

[54] **CONTAINER CLOSURE**

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[22] Filed: **July 12, 1972**

[21] Appl. No.: **270,905**

[52] U.S. Cl....**215/228, 215/296, 215/304, 215/355,**
215/364

[51] Int. Cl..... **B65d 39/04, B65d 39/16**

[58] Field of Search **215/47, 48, 52; 220/24.5,**
220/60; 217/78, 108, 110, 111

[56] **References Cited**

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1,229,823	3/1960	France	220/24.5

Primary Examiner—Donald F. Norton

Attorney, Agent, or Firm—Frank C. Parker; Bernard

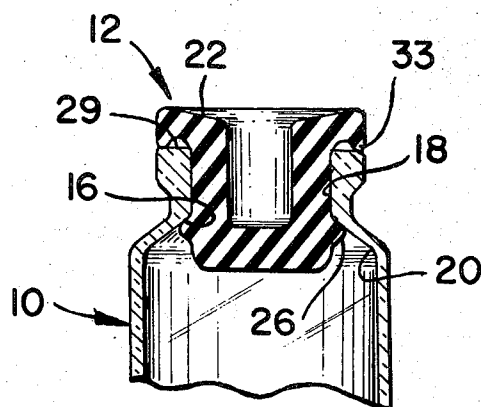
D. Bogdon; DeWitt M. Morgan

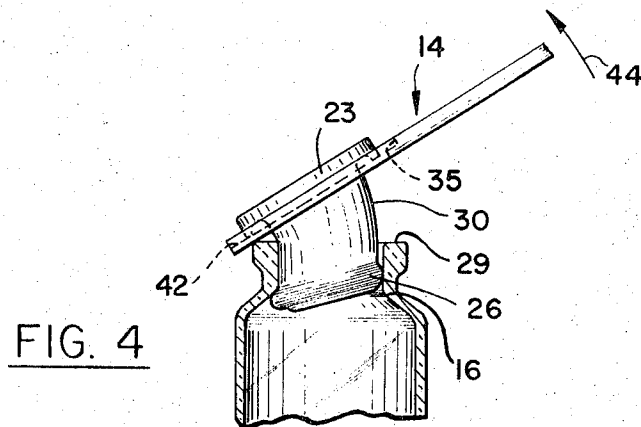
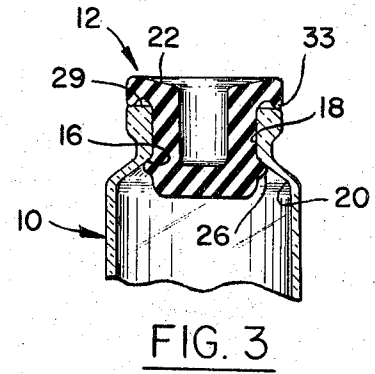
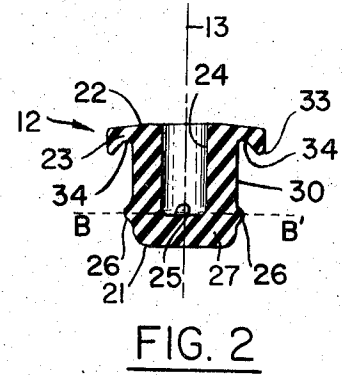
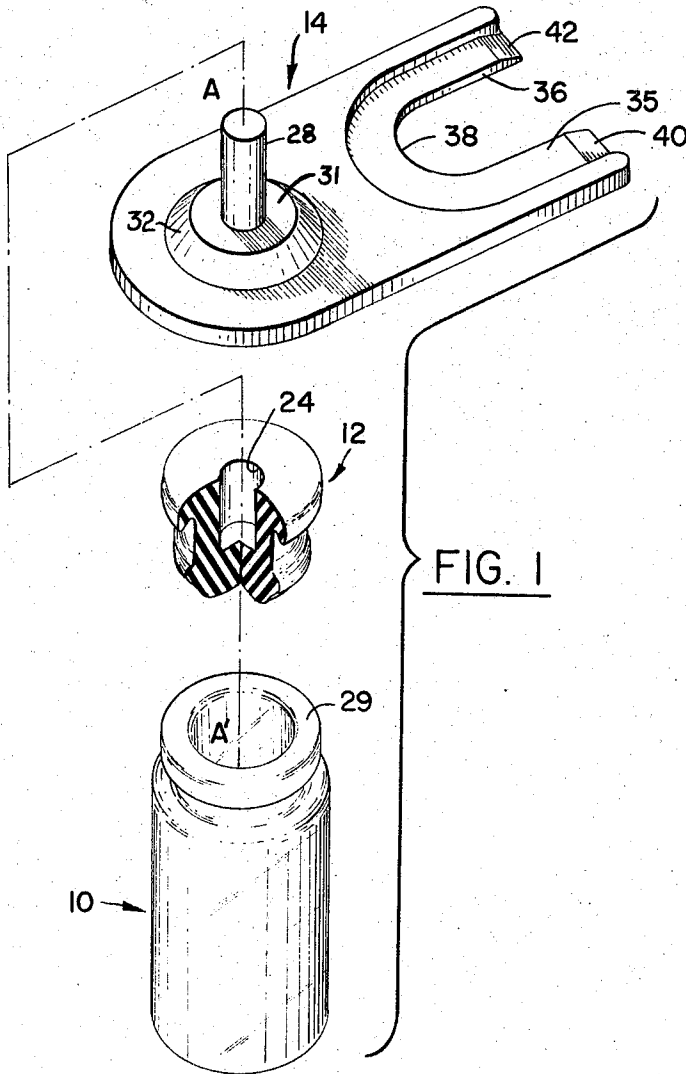
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ABSTRACT

