of portion **27** of the stem is rounded as shown at **29**. Base **21** has a plurality of passages (four shown) **30** extending therethrough, the axes of such passages in the illustrative embodiment lying substantially upon the outer surface of portion **26** of the stem-like member. Communicating with passages **30** and, in effect, forming prolongations of the radially inner one-half of each are flutes **31**, which extend longitudinally of the member **25**. Such flutes extend upwardly to terminate at the shoulder **32** forming the junction between portions **26** and **27** of the member **25**.

The outer portion of the closure device **10**, of which the above described sleeve **12** is a part, is generally designated by the reference character **34**. The lower portion of part **34** is generally in the form of a cap having a skirt **35** provided with screw threads **36** on the inner surface

thereof, whereby the skirt may be threadedly engaged with the neck of the bottle. The cap portion of part **34** is provided with a shoulder **37** having annular inner surfaces which accurately interfit with the annular outer portions of the base **21** of the insert **20**. Thus shoulder **37** has a lower inner annular surface **39** which overlies and forms a seal with the upper surface of the flange **24** on the insert member **20**. Radially inwardly of an above surface **39** the shoulder **37** is provided with an upright circular cylindrical surface **40** which accurately receives therewithin the circular cylindrical portion **23** of the base of the insert lying above flange **24**. Thus when the skirt of the outer portion **34** of the closure device is screwed tightly down upon the neck of the bottle a screw seal is established, from the interior of the container **11**, through the passages **30**, into the space **41** above the base **21** of the insert **20**, and within the conduit-forming further portion, now to be described, of the outer member **34**.

The lower end of the sleeve **12** of the outer portion **34** of the device is connected to the radially inner edge of the shoulder **37** thereof by a diaphragm in the form of a thin flexible sidewall portion **42**. The diaphragm **42** has a radial width when relaxed which exceeds the radial distance between the ring and the sleeve; when diaphragm **42** is extended into the closure device open position of FIG. 5 it is of upwardly converging frusto-conical configuration, and when it is retracted into the closed position of FIG. 4 it is of downwardly converging frusto-conical configuration. In its latter, retracted condition sidewall portion **42** is folded on itself to lie generally above and radially outwardly of the root of sleeve **12**, and lies telescoped into the above described space **41** formed by the upper surfaces of the base **21** of the insert member. The surface of the sidewall portion **42** which lies inwardly and downwardly in FIG. 4 now, in the position thereof in FIG. 5, contacts the frusto-conical upper surface of base **21** of the insert. Sidewall **42**, which is integral with skirt **35** and sleeve **12**, is made of flexible plastic material such as polyethylene. To facilitate distortion of the sidewall **42** so that it may change in shape as described, such sidewall is provided with a lower annular zone **44** (FIG. 4) at which its section is thinned and a similar upper portion **45**. When the sleeve **12** is thrust inwardly, that is, downwardly from the position of FIG. 5 the sidewall portion **42** tends first to become radially compressed and to function somewhat as a toggle. After the distorted sidewall portion **42** has slightly passed a predetermined intermediate "dead center" point in its travel at which such compression is at a maximum, sidewall portion **42** is able to expand radially, thereby causing the sleeve **12** to move downwardly to its final closed position, shown in FIG. 4.

The sleeve **12** has a sidewall **46** of appreciable thickness, so that the sleeve is substantially rigid. The bore through the main portion of the sleeve **12** has a diameter substantially equal to the over-all diameter of the portion of part **26** of the stem. As a consequence, in all positions of its axial travel the sleeve **12** is guided by engagement between the sidewall **46** of the passage through the sleeve and the circular cylindrical surfaces of portion **26** of the stem between the flutes **31** therein.

The outer end of sleeve **12** is provided with an outwardly converging frusto-conical portion **47** having a frusto-conical inner surface **49** which leads to a central dispensing opening **50** in portion **47** of the sleeve. The relaxed diameter of portion **27** of the stem slightly exceeds the relaxed diameter of the opening **50** through portion **47** of the sleeve **12**. As a result when the outer end of portion **27** of the stem is advanced into the opening **50** the stem **27** is resiliently compressed and the plastic material of portion **47** surrounding opening **50** is resiliently expanded, thereby establishing a secure seal at the outer end of the closure.

