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CLOSURE CAPS

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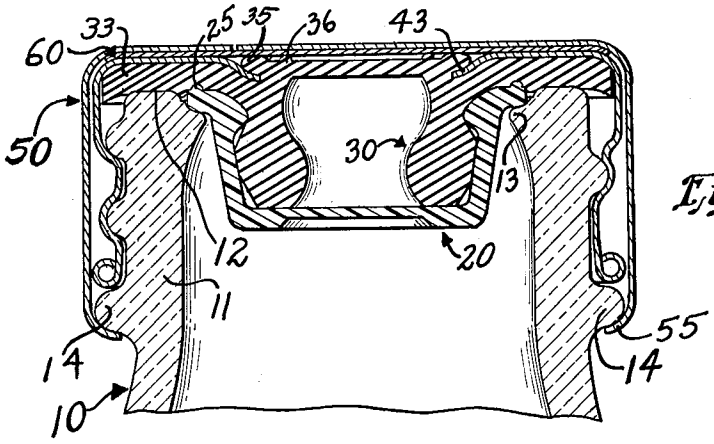


FIG. 1.

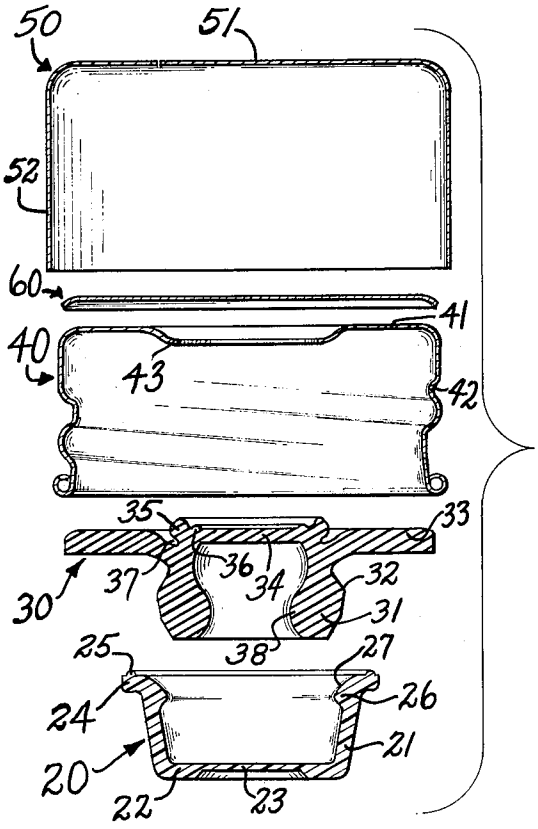
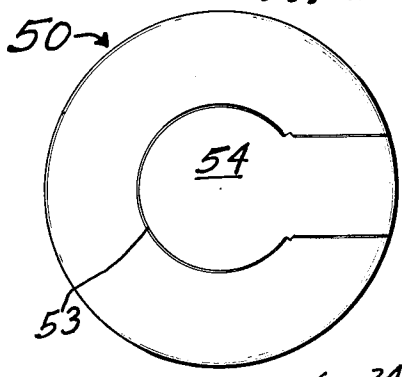


FIG. 2.

FIG. 3.



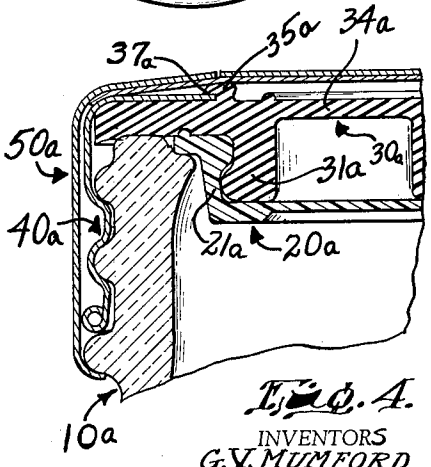


FIG. 4.

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CLOSURE CAPS

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This invention relates generally to closures, and more particularly to puncturable closures providing hermetic seals.