An elastic closure member or stopper for a container which forms a positive fluid tight seal with the container in which it is received to thereby prevent fluid from passing inwardly or outwardly under a wide variation of pressure and temperature. The elastic closure member which includes cap portion and an integral neck portion, has a before installation configuration which is different from the configuration which is when received within the container. This is due to the fact that the closure member is in both tension and compression when it is received in the container. The integral cap portion includes a bead or lip engaging portion for engaging an uppermost edge proximate the mouth of the container to best seal the inside of the container from outside contamination. The lip engaging portion is spaced from a circumferentially extending bead provided on the neck portion a distance which is less in length than the neck length of the container. To provide further assurance of a fluid tight engagement between the closure member and the inner surface of the neck of the container a second bead may be provided. The closure member may also include a cylindrically shaped insert for providing a uniform and constant radial sealing force between the central body of the closure member and the neck of the container. Finally, a tool is provided to aid insertion and extraction of the closure member.

6 Claims, 8 Drawing Figures





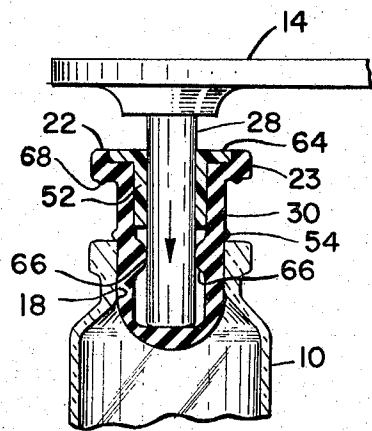
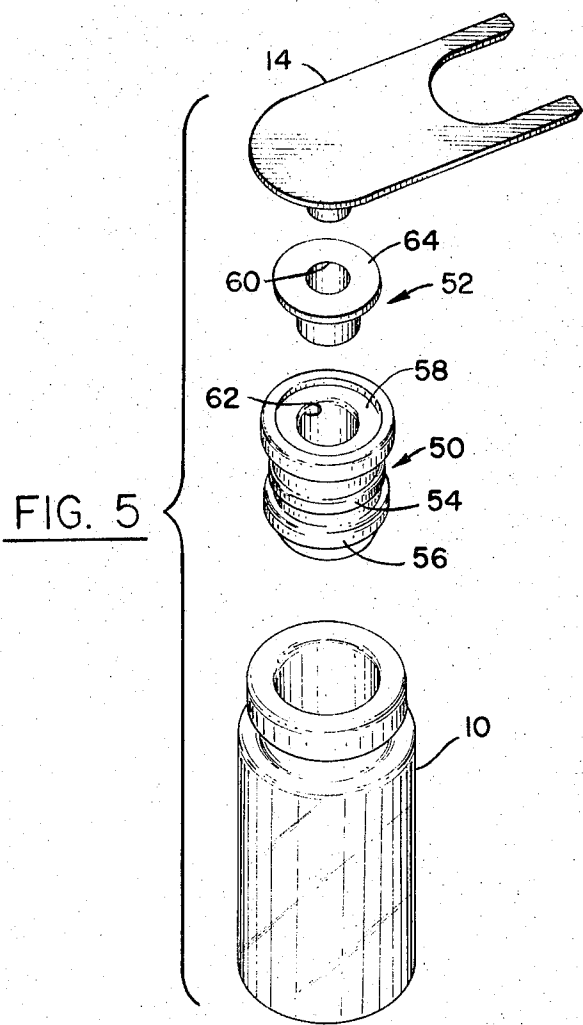