In FIG. 3 there is shown an alternative manner in which the closure device **10** may be operated. As there shown, the operator has pressed the outer end of the sleeve **12**,

when such sleeve is in its inwardly retracted position, laterally with sufficient force to tip the sleeve **12** at a pronounced angle. The distortable portion **42** of the sidewall of the member **34** permits the illustrated tipping of the sleeve. The tipping of the sleeve causes the stem-like member **25** to bend, thereby withdrawing the outer end of the portion **27** of member **25** from the orifice **50** and opening the closure. The tipping of sleeve **12**, although shown as being effected by a finger of the user of the device, can readily be produced by forcing the outer end of the sleeve **12** at a suitable angle against a surface of an object onto which a portion of the contents of the container are being dispensed. The resilience of the sidewall portion **42** of part **34** of the device **10** and that of stem-like member **25** immediately restore the closure device **10** to its closed condition of FIG. 4 after removal of the lateral sleeve-tipping force from the sleeve **12**. This manner of opening the closure device is particularly useful in breaking any temporary seal which may have occurred between the stem-like member and the sleeve of the device; such sealing of the sleeve to the stem-like member is particularly marked when viscous materials such as glue is dispensed by the closure device.

The upwardly converging frusto-conical configuration of the inner surface **49** of the partition **47** on the sleeve **12** has a centering action upon the outer end **29** of stem-like member **20** as such ends nears the orifice **50** in portion **47**. Thus regardless of how the end of member **20** has been withdrawn from orifice **50**, whether by straight-line withdrawal or by the described tipping of sleeve **12** and the consequent bending of member **20**, the end of member **20** will always find its way correctly into orifice **50** when the parts **29** and **47** approach each other as the device **10** is closed.

The closure device of the present invention is of advantage for a number of reasons as will be apparent from the above description of its construction and manner of operation. It is also of advantage, particularly in dispensing materials having a tendency to drip, because the action of collapsing the portion **42** of the sidewall of the outer member **34** has an indrawing pump-like effect upon the material which then lies in space **41** of the device, as well as that lying outwardly of stem portion **27** in the vicinity of opening **50**. This action thrusts the material back into the container from space **41**, and creates a suction to withdraw the material from the immediate vicinity of the opening **50** prior to engagement of the end of stem **27** with such opening. Consequently, the cutoff of material being dispensed through the device is sharp, there being almost no wastage of material.

The outer member **34** of the device **10** may conveniently be molded as an integral piece with the diaphragm **42** in the position shown in FIG. 4. The molding of the diaphragm in this manner aids it in seeking its downward, closed position because of the so-called "plastic memory" of the diaphragm. The insert **20** is likewise preferably molded as a separate, integral piece. To aid in the stability of holding of the sleeve **12** in its closed position (FIG. 4), the apex angle of the frusto-conical sidewall of the dished portion of base **21** of the insert **20** which defines space **41** is made somewhat less than the apex angle of diaphragm **42** when the latter is in its upwardly converging position (FIG. 5).

Although the parts of the closure device of the invention have been described as being made of polyethylene, it is to be understood that the invention is not limited thereto. Thus such parts may be made of a number of different materials which are suitable for the functions of the parts and the properties of the materials to be dispensed by the closure device. Among other suitable materials of which the parts of the closure may be made are neoprene, polyvinyl chloride, and polypropylene; it is to be understood that such recited materials are illustrative only, and not exclusive.

Although only a limited number of embodiments of the invention have been illustrated in the accompanying drawings and described in the foregoing specification, it is to be especially understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention will now be apparent to those skilled in the art.