This present invention constitutes an improvement in the art of packaging, especially in the pharmaceutical and biological fields, wherein the material to be packaged is hermetically sealed in a container by means of a closure and dispensed by means of an administration set spike or hypodermic needle which is inserted through the closure. To provide a hermetic seal, it is frequently necessary to use a closure having a sealing member which has soluble components. These components migrate into the contents of the container, thereby causing objectionable contamination of the contents. Another problem in packaging pharmaceuticals is that frequently the contents of the container have to be modified by the addition of some other substance. This requires a puncturable closure that can be easily removed and reapplied to the container, as a single assembly. In addition, it is desirable that the puncturable surface of the closure be adapted to be hermetically sealed so as to permit it to be kept in a sterile state.

Accordingly, it is an important object of our invention to provide a hermetically sealing, puncturable closure having an inert, relatively insoluble shield isolating the hermetically sealing member from the contents the container, thereby preventing the migration of soluble components of the sealing member to the contents of the container and preventing objectionable contamination.

Another important object of our invention is to provide a hermetically sealing, puncturable closure which is adapted to be threadedly secured to a container, thereby permitting easy removal and reapplication of the closure when it is necessary to modify the contents of the container prior to their being dispensed.

The specific nature of this invention, as well as other objects and advantages thereof, will become apparent to those skilled in the art from the following detailed description taken in conjunction with the annexed sheet of drawings, on which, by way of example only, the preferred embodiments of this invention are illustrated.

A further object of our invention is to provide a puncturable closure which may be threadedly secured to a container and has a puncture surface which is adapted to be hermetically sealed.

In the drawings:

FIG. 1 is a vertical sectional view of the preferred embodiment of the closure of our invention assembled on a container;

FIG. 2 is an exploded view showing the various components of the closure in central section;

FIG. 3 is a top view of the tear-off cap; and

FIG. 4 is a vertical sectional view of a modification of the closure of FIG. 1.

Basically, the closure of our invention, in its preferred form, comprises a cup-like shield **20** disposed within and forming a liquid tight seal with a container **10**, a sealing member **30** isolated from the contents of the container **10** by the shield **20** and having a flange forming a hermetic seal with the neck of the container, a threaded cap **40** for removably securing the shield and sealing member **30** on the container and leaving exposed a readily puncturable surface, or area, formed on the sealing member

30, and retaining means comprising a cup-like tear-off cap **50** and a disc **60** for hermetically sealing or protecting the puncturable surface and providing a degree of tamperproofness for the closure.

Referring to FIG. 1, the container **10** has an externally threaded neck portion **11** which defines a dispensing or mouth opening for the container. An annular top sealing surface **12** or rim is formed on the upper end of the neck portion. An annular, continuous shoulder or seat **13** is formed internally of the neck portion **11**, adjacent to and spaced radially inwardly from inner margin of the top sealing surface **12**. An annular retaining bead **14** is formed beneath the threaded portion of the container for holding engagement with the cap or shell **50**.

Referring to FIG. 2, the shield **20**, which is formed of a relatively insoluble material capable of being sterilized, such as high density polyethylene, for example, comprises an annular side wall or skirt **21** adapted to fit within the dispensing opening of the container **10**. The annular side wall **21** is connected at its lower marginal edge to a panel **22**. The panel **22** has a thinned out central portion **23** which may be easily punctured by intravenous administration set spike. At the upper marginal edge of the side wall **21** is an integral radially outwardly extending flange **24** which is adapted to sealingly engage the annular shoulder **13** or seat formed on the container. The flange **24** also serves to support the shield within the container. On the upper surface of the flange **24** is formed an annular, axially extending ridge **25**, whose function will be described presently. On the inner surface of the side wall **21**, adjacent its upper end, is formed an annular, radially inwardly extending bead **26**. The bead **26** has an upper rather wide sloping surface **27** which is adapted to guide a portion of the sealing member **30** into underlying relationship with the bead **26** so as to separably interlock the shield **20** and sealing member **30**. This will be more fully described later.