FIG. 6

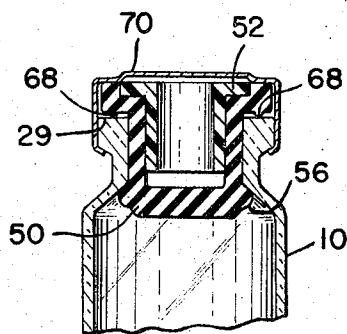


FIG. 7

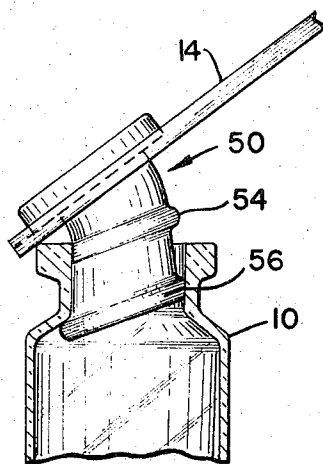


FIG. 8

CONTAINER CLOSURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a closure member for a container, and more particularly for a closure member for a container subject to a wide variation of temperatures and pressures.

2. Brief Description of the Prior Art

A study of the prior art relating to closures for containers reveals that the design of closures had progressed on the basis of solving closure problems as they arise. Each field of use has different problems the solutions to which, in many instances, do not apply to other fields of use. A great deal of prior art exists in the field relating to the capping of wine bottles, particularly where the contents are to be under pressure. In addition, in the beverage and food industries, a great number of closure devices have been designed which are expendable. Other closures are intended to have a very short life, since many of the containers for which they are intended carry expandable or perishable merchandise which is usually quickly consumed or disposed of in some fashion. Those closure devices which are used for beverages, for example, generally are physically touched by the consumer and are only intended to make what might be considered to be a satisfactory seal for general consumer use, but in most instances would be an entirely unsatisfactory seal for other commercial considerations where the containers are used in a generally "clean" environment, particularly sensitive to contamination.

In French Patent No. 1,229,823, published Sept. 9, 1960, there is disclosed an invention which relates to a shut-off device intended to close an orifice of a tank under internal pressure. In the French patent it states that prior art devices include plugs which may be screwed into container walls to close holes or plugs of compressible materials generally known as stoppers. Additionally, it states that most of the prior known devices present the same inconvenience in that they require a tool in order to be put into place while those plugs which cannot be applied without a tool do not resist high pressure. To remedy the foregoing problems the French patent discloses a removable closing device for use on a container which is subject to internal pressure. The disclosed device includes a generally elastic stopper which has an internal opening for receiving a plunger which basically acts as a tool for inserting the device into a selected container and for remaining engaged therewith as long as the stopper is in place in order that the stopper resist high pressure. The plunger has an annular groove circumferentially extending about it to receive deformed elastic stopper material which is subjected to the internal pressure of the container. With stopper material being urged into the annular groove of the plunger, it is particularly difficult to remove the plunger therefore it is especially difficult to remove the stopper since the stopper most probably could not be removed unless the plunger was removed firstly. This is a two part plunger stopper arrangement and even though it is useful, it is more costly and less convenient to use than the hereafter disclosed invention.