What is claimed is:

1. A dispensing closure device for a container, comprising a body having an annular upper portion in the form of a ring, an elongated sleeve coaxial of the ring, having a passage therethrough, and projecting outwardly therefrom, a deformable annular diaphragm made of flexible resilient material coaxial of the ring and the sleeve, the diaphragm having a width when relaxed measured from its axis which exceeds the radial distance between the ring and the sleeve, the inner edge of the diaphragm being sealingly connected to the inner end of the sleeve by an inner foldable annular zone of the diaphragm and the outer end of the sleeve and the outer edge of the diaphragm being sealingly connected to the ring by an outer foldable annular zone of the diaphragm, the annular zone of the diaphragm between said inner and outer foldable zones thereof being markedly more resistant to bending than said inner and outer foldable zones, the relaxed dimensions of the diaphragm relative to the diameters of the ring and the sleeve being such that the sleeve may be advanced into an outer terminal position with the diaphragm in a stable outwardly converging frusto-conical shape, and that the sleeve may be retracted into a stable inner terminal position wherein the diaphragm is in inwardly converging frusto-conical shape, during travel of the sleeve between its advanced and retracted positions the diaphragm first being radially compressed following which it expands radially, whereby the diaphragm functions as a toggle to hold the stem stably in each of said two positions, the passage in the sleeve having an orifice therein, a stem-like member connected at an inner portion thereof to the ring, the stem-like member having an outer free end aligned with the orifice and adapted to enter and seal the orifice when the sleeve is retracted and to be withdrawn from the orifice when the sleeve is advanced outwardly, the closure device providing communication for the passage of a fluid therethrough from inwardly of the stem-like member to the orifice in the sleeve.

2. A dispensing closure device as claimed in claim **1**, wherein the diaphragm is the sole means for securing the sleeve to the ring, and comprising cooperating slidingly engaging means on the stem-like member and the inner wall of the sleeve for maintaining the inner end of the stem-like member and the inner end of the sleeve in alignment.

3. A dispensing closure device as claimed in claim **1**, wherein the sleeve has a partition across the passage therethrough, and the orifice extends through the partition.

4. A dispensing closure device as claimed in claim **1**, wherein the sleeve has an outwardly converging frusto-conical surface coaxial of and closely surrounding the orifice, whereby to guide the outer free end of the stem-like member into the orifice when the sleeve and stem-like member are moved toward each other.

5. A dispensing closure device as claimed in claim **1**, wherein the stem-like member has an inner base in the form of a disc spanning across and sealed to the ring, the base having at least one passage therethrough providing for communication of fluid from the space inwardly of the base to the space within the passage through the sleeve, and wherein the upper surface of the base is annularly dished to receive the inwardly and downwardly converging diaphragm when the sleeve is retracted to close the device.

6. A dispensing closure device as claimed in claim **1**, wherein the sleeve, diaphragm, and ring are integral.

7. A dispensing closure device as claimed in claim **1**,

wherein the device is in the form of a threaded cap for the threaded neck of a container, and comprising a threaded skirt attached to the ring coaxially thereof; and means on the device adapted to effect a seal with the neck of the container.

8. A dispensing closure device as claimed in claim **7**, comprising an insert having a disc-like base sealingly fitting within and spanning across the ring, the stem-like member being attached to the base and projecting outwardly from the upper outer surface of the base.

9. A dispensing closure device for a container, comprising an integral body made of flexible resilient plastic material, said body having an annular upper portion in the form of a thick substantially rigid ring, an elongated substantially rigid sleeve coaxial of the ring, having a passage therethrough, and projecting outwardly therefrom, and a relatively thin flexible annular diaphragm coaxial of the ring and the sleeve, the diaphragm having a width when relaxed measured from its axis which exceeds the radial distance between the ring and the sleeve, the ring, diaphragm, and sleeve forming an imperforate conduit, the diaphragm being the sole means securing the sleeve to the ring, the relaxed dimensions of the diaphragm relative to the diameters of the ring and the sleeve being such that the sleeve may be advanced into an outer terminal position with the diaphragm in an outwardly converging frusto-conical shape, and that the sleeve may be retracted into an inner terminal position wherein the diaphragm is in inwardly converging frusto-conical shape, during travel of the sleeve between its advanced and retracted positions, the diaphragm first being radially compressed following which it expands radially, whereby the diaphragm functions as a toggle to hold the stem stably in each of said two positions, the outer end of the passage in the sleeve having a central orifice therein, a central stem-like member connected at an inner portion thereof to the ring, the stem-like member having an outer free end aligned with the orifice and adapted to enter and seal the orifice when the sleeve is retracted and to be withdrawn from the orifice when the sleeve is advanced outwardly, the closure device providing communication for the passage of a fluid therethrough from inwardly of the stem-like member to the orifice in the sleeve.