The sealing member **30**, which may be formed of any resilient material capable of forming a hermetic seal, such as rubber, for example, comprises an annular shank portion **31**, which is adapted to fit within the side wall **21** of the shield and has a radially outwardly extending portion **32** which is adapted to underlie the bead **26** formed on the shield to separably interlock the sealing member and shield. An annular sealing flange **33** is formed at the upper end of the shank portion and extends radially outwardly therefrom. The sealing flange **33** is adapted to sealingly overlie the sealing surface **12** or rim of the container. A puncturable central panel **34** spans and closes the upper end of the hollow shank portion. The central panel **34** is surrounded by an annular, axially extending sealing ridge **35**, which cooperates with the disc **60** to seal off the panel **34** so as to keep it sterile, in a manner to be more fully described. A second smaller annular ridge **36**, spaced radially inwardly from and concentric with the sealing ridge **35**, is axially centered on the panel **34** and acts as a target to guide the insertion of an administration set spike. An annular undercut **37** partially underlies the sealing ridge **35** and cooperates with a portion of the threaded cap **40** to separably interlock the sealing member **30** and threaded cap **40**, in a manner to be described. In dispensing the contents of the container, an administration set spike having a circular stem portion is inserted axially through the puncturable panel **34**. To prevent the escape of liquid past the stem which extends through the hollow shank **31** an internal side sealing surface **38** is formed by a radially inwardly extending portion of the inner wall of the annular shank **31**, and provides a liquid-tight seal with the administration set spike. It is to be understood, of course, that where a hypodermic needle is used as the

dispensing means the puncturable panel may merely be thickened to provide a self-sealing surface.

The threaded cap **40** comprises an annular, ring-like top portion **41** which has at its outer peripheral edge an annular depending threaded attaching skirt **42** adapted to threadedly engage the threaded neck portion **11** of the container and telescope over the sealing member **30**. The inner marginal edge **43** of the top portion **41** is contoured to interlock with the undercut **37** formed on the sealing member **30**, and defines an opening which allows the sealing ridge **35** of the sealing member to extend above the top portion **41** of the threaded cap, thereby leaving the puncturable central panel **34** of the sealing member exposed.

The annular disc **60** is adapted to span the puncturable central panel **34** and sealingly engage the annular sealing ridge **35** of the sealing member **30**. The disc **60** is preferably formed of aluminum to prevent rusting, which may otherwise occur when the closure is sterilized.

The tear-off cap **50**, which is preferably formed of a relatively soft, rust-proof material, such as aluminum, comprises a top panel **51** having at its outer peripheral edge a depending annular skirt **52**. A line of weakness **53** defining a tab **54** (FIG. 3) is also formed on the tear-off cap **50**.

In assembling, the sealing member **30** and shield **20** are telescoped together and are separably interlocked by means of the bead **26** formed on the shield and the enlarged portion **32** formed on the sealing member. Next, the assembled shield and the sealing member are placed within the threaded cap **40**, with the annular sealing ridge **35** extending through the opening formed by the inner peripheral edge **43** of the top portion of the cap and with the inner peripheral edge **43** interlocking with the undercut **37** formed on the sealing member **30**. These assembled components, i.e., the shield, the sealing member, and the threaded cap, are then screwed onto the container **10**, with the flange **24** of the shield resting on and forming a liquid-tight seal with the annular shoulder **13** or seat formed on the container neck, and with the sealing flange **33**, of the shield resting on and providing a hermetic seal with the top sealing surface **12** or rim of the container neck. It is to be noted that the annular rib or ridge **25** formed on the shield presses against the underside of the sealing flange **33**, thereby taking up any excess tolerance and insuring a liquid-tight seal between the shield and the container. The disc **60** is placed over and allowed to rest on the annular sealing ridge of the sealing member, which extends above the top portion **41** of the threaded cap **40**. The tear-off cap **50** is then telescoped over the disc and threaded cap, and its lower marginal edge **55** is spun radially inwardly to holdingly engage the retaining bead **14** formed on the container, thereby maintaining the disc in sealing relationship with the annular sealing ridge **35** and providing a degree of tamperproofness for the closure. The closure and the container are then sterilized as a single unit.