It should be appreciated from this that a satisfactory closure which is relatively inexpensive is needed for ex-

ample, for adequately pathologically sealing pharmaceutical apparatus which might possibly include such things as contact lenses.

SUMMARY OF THE INVENTION

This invention provides an improved closure which overcomes the hereinbefore mentioned shortcomings and offers a sealing device for a container which is very reliable and provides strong assurance that articles sealed within the container will not be contaminated from outside sources providing the closure is properly in place. In addition, under other pressure influences, materials sealed within a container can not leak out to adversely affect an outside environment. A closure formed of elastic material which is dimensioned to be both in tension and compression when engaged with a container provides a seal which overcomes a great number of the major shortcomings of the prior art devices particularly when they are subjected to varying temperatures and pressures. The closure is such that once inserted in the container any built-up internal pressure continually causes the seal to improve. The built-up force exerted on the closure surface within the container would for other devices tend to expell the closure from the container, but in the case of this invention the force actually acts to better seal between the closure and the container. In one embodiment of the invention a cylindrical sleeve is incorporated for use with the closure in order to provide an improved positive fluid tight seal at the neck of the container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of one embodiment of the closure device according to the present invention and tool for inserting such closure into a bottle; the closure member being illustrated in partial cross-section.

FIG. 2 is a cross-sectional view of the closure of FIG. 1.

FIG. 3 is a partial cross-sectional view of the closure of FIGS. 1 and 2 engaged with the container.

FIG. 4 is an illustration of the closure member of FIG. 1 being removed from the container with the aid of the tool.

FIG. 5 is an exploded view of elements according to the principles of the invention wherein a modified closure is illustrated for engagement with a container and a closure sleeve insert is further illustrated for improving the seal of the closure to the container.

FIG. 6 is a partial cross-sectional view of the embodiments according to FIG. 5 in position for being engaged with each other with the aid of the tool.

FIG. 7 is a partial cross-sectional view of the elements of FIG. 5 in their final assembled relation.

FIG. 8 is an illustration of the embodiment of FIG. 5, being removed from the container with the aid of the tool.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1-3 illustrates the first embodiment according to the principles of the present invention, with FIG. 1 depicting a typical container or bottle 10 disposed for receiving a stopper 12 with the use of a tool 14. The stopper 12 is shown in FIG. 2 in a before installation configuration and in FIG. 3 in an installed configuration. The stopper 12 is best adapted to provide a fluid tight seal engagement with a container of the type iden-

tified as glass bottle 10. The bottle 10 has an internal shoulder 16 which is generally of a rounded circular configuration and is formed by the merging between an inner neck 18 of the bottle 10 and a major inner conical wall 20.

Since it is highly desirable that there be a very tight engagement between the stopper 12 and the inner neck 18 of the bottle 10, it will be appreciated that the stopper is ideally constructed of an elastic material such as one having a silicone rubber base. Further, it is desirable to have the length of the stopper 12, when it seals with the bottle 10, slightly shorter than the opening to be closed and the diameter of the stopper 12 at the sealing portion slightly greater in size than the opening to be closed. The stopper 12, which is symmetrical about axis 13, includes a top or upper surface 22 and a bottom surface 21. From FIG. 2, it is readily seen that before installation the upper surface 22, which is a part of a cap or top portion 23 of the stopper 12, is at a different aspect with respect to other lines of the stopper's configuration than when engaged with the bottle 10, as viewed in FIG. 3. Further, the proportions of the stopper 12, as illustrated in FIG. 2, fairly well define the wall thickness of the stopper 12 relative to its overall width and length. Additionally and in particular, it should be noted that a central opening 24 in the stopper 12 extends to a bottom surface 25 to provide a closed bottom 27. Surface 25 which is disposed in a plane B—B', which plane is substantially in the plane of a circumferentially disposed endless bead 26 extending about the stopper 12. The approximate even level of surface 25 with the endless bead 26 provides a particularly significant feature of this invention, one which will be more fully discussed hereinafter as being a configuration which enables significant internal pressures to be maintained in the bottle 10 without expelling or explosion of the stopper 12 from the bottle 10.