10. A dispensing closure device for a container, comprising a body having an annular upper portion in the form of a ring, an elongated sleeve coaxial of the ring, having a passage therethrough, and projecting outwardly therefrom, a deformable annular diaphragm made of flexible resilient material coaxial of the ring and the sleeve, the diaphragm having a radial width when relaxed which exceeds the radial distance between the ring and the sleeve, the inner edge of the diaphragm being sealingly connected to the inner end of the sleeve and the outer end of the sleeve and the outer edge of the diaphragm being sealingly connected to the ring, the relaxed dimensions of the diaphragm relative to the diameters of the ring and the sleeve being such that the sleeve may be advanced into an outer terminal position with the diaphragm in an outwardly converging frusto-conical shape, and that the sleeve may be retracted into an inner terminal position wherein the diaphragm is in inwardly converging frusto-conical shape, the passage in the sleeve having an orifice therein, a stem-like member connected at an inner portion thereof to the ring, the stem-like member having an outer free end aligned with the orifice and adapted to enter and seal the orifice when the sleeve is retracted and to be withdrawn from the orifice when the sleeve is advanced outwardly, the closure device providing communication for the passage of a fluid therethrough from inwardly of the stem-like member to the orifice in the sleeve, cooperating slidingly engaging means on the stem-like member and the inner wall of the sleeve for maintaining the inner end of the stem-like member and the inner end of the sleeve in alignment, the outer portion of the sleeve being substantially rigid, and the stem-like member being flexible, whereby the closure device may be opened by thrusting the outer end of the sleeve laterally when the sleeve is in its inner, retracted position, thereby tipping the sleeve and bending the stem-like member longitudinally and withdrawing its outer free end from the orifice.

11. A dispensing closure device for a container, comprising a body having an annular upper portion in the form of a ring, an elongated sleeve coaxial of the ring, having a passage therethrough, and projecting outwardly therefrom, a deformable annular diaphragm made of flexible resilient material coaxial of the ring and the sleeve, the diaphragm having a radial width when relaxed which exceeds the radial distance between the ring and the sleeve, the inner edge of the diaphragm being sealingly connected to the inner end of the sleeve and the outer end of the sleeve and the outer edge of the diaphragm being sealingly connected to the ring, the relaxed dimensions of the diaphragm relative to the diameters of the ring and the sleeve being such that the sleeve may be advanced into an outer terminal position with the diaphragm in an outwardly converging frusto-conical shape, and that the sleeve may be retracted into an inner terminal position wherein the diaphragm is in inwardly converging frusto-conical shape, the passage in the sleeve having an orifice therein, a stem-like member connected at an inner portion thereof to the ring, the stem-like member having an outer free end aligned with the orifice and adapted to enter and seal the orifice when the sleeve is retracted and to be withdrawn from the orifice when the sleeve is advanced outwardly, the closure device providing communication for the passage of a fluid therethrough from inwardly of the stem-like member to the orifice in the sleeve, the stem-like member having an inner base in the form of a disc spanning across and sealed to the ring, the base having at least one passage therethrough providing for communication of fluid from the space inwardly of the base to the space within the passage through the sleeve, the upper surface of the base being annularly dished to receive the inwardly and downwardly converging diaphragm when the sleeve is retracted to close the device.

12. A dispensing closure device as claimed in claim **11** wherein the upper dished surface of the base is contacted by and functions as a stop for the diaphragm when the sleeve is retracted to close the device.

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