In use, the tear-off cap **50** is removed by tearing off the tab **54** formed by the line of weakness **53** and then removing the remaining portions of the tear-off cap. The disc **60** is then removed to expose the previously sealed off, and and hence sterile, puncturable central panel **34** of the sealing member **30**. If the contents of the container are to be supplied intravenously, an intravenous administration set spike is pushed through the puncturable central panel **34** of the sealing member and then through the thinned out portion **23** of the shield. The shield is prevented from being pushed or forced into the container by its annular flange **24** which rests on the annular shoulder **13** formed on the container. The administration set spike will form a liquid-tight seal with the side sealing surface **38** formed internally on a shank portion **31** of the sealing member. If desired, access may be gained to the contents of the container by unscrewing the threaded cap **40**, which may then be rethreaded on the container and the container resealed. This may be desirable where it is necessary to modify the contents of the container prior to their being dispensed by an administration set spike. It is to be noted that the shield **20** effectively isolates the sealing member **30** from the contents of the container, thereby preventing migration of soluble components of the sealing member into the contents of the container. This isolation of the sealing member from the contents of the container allows greater latitude in varying the composition of the sealing member to obtain a material which will hermetically seal against the container and yet will not be adversely affected when the container and closure are sterilized.

FIG. 4 illustrates a modification of the above-described closure in which the shank portion **31***a* of the sealing member **30***a* and the side wall **21***a* of the shield **20***a* have been correspondingly shortened to allow a shorter administration set spike to be used in dispensing the contents of the container. The annular sealing ridge **35***a* and the undercut **37***a* of the shield have been modified to lie further above the plane of the central punctural panel **34***a*. In all other respects the closure is identical to the previously described preferred embodiment and its elements perform in the same manner as previously described.

It will also be understood that various details of construction may be modified through a wide range without departing from the principles of this invention, and it is not, therefore, the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

We claim:

1. A closure for use with a container having an externally threaded circular neck portion defining a mouth-opening, comprising a shield formed of a heat resistant, relatively insoluble material and having a relatively thin puncturable center panel and a thickened annular, radially outwardly extending flange, said shield being adapted to span the mouth-opening with the annular flange resting on and providing a continuous liquid-tight seal with the neck portion of the container, an external sealing member formed of a resilient material capable of forming a hermetic seal with said neck portion, said sealing member comprising transverse panel having a relatively thin central puncturable zone, an annular sealing ridge surrounding said zone and extending axially outwardly therefrom, and an annular sealing flange extending radially outwardly from said ridge and adapted to sealingly engage the neck portion of the container, said sealing member being adapted to overlie said shield and thereby isolated from the contents of the container, said external sealing member and shield having cooperating means for separably interlocking them, a retaining member comprising a top panel having at its outer peripheral edge a depending threaded attaching skirt adapted to threadedly engage said threaded neck portion of the container, said top panel having a central cutout portion adapted to receive said annular sealing ridge, thereby permitting said ridge and central puncturable panel of the external sealing member to be exposed when the retaining member is telescoped over the sealing member, said retaining member and external sealing member having cooperating means for locking the two together.

2. A closure as defined in claim 1, wherein said last-named cooperating means comprises an annular undercut formed on said sealing member adjacent said sealing ridge, and the inner peripheral edge defining said cutout portion, being adapted to interlockingly engage said undercut.

3. A closure as defined in claim 1, and means for hermetically covering said puncturable zone.

4. A closure as defined in claim 3, wherein said means comprise a disc spanning said puncturable zone and sealingly engaging said sealing ridge, and a tear-off cap telescoped over said disc and retaining member and adapted to be secured to said container.

5. In combination, a container having a threaded neck portion defining a mouth opening, said neck portion having an end rim providing an annular sealing surface, an annular seat spaced radially inwardly and axially from said sealing surface, and an annular external retaining bead formed beneath said threaded neck portion; a shield having an annular body portion, a puncturable panel spanning said body portion, said shield also having an annular flange extending radially outwardly from the body portion and adapted to engage said depressed portion, thereby supporting said shield within the container; a resilient insert having an annular shank disposed within said body portion, a central panel spanning said shank and adapted to be punctured, an annular sealing flange extending radially outwardly from said shank and adapted to engage said sealing surface, and an annular undercut and longitudinally extending continuous sealing ridge surrounding said central puncturable panel and opposite said shank portion; a closure for securing said insert and shield to the container, said closure comprising an annular threaded skirt adapted to threadedly engage said threaded neck portion and encircle said sealing flange, said skirt having at its upper marginal edge a radially inwardly extending flange having an inner peripheral annular edge adapted to engage said undercut to lock said closure and insert together; a disc adapted to overlie said central panel and sealingly engage said annular ridge; and a cover cap comprising a circular top panel having a depending annular skirt at its outer peripheral edge, said cap adapted to be telescoped over said closure and disc, and said skirt having a lower marginal portion spun radially inwardly to underlie said retaining bead, thereby maintaining said disc and annular ridge in sealing relationship.

6. A closure for hermetically sealing a container comprising, a resilient sealing member having a depending annular shank portion and a central panel, adapted to be punctured, closing one end of said shank, an annular sealing surface encircling said shank portion, said surface arranged to provide a continuous hermetic seal with said container, a shield formed of a relatively insoluble material and adapted to isolate said sealing member from the contents of the container, said shield having a depending annular body portion surrounding said annular shank portion, a puncturable panel integral with said annular body portion and closing the lower end thereof, said shield also having a radially extending flange adapted to sealingly engage the container and support said shield within the container, and means for removably securing said resilient sealing member to the container.

7. A closure as defined in claim 6, plus an annular axially extending ridge surrounding said central panel, a disk adapted to span said panel and sealingly engage said ridge, thereby sealing the surface of said panel and means for securing said disk and ridge in sealing relationship.

8. A closure cap for hermetically sealing a container, comprising a resilient insert having a depending annular shank portion, a relatively thin central panel closing one end of said annular shank, said panel adapted to be punctured and surrounded by an annular undercut, an annular

sealing flange encircling said shank, said flange arranged to sealingly engage said container, a shield adapted to isolate said insert from the contents of a container, said shield comprising a cup-like body portion enclosing said annular shank and having a puncturable panel spaced axially from said central panel, said shield also having an annular radial flange integral with the periphery of the cup-like body portion and adapted to partially underlie said sealing flange and supportingly rest on said container, and means for removably securing the insert to the container while leaving the central panel exposed, said means interlocking with the annular undercut surrounding said central panel.

9. A puncturable closure cap for an intravenous bottle, comprising an annular sealing ring of rubber-like material, a hollow cylinder-like shank extending axially from one side of the inner margin of the ring and formed integral with the latter, a readily puncturable panel closing the shank substantially at its juncture with the ring, attaching means carried by the ring for removably securing it to a bottle neck, a cup-like shield of inert material closing said shank and formed with a puncturable panel spaced axially from the first-named panel, a radially outwardly directed flange at the open end of the cup-like shield arranged to be interspaced between said ring and container when the ring is in sealing relationship with the container, and means for securing the shield in engagement with the shank and sealing ring.

10. A closure for dispensing pharmaceutical preparations from a container having a circular neck portion defining a mouth opening, comprising a shield formed of a sterilizable, relatively insoluble material, said shield having a relatively thin puncturable center panel and a thickened annular, radially outwardly extending flange, said shield being adapted to span the mouth-opening with the annular flange resting on and providing a continuous liquid-tight seal with the neck portion of the container, an external sealing member formed of a resilient material capable of forming a hermetic seal with said neck portion, said sealing member comprising transverse panel having a relatively thin central puncturable zone, and an annular sealing flange extending radially outwardly from said transverse panel and adapted to sealingly engage the neck portion of the container, said sealing member being adapted to overlie said shield and thereby isolated from the contents of the container, said external sealing member and shield having cooperating means for separably interlocking them, means for removably securing said sealing member to the container while leaving said puncturable zone exposed, and means for hermetically sealing said central zone.

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