In order to provide a stopper capable of overcoming the deficiencies of the prior art devices, it will be appreciated that a tool may be particularly helpful for insertion of a suitably provided stopper. Although a stopper according to the principles of the present invention can be inserted without the aid of a tool, the tool 14 is a significant contribution to the invention and greatly enhances the versatility and usefulness of the stopper 12. To best illustrate the tool 14, it is shown in FIG. 1 in an inverted aspect with respect to the position it assumes when being used to insert the stopper 12 into the bottle 10. The construction line A—A' of FIG. 1 points out the inversion of the tool 14. The tool 14 may be of any suitable material including one of those in the metal families such as stainless steel or any of the generally inexpensive materials which are available in the plastic family.

When inserting the stopper 12 into the bottle 10, a dowel extension 28 of the tool 14 is fully seated into the opening 24 for the dowel tip to engage and contact the bottom 25 of the opening 24. Initially, the stopper 12 is placed in intimate contact with the uppermost lip 29 of the bottle 10 to an extent where the circumferential bead 26 is disposed above the lip 29 and is just short of engagement with it. A sufficient force exerted on that side of the tool 14 opposite the dowel 28 stretches the stopper 12 to an extent that the bead 26 slips into and down through the inner neck portion 18 of the bottle 10 to fully seat and tightly engage with the internal shoulder 16 of the bottle 10, as best seen in FIG. 3. In

addition, a central neck portion 30 of the stopper 12 tightly engages the inner neck 18 of the bottle 10. During insertion of the stopper 12, the bead 26 stretches and relatively easily passes into the bottle 10. Since the diameter of the dowel extension 28 is less than the diameter of the opening 24 in the stopper 12, any material of the bead 26 which does not stretch sufficiently to enter the neck 18 of the bottle 10 is temporarily forced inward toward the dowel extension 28 until the bead 26 is totally through the neck 18 of the bottle 10. This inward movement of the elastic material of bead 12 is facilitated by the downward movement of bottom 25 below the level of plane B—B' as dowel 28 stretches stopper 12. An example of this condition is present hereinafter with reference to FIG. 6.

Since the stopper 12 is intended to be used repeatedly, there may be a concern that the elastic material of the stopper 12 may be overstretched to a point of separation when the dowel 28 forces the stopper 12 into the container of the bottle 10. To preclude overstretching the elastic material of the stopper 12, the dowel 28 may be of a predetermined length to enable easy insertion of the stopper 12 and to safely limit the stretching of the elastic material. Accordingly, a top circular area 31 of a frustum shaped base 32 of the dowel 28 contacts the upper surface 22 of the stopper top portion 23 when the dowel 28 is fully inserted to preclude overly stretching the stopper 12.

When the stopper 12 is fully engaged with the bottle 10, it is easily appreciated that an integrally formed elastic bead or lip 33 extending about the undersurface of cap portion 23 is tightly engaged with the bottle 10 at the uppermost lip 29. This tight engagement is obtainable, at least in part, due to the undercut configuration generally at that circular portion 34 where the central neck portion 30 and the underside of cap portion 23 merge together. Due to the length of the stopper 12 being slightly shorter than the length of the opening to be closed, the stopper 12, when engaged with the bottle 10, stretches and causes the stopper lip 33 at the uppermost bottle edge 29 to tightly seal the bottle 10. This is best seen in FIG. 3, where the stopper 12 is engaged with the bottle 10 and the elastic lip 33 is deformed from its before installation configuration as illustrated in FIG. 2. It will be appreciated from FIG. 3 that the engagement of the stopper 12 with the bottle 10 provides fluid tight engagement from the circumferential bead 26 upward throughout the inner neck 18 of the bottle 10 to the uppermost edge 29 at the mouth of the bottle 10. In addition as before stated, the engagement is fluid tight at the elastic lip 33 of the stopper 12 bearing against the uppermost edge 29 of the bottle outward from the mouth of the bottle 10. With the engagement and configurations as typically illustrated in FIG. 3, pressures internal to the bottle can substantially exceed 65 p.s.i. and temperatures can exceed 240°F without forcing the stopper 12 out of engagement with the bottle 10. With this configuration it will be appreciated that the higher the internal pressure is in the bottle, the tighter will bead 26 be pressed against the bottle thereby effecting a tighter seal. This tighter seal with increased pressure is accomplished without the aid of an insert plunger as hereinbefore mentioned as being necessary with regard to the aforementioned French Patent No. 1,229,823. In addition, the greater the ambient pressure the tighter is the seal accomplished at the lip 33 of the stopper 12 and the uppermost edge 29

of the bottle 10. These tighter seals, respectively, preclude leakage from inside outward and outside inward.

Even though the stopper 12 tightly engages the bottle 10 it can easily be removed with the aid of the tool 14. FIG. 4 illustrates, in part, the tool 14 engaged with the stopper 12 under the stopper's top portion 23 so that elastic bead 33 bears against a U-shaped land portion 35 of the tool 14. A U-shaped cutout 36 of the tool 14 at its innermost semicircular portion 38 closely engages the central neck 30 of the stopper 12. For easily inserting the tool 14 around the central neck 30, ramps 40 and 42 are provided at the open end of the U-shaped land portion 35. After the tool 14 is fully engaged with the stopper 12, the tool 14 is pivoted about the uppermost edge 29 of the bottle in the direction indicated by arrow 44 of FIG. 4. Due to the elastic configuration of the stopper 12 it can be removed with relative ease since the lower bead 26 is tipped sideways so that it can become oblong to easily pass through the neck 18 of the bottle 10 and will stretch, as is generally illustrated in FIG. 4, until bead 26 is turned partially sideways for easy extraction above the inner neck 18 of the bottle 10.

It is emphasized that removal of the stopper 12 from the bottle 10 is relatively simple and can be done without great effort since the pivoting action of the tool 14 allows the lower bead 26 to exit through the neck 18 by only slightly deforming that part of the bead 26 on the side opposite the pivot area of the tool 14 until that part of the bead 26 is in the opening of the bottle 10. Once that part of the bead 26 is in the opening and clear of the internal shoulder 16 of the bottle 10 it generally takes on its non deformed configuration and the remaining part of the bead 26 is forced upward by means of the pivoting tool 14 until substantially half of the circular bead 26 is forced past the internal shoulder 16 onto the inner neck 18 up to the uppermost lip 29 of the bottle 10. When half or slightly over half of the bead 26 is past the uppermost lip 29, the stopper 12, due to its elastic strength, forces the remaining portion of the stopper 12 engaged with the bottle 10 from the bottle 10 to totally disengage the stopper 12 from the bottle 10. During the process of disengagement, it can easily be seen that the plane B—B' through bead 26 changes from being substantially at right angle to a longitudinal axis of the bottle 10 when fully engaged therewith, to curve upward until the plane B—B' is practically parallel to the longitudinal axis of the bottle 10.

Removal of the stopper 12 is convenient and without mess for an operator generally would hold the bottle in one hand while actuating the tool 14 in his other hand. The design of the tool 14 is such that the stopper 12 once removed from the bottle 10, remains in contact with the tool 14 and can easily be slid from the U-shaped cut out 36 and be set aside for further use, including being reinserted into the bottle 10 as need be. The materials and configurations are such that the stopper and tool are not expected to be expendable or destroyed even after being used repeatedly in insertions and removals.

Embodiment illustrated in FIGS. 5-8 are similar in many respects to the embodiment illustrated in FIGS. 1-4 and like reference characters refer to like parts. This alternate embodiment includes a stopper 50 for use with an insert 52 to cooperatively provide a positive

fluid tight seal between neck portion 30 and bottle neck 18. The stopper 50 differs from the stopper 12 in at least two ways, as hereinafter mentioned. The stopper 50 includes a circular bead 54 encompassing the stopper centrally about the neck portion 30 of the stopper 50. Ideally, the bead 54 protrudes outwardly from the stopper central neck portion 30 less than a second bead 56 located substantially toward that end of the stopper farthest from the top portion 23 of the stopper 50. The centrally disposed bead 54 provides further assurance of a fluid tight engagement between the stopper 50 and the inner neck 18 of the bottle 10.

To insure tight engagement between the central bead 54 and the inner neck 18 of the bottle a tubular sleeve insert 52 is provided. The insert 52 seats within an annular recess 58 within the top portion 23 of the stopper 50, as best seen in FIGS. 6 and 7. The insert 52 has a central opening 60 for receiving the dowel 28 of the tool 14 and is generally cylindrical for snug engagement with a central opening 62 of the stopper 50. In addition, a cap portion 64 of the insert 52 is configured to closely fit within the annular recess 58 of the stopper 50 to substantially provide a plane defined by the top of the cap 64 and the upper surface 22 of the stopper 50. The stopper 50 with the insert 52 is urged into tight engagement with the bottle 10 in a means similar to that discussed for FIGS. 1-4. It will be appreciated that the sleeve 52 may be of other simple configuration, such as being completely cylindrically shaped.

FIG. 6 best illustrates the insertion of the stopper 50 into the bottle 10. It should be noted that because the bead 54 extends outwardly from the central neck portion 30 of the stopper 50 that during insertion, as partially shown by FIG. 6, the elastic material is forced inward, as illustrated by the bulbous configuration 66 which extends inwardly about the opening 62 in the stopper 50. However, it will be appreciated that after insertion of the stopper 50 into the bottle 10, as shown in FIG. 7, the insert 52 extends sufficiently down into the neck of the bottle 10 to force the elastic material in all directions particularly toward the inner neck 18 of the bottle 10 and thereby provides a uniform force to insure a positive fluid tight seal of the stopper 50 with the bottle 10.

The circular bead 68 may be included at the under surface of the top portion 23 of the stopper 50 to more positively seal the bottle 10 at uppermost edge 29 in a manner similar to the seal provided by stopper lip 33 as hereinbefore explained. In addition, as a measure of sealing for control purposes, an expendable cap 70 formed, for example, of aluminum may be crimped about the insert-stopper configuration engaged with the bottle 10, as shown in FIG. 7.

Removal of stopper 50 is equally as easy as the removal of the stopper 12, as earlier discussed in conjunction with FIG. 4. In FIG. 8 it is readily seen that the tool 14 may be pivoted against the edge of the bottle 10 to remove the stopper 50 from the bottle 10 by urging the sealing beads 54 and 56 upward in a tilting manner so that the beads appear substantially oblong in the neck of the bottle and are lifted until they are no longer in contact with the bottle 10.

I claim:

1. An article having a generally cylindrically shaped opening extending from a lip to an internal shoulder and a closure member formed of material having elastic properties for sealing said opening, said closure mem-

ber having an axis and including a cap portion having a first diameter and an integral neck portion having a second diameter, said first diameter being greater than said second diameter, said cap portion including a top surface and a lip engaging portion, said top surface being axially spaced from said lip engaging portion, said neck portion extending along said axis from said lip engaging portion to a bottom surface, said closure member further including an outwardly extending endless bead and an open ended cavity, said bead located on said neck portion between said lip engaging portion and said bottom surface, wherein said improvement comprises:

said bead being axially spaced from said lip engaging portion a distance which is less than the distance from said lip to said shoulder, said cavity extending from said top surface into said neck portion to the approximate axial position of said bead to thereby provide said closure member with a closed bottom extending from the approximate axial position of said bead to said bottom surface, the relationship between said bead and said closed bottom permitting, when said closure member is properly received within said opening, at least a portion of said neck portion to be in tension to thereby hold said bead in engagement with said shoulder and said lip engaging portion in engagement with said lip.

2. The article and closure member as set forth in claim 1 further including an undercut where said neck portion merges with said lip engaging portion.

3. An article having a generally cylindrically shaped opening extending from a lip to an internal shoulder and a closure member formed of material having elastic properties for sealing said opening, said closure member having an axis and including a cap portion having a first diameter and an integral neck portion having a second diameter, said first diameter being greater than said second diameter, said cap portion including a top surface and a lip engaging portion, said top surface being axially spaced from said lip engaging portion, said neck portion extending along said axis from said lip engaging portion to a bottom surface, said closure member further including an outwardly projecting endless bead and an open ended cavity, said bead located between said lip engaging portion and said bottom surface, wherein said improvement comprises:

an additional outwardly extending endless bead, said endless bead being axially spaced from said lip engaging portion a distance which is less than the distance from said lip to said shoulder, said additional bead disposed between said lip engaging portion and said bead, said cavity extending from said top surface into said neck portion to the approximate axial position of said bead to thereby provide said closure member with a closed bottom extending from the approximate axial position of said bead to said bottom surface, the relationship between said bead and said closed bottom permitting, when said closure member is properly received within said opening at least a portion of said neck portion to be held in tension to thereby hold said bead in engagement with said shoulder and said lip engaging portion in engagement with said lip.

4. An article having a generally cylindrically shaped opening extending from a lip to an internal shoulder and a closure member formed of material having elastic properties for sealing said opening, said closure mem-

ber having an axis and including a cap portion having a first diameter and an integral neck portion having a second diameter, said first diameter being greater than said second diameter, said cap portion including a top surface and a lip engaging portion, said top surface being axially spaced from said lip engaging portion, said neck portion extending along said axis from said lip engaging portion to a bottom surface, said closure member further including an outwardly projecting endless bead and an open ended cavity, said bead located between said lip engaging portion and said bottom surface, wherein said improvement comprises:

an additional outwardly extending endless bead and an insert, said endless bead being axially spaced from said lip engaging portion a distance which is less than the distance from said lip to said shoulder, said additional bead disposed between said lip engaging portion and said bead, said cavity extending from said top surface into said neck portion to the approximate axial position of said bead to thereby provide said closure member with a closed bottom extending from the approximate axial position of said bead to said bottom surface, said cavity having an inner wall, the relationship between said bead and said closed bottom permitting, when said closure member is properly received within said opening, said bead to be held in engagement with said shoulder, said lip engaging means in engagement with said lip and said additional bead in engagement with an intermediate portion of said opening, said insert received within said cavity and contacting said inner wall at least at the position of said additional bead to reinforce the engagement of said additional bead with said intermediate portion of said opening.

5. The article and closure member as set forth in claim 4 wherein said insert is provided with a central opening for receiving a tool.

6. An article having a generally cylindrically shaped opening extending from a lip to an internal shoulder, a closure member formed of material having elastic properties for sealing said opening and a tool for inserting and removing said closure member from said opening, said closure member having an axis and comprising a cap portion having a first diameter and an integral neck portion having a second diameter, said first diameter being greater than said second diameter, said cap portion including a top surface and a lip engaging portion, said top surface being axially spaced from said lip engaging portion, said neck portion extending along said axis from said lip engaging portion to a bottom surface, said closure member further including an outwardly extending endless bead and an open ended cavity, said bead located on said neck portion between said lip engaging portion and said bottom surface and axially spaced from said lip engaging portion a distance which is less than the distance from said lip to said shoulder, said cavity extending from said top surface into said neck portion to the approximate axial position of said bead to thereby provide said closure member with a closed bottom extending from the approximate axial position of said bead to said bottom surface, the relationship between said bead and said closed bottom permitting, when said closure member is properly received within said opening, at least a portion of said neck portion to be in tension to thereby hold said bead in engagement with said shoulder and said lip engaging

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portion in engagement with said lip, said tool including a dowel portion and a U-shaped cutout portion, said dowel portion configured so as to be receivable within said cavity to facilitate insertion of said closure member into said opening, said cutout portion configured so as to closely engage said neck portion and including a

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ramp to permit easy insertion of said cutout portion between said lip engaging means and said lip when said closure member is received within said opening to thereby facilitate removal of said closure member from said opening.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,842,790 Dated October 22, 1974

Inventor(s) James A. Clark

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Abstract, line 8, after "configuration" delete "which is";
line 13, after "edge" insert --of the
container--;
line 14, after "mouth" delete "of the
container"; and
Col. 3, line 59, after "with" delete "the" and
substitute --an--.

Signed and sealed this 17th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents