Sept. 13, 1966 G. W. TODD ETAL 3,272,405

CLOSURE FOR CONTAINER

Filed Dec. 31, 1964 2 Sheets-Sheet 1

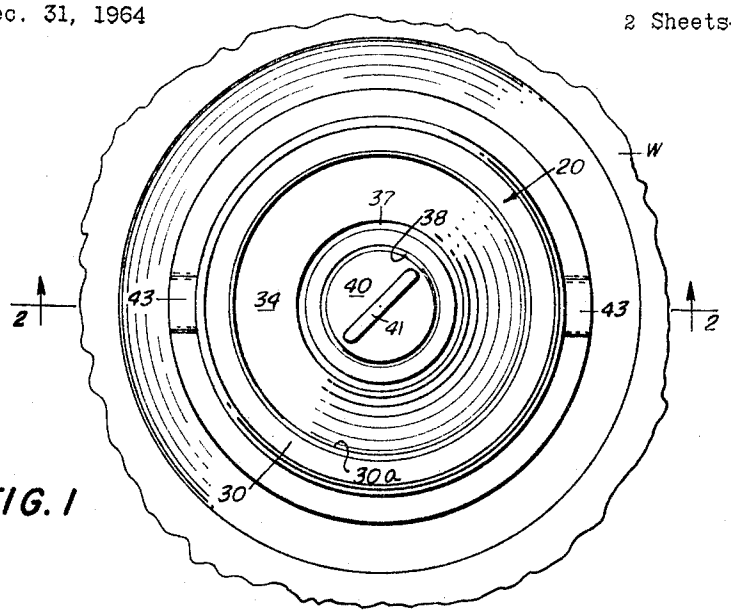


FIG. 1

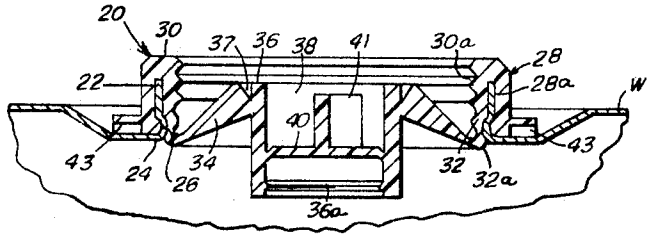


FIG. 2

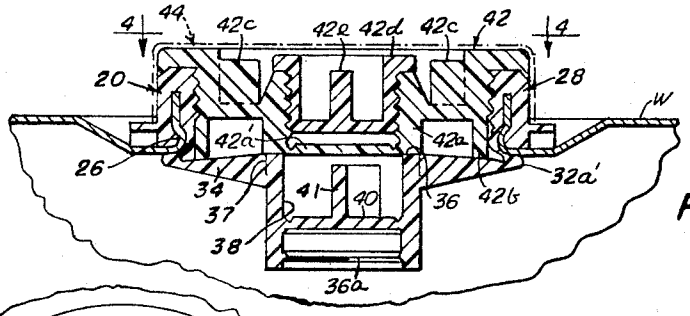


FIG. 3

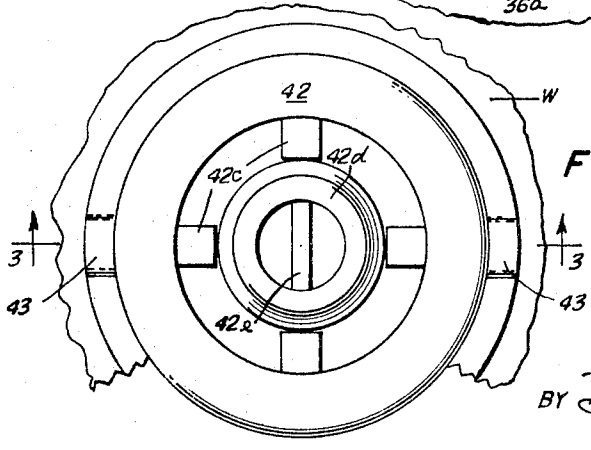


FIG. 4

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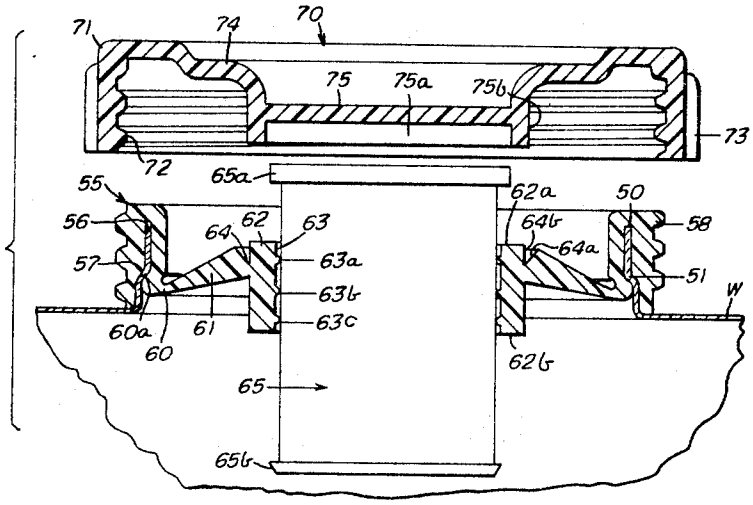
BY Beale and Jones
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FIG. 5



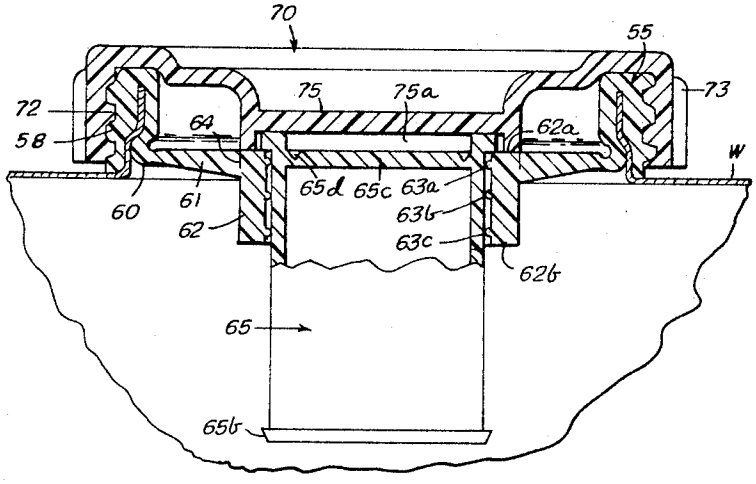


FIG. 6

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3,272,405

CLOSURE FOR CONTAINER

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21 Claims. (Cl. 222—525)

This invention relates to an improved closure, a plug and sealing element assembly, for containers, particularly barrels, drums and pails principally, but not exclusively, steel barrels, drums or pails.

This type of container is used in great numbers for the shipment and storage of an infinite variety of products, particularly liquid products, and it is with containers for the shipment and storage of liquid products that we are chiefly concerned. Specifically, this invention relates to a closure which requires a minimum of preparation in or of the container for its installation and which provides a sturdy, positive and dependable seal for the opening.

Containers of the type with which we are chiefly concerned are regularly provided with two openings, a vent opening and a filling or bung opening, with closure means. The vent opening is almost always located in the head of the container; the bung opening is located as desired by the user but usually in the head. These openings usually consist of two principal parts: (a) an annular fitting, called a flange, welded to or mechanically trapped or crimped into the metal wall of the container, said fitting having interior threads; and (b) an exteriorly threaded plug element engaging the annular fitting by means of the threads. The closure is finally sealed by means of a gasket. While this type of threaded structure has proved to be sturdy, positive and dependable, it is expensive because, in addition to the cost of the component parts themselves, considerable expense is incurred in the installation of them and in testing and plugging them, incidental to the completion of the container.

There has been a great need for a simple container closure which can be effected without complicated and expensive preparation in and of the container, which is sufficiently sturdy, positive and dependable to withstand the rough usage encountered in commercial shipment and which may also be reused after the container has been emptied and reconditioned.

Because of its diminishing importance and because there are cheap and satisfactory substitutes for the threaded flange and plug vent opening, the principal concern of this invention is the bung or fill opening; but the type of plug and sealing element closure here proposed for the fill opening is equally applicable to a vent opening. This invention is an improvement on the Todd U.S. Patent 3,099,364, issued July 30, 1963.

The principal object of this invention is, therefore, to provide for containers, particularly barrels, drums and pails and principally, but not exclusively, steel barrels, drums and pails, a sturdy, positively sealed and dependable closure means not requiring special, complicated preparatory operations in the container, nor special tools for applying it.

It is the further object of this invention to provide a shipping container closure which is re-usable.

It is the further object of this invention to provide a shipping container closure which will function, if necessary, with certain standard plug elements presently available on the market.

It is the further object of this invention to provide a shipping container closure which is usable with a container insert or lining, for example, a polyethylene or other flexible and separate insert, or a vinyl, phenolic, epoxy,

epoxy-phenolic, et cetera, integrally applied and cured lining, without damaging such insert or lining.

Another object of the invention is to provide a closure for a flanged opening in a container wall wherein an annular sealing element has a portion seating on the flange and provided with threads, an annular relatively thin portion adjacent the flange attachment and a central integral relatively thick portion that extends initially upwardly and has an annular V-shape groove in cross section formed downwardly into the central relatively thick portion in its stop and a through-opening the center of which may be cut out and cooperating with this a closing element plug or cap that has a threaded portion which engages the threaded portion of the sealing element downwardly into a generally horizontal attitude whereupon the relatively thin portion is pushed into sealing engagement with the flange and the annular V-shaped groove in cross section closes so that the central portion becomes a relatively solid rigid center from which the through-opening center may be cut out.

This invention embodies other novel features, details of construction and arrangement of parts which are hereinafter set forth in the specification and claims and illustrated in accompanying drawings, wherein:

FIG. 1 is a top plan view of a sealing element installed in a flanged aperture in the wall of a container;

FIG. 2 is a cross section along line 2—2 of FIG. 1 showing the sealing element installed in the flanged opening and with its center in an upwardly protruding position;

FIG. 3 is a view of line 3—3 of FIG. 4 showing the sealing element of FIG. 2 with a plug screwed therein and with the central portion thereof against the central portion of the sealing element to place it in a generally horizontal extended sealing position against the flange;

FIG. 4 is a top plan view of the sealing element and plug along line 4—4 of FIG. 3;

FIG. 5 is a cross sectional view of a modified form of sealing element in protruding upward position with telescopic nozzle at its center and having external threads to receive a cap all on a larger scale; and

FIG. 6 is a view of the sealing element of FIG. 5 with the nozzle in down position and a cap secured on the threaded flange and having its central portion forcing the sealing element into a relatively horizontal position in sealing position on the flange opening.

Throughout the description like reference numbers refer to similar parts.

Briefly, the invention has to do with a complete plug and sealing element assembly, the closure means or element of which is so formed that it may be forcefully expanded into, not crimped onto, and tightly seal a prepared and unthreaded opening, round or circular in section formed in the head or body of a container, particularly a shipping container. The closure means is a resilient generally cup-shaped sealing element having an interiorly or exteriorly threaded mouth and comprising a relatively convex-upward bottom wall, said generally cup-shaped sealing element depending into said opening with its mouth engaging about the margin of said opening; and a plug element exteriorly threaded or a cap interiorly threaded and threadedly received by said respectively internally or externally threaded mouth and adapted upon being screwed home, to flex said upwardly extending bottom wall or center portion into an approximately horizontal disposition thereby propping outward said circular wall against said opening flange and below at least a portion of same to prevent upward displacement of said sealing element, and to provide a seal on this circumferential area.

Referring more specifically to the drawings: FIG. 2

discloses in section one form of a readily prepared upstanding flanged opening **22** in, for example, the head of the container for the reception of the closure generally indicated at **20**, specifically the sealing element **28** of the closure **20** with which this invention is primarily concerned. The only operation necessary for preparing the container for the closure **20** is the simultaneous piercing of an opening in a wall of the container and forming of an annular upwardly turned collar or flange **22** about the opening. The flange **22** is, as illustrated, turned outwardly from the container wall at the bend **24**, vertically, except that it is provided with an annular, necked-in or reduced diameter portion **26** at the bottom thereof which strengthens the opening structure and provides seating area for the sealing element **28**, and a sealing means. The flanged opening **22** and the complete closure, usually in the head of the container and so shown here, may be installed in the head, bottom or shell of the container as desired.

FIG. 2 also discloses a generally cup-shaped sealing element **28** which includes a somewhat thickened interiorly threaded annular mouth portion **30**, a generally vertical wall or annular portion **32** which is relatively thin, and a convexed upward generally cone-shaped bottom wall **34** which is relatively thicker and increases in thickness towards the center upwardly extending portion shown in FIG. 1. This cup-shaped element **28** is an integrally molded body of thermoplastic material, for example—polyethylene, rubber or the like. The flexibility of the various parts or sections thereof depends on the design, material used and the thickness thereof. The comparatively thin vertical wall **32** and its foot portion **32***a* are relatively flexible. The relatively thicker bottom wall **34** is relatively rigid and the required flexing movement is to some extent obtained by means of a generally V-shaped annular groove **37** around and near a central boss **36** which groove or void closes, making the bottom wall structure **34** in effect solid and relatively rigid, at the final or sealing stage or position thereof as shown in FIG. 3 where the center portion extends generally horizontal.

Still referring to FIG. 2 there is shown that the annular portion **30** of the sealing element is formed with an internal annular slot **28***a* extending up from its bottom to be received over the upstanding shaped flange **22**. The sealing element **28** itself in effect folds over the upstanding flange **22** and clings to the exterior surface thereof. Also by reason of there being molded into the sealing element **28** the slot or groove **28***a*, the sealing element **28** snugly accommodates the top edge of the upstanding flange **22**, as shown in FIGS. 2 and 3.

The central portion of the bottom wall of the sealing element **28** adjacent the central thickened portion **34** is formed with the central axial thickened cylindrical or annular boss **36**. As shown, the boss **36** is formed with a bore **38** extending therethrough from opposite directions and leaving a thin horizontally extending membrane **40** intermediate its ends. This membrane **40** of resilient material is frangible. It may be broken out by a sharp instrument so that a faucet or the like may be screwed through the central threaded apertured portion of the plug, to be described (see FIG. 3) from the outside to communicate with the inside of the container through the bore **38**. That portion of the bore **38** above the membrane **40** is not threaded but does have within it, and molded to the upper side of the membrane, an upstanding fin or eyelet **41** by means of which the sealing element **28** may be grasped and pulled out of the flange **22**, prior to the membrane **40** having been cut or broken out. The sealing element **28** itself is provided with one or more tool recesses **43** molded into its outside curtain wall at its base to facilitate the removal of the sealing element **28** if the membrane **40** and fin **41** have been removed.

The underside of the cylindrical boss **36** forming a part of the bore **38** is normally threaded or provided with a fin such as at **36***a* that may be interrupted, spiral or the like to receive and carry in transit a faucet (not shown) inserted therein prior to the insertion of the sealing element and plug and the sealing of the closure.

It is understood that the sealing element **28** may be made to conform to flanges **22** of varying design, for example, flanges that may flare outwardly or taper inwardly, with or without lips, hems, or folds, etc., and of various shapes and heights in order that, for example, the closure may be made adaptable to containers made of steel, fiber or other materials and with or without inserts or inside containers made of polyethylene or the like. Thus, the flange may be variously arranged so long as it provides resistance to expansion of the sealing element with which it cooperates.

Whereas in closures presently in general use, the function of the plug is to actually plug the opening and in conjunction with a gasket to develop the necessary seal against leakage of contents, the function of the plug element generally indicated at **42** in this invention is to actuate the sealing element **28** which in conjunction with the flange **22** and without use of a gasket develops the one or more seals against leakage. While the sealing element **28** of this invention will function with one or more of the standard plugs on the market, a somewhat special plug **42** shown in FIGS. 3 and 4 is provided to develop optimum results. The plug **42** is formed with a central annular boss **42***a* and an outer annular depending boss **42***b* with the annular boss **42***a* intermittently threaded to receive from the top a threaded plug **42***d* that may be removed to thread in a dispensing faucet. Smaller plug **42***d* is formed with a recess therein and a strengthening cross web **42***e* which may be grasped to assist in its removal. The annular boss **42***a* has a membrane **42***a'* similar to the membrane **40** that is removed with a sharp tool. In FIG. 4 it will be noted that the plug **42** is also formed with spaced circumferentially spanner wrench receiving lug portions **42***c*.

In operation, the cup shaped sealing element **28** is, subsequent to the filling of the container, inserted into the opening with the annular groove or slot **28***a* engaging the upstanding flange **22**. As shown in FIG. 2, the bottom wall **34** of the cup shaped sealing element **28** is at this stage convex upward or projecting upwardly.

Next, the plug element **42** is inserted into the sealing element **28**, the threads thereon engage the threads of the mouth portion **30** of the sealing element **28**. As the plug element is turned home, the bottom surface of its central threaded boss section **42***a* makes contact with the top central boss **36** of the sealing element **28** and as the turning of the plug element **42** is continued, the bottom wall structure **34** of the sealing element **28** is flexed downwardly until as the plug element **42** is finally seated, the bottom wall structure **34** is approximately horizontal and the V-shaped groove **34** is closed. At this stage, the bottom wall **34** has with the central portion **36** become a rigid structure as shown in FIG. 3, propping outwardly the relatively thin and flexible portion of the vertical wall **22** so that an annular portion **32***a'* flattens outwardly seating against the under surface of the container wall material under the bend **24** and about the opening. The seating serves not only as the first seal against leakage of the fluid contents of the container up between the flange **22** and the sealing element **28** but also to prevent the upward displacement of the sealing element **28** out of the opening under internal pressures.

In addition to flexing the bottom wall of the sealing element into the stage at which it becomes a rigid structural member, the plug element **42**, engaged as it is with the threads **30***a* of the mouth portion **30** of the sealing element **28**, finally seats itself as it is turned home, firmly upon and forcefully compressing the upper portion of the relatively thin and flexible vertical wall **32** against the upper shoulder of the reduced diameter portion **26** of the upstanding flange **22**, as shown in FIG. 3, thus

forming a second seal against leakage of the fluid contents of the container up between the flange **22** and the sealing element **28**.

As a precaution against possibility of the bottom wall **34** of the sealing element **28** flexing upwardly even slightly under internal pressure and thereby even slightly relieving the outwardly propping pressure against a relatively flexible portion of the vertical wall **32** with the resultant relieving of the holding pressure against the annular portion **32***a'* thereof, the plug element **42** is provided with the annular and downwardly projecting boss or skirt **42***b* which engages and supports the adjacent top surfaces of the bottom wall **34** near its periphery against such possible reverse flexing.

The assembly may be completed with the addition of a protective cap or cover, known in the trade as a cap seal, which cannot be removed without its being destroyed, thus revealing tamperage. The cap seal may be made of metal (tin plate, etc.) or polyethylene or other plastic or a combination thereof. A tear strip is almost invariably built into the cap seal to facilitate removal. The general nature of the cap seal is shown in FIG. 3 at **44**.

The device of the invention may be used with a container insert, previously mentioned, in the container, with the neck of the insert (not shown) disposed annularly between the flange **22** and the sealing element **28**. So disposed, the liner neck is not subjected to, for example, the cutting action of the threads, only to the compression of the sealing element **28** against the flange **22**. Thus the liner is not damaged and may be reused.

The modified form of the closure shown in FIGS. 5 and 6 will now be described. This modified form of closure is particularly useful with 1 to 15 gallon light shipping pails and drums. The wall W of the container is formed with an upwardly extending annular flange **50** which has an abutment for the sealing element, to be described. Thus the annular flange **50** defines the opening which receives a sealing element generally indicated at **55**.

The sealing element **55** is similar to the sealing element **20**, previously described, but has outside threads for receiving an operating or cap member, to be described. There is an annular flange receiving portion **56** that has an annular slot **57** extending upwardly therein from its bottom that is received over the upstanding flange **50**. This slot is formed to conform to the shape of the flange and even in the unextended sealing element **55** shown in FIG. 5 it expands against the underneath portion of the flange portion **51**. This annular portion **56** is formed with external threads **58**.

The sealing element **55** has a relatively thin flexible annular bottom portion **60** integrally adjacent the annular flange receiving portion **56** that is flexed outwardly into sealing position with the flange portion **51**, to be described. The bottom portion **60** increases in cross sectional thickness toward the center in its central bottom portion **61** and terminates in a central cylindrical boss **62** that has an upper end **62***a* and a depending downwardly extending bottom end **62***b*. The cylindrical boss **62** forms the vertically extending bore **63**. This bore has formed integrally therein spaced apart annular sealing rings **63***a*, **63***b* and **63***c* that are generally semicircular in cross section. An annular V-shaped groove **64** is formed into the juncture of the portion **61** with the center cylindrical boss portion **62** in the relatively thick rigid portion and the walls **64***a* and **64***b* forming this groove **64** come together in abutting relation as shown in FIG. 6 when the sealing element is expanded into substantially horizontal extending position as will be described.

In FIG. 5 there is shown telescopically received in the bore **63** of the sealing element **55** pouring spout **65** having an upper end outwardly extending flange **65***a* that seats and seals on the upper end **62***a* of the boss **62** when the depending center portion **75** and annular portion **75***b* of the cap element **70** is screwed down on the sealing element **55**, as shown in FIG. 6. Its bottom end has an outwardly extending flange **65***b* to provide a stop when the spout is extended for pouring. In the assembly in FIG. 5, it will be noted that the spout has a slightly loose fit with the sealing element **55** down through which its lower flanged end **65***b*, smaller than its upper end **65***a*, has been thrust in assembling. Seals for this loose fit are provided by three annular rings **63***a*, **63***b* and **63***c* molded in the vertical wall of the bore **63** which also prevent cocking or wobbling of the spout while in the extended pouring position. The upper end of the spout **65** has a transversely extending membrane **65***c* closing the same, see FIG. 6, that has a weakening annular indentation **65***d* in its upper surface so that the membrane may be easily cut or punched out to ready the spout for pouring therethrough.

An operating cap element for the sealing element **55** is generally indicated at **70**. The operating cap **70** is formed with a depending annular skirt portion **71** that is internally threaded at **72** and has serrations **73** on its outside to provide for hand grasp for screwing the cap onto the external threads of the sealing element **55**. Extending inwardly from the skirt portion **71** is the top portion **74** which has a depending annular center portion **75** that has a circular pocket **75***a* formed therein by the depending annular flange portion **75***b*. The pocket **75***a* fits over the top flanged end **65***a* of the spout **65** and the depending annular boss portion **75***b* of the center of the operating cap abuts the top **62***a* of the central boss **62** of the sealing element **70** forcing it downwardly as the operating cap **70** is screwed down on the sealing element **55**. The center portion of the sealing element is flexed into a general horizontal position and its diameter becomes maximum. The bottom annular outer portion **60** of the sealing element **55** expands outwardly and at its portion **60***a* seats up against the under side of the offset portion **51** of flange **50**. As pressure develops against the bottom of the sealing element **55**, the seal at **60***a* with flange portion **51** becomes even tighter. The wall of the spout **65**, as shown in FIG. 6, abuts tightly against the annular rings **63***a*, **63***b* and **63***c* on the adjacent boss portion **62** of sealing element **55**.

Because the closure means of this invention will withstand the Interstate Commerce Commission specification tests, is relatively inexpensive and possesses other advantages, noted above, it is felt that it answers the long-felt need in the art.

While this invention has been shown in but a limited number of forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit and scope of the claimed invention.

We claim:

1. A container partly defined by a wall having an opening therein; a resilient sealing element for said opening having an annular outer wall portion received by and attached to said wall at the opening, a relatively thin and flexible annular portion joining with the annular wall portion and initially inwardly thereof and an initially upwardly extending central portion increasing in relative thickness inwardly from the relatively thin and flexible annular portion and having an annular V-shaped groove portion extending inwardly from the top of the central portion and a portion within the outline of the annular V-shaped groove portion adapted for forming an aperture therethrough, said annular wall portion having threads thereon for receiving a closing and operating member for the sealing element; and a closing and operating member for the sealing element having a threaded portion for reception by the threaded portion of the sealing element and a central portion for abutment against the top of the upwardly extending central portion of the sealing element so as to push it downwardly as the closing and operating member is threaded to the sealing element

whereby the relatively thin and flexible annular portion and the central portion is flexed into a generally horizontal position with the relatively thin and flexible portion flexed into sealing engagement with the adjacent portion of the upstanding flange and whereupon the annular V-shaped groove portion closes to form a solid rigid portion with the central portion of the sealing element as that portion flexes into the generally horizontal extending position.

2. A container according to claim 1 wherein said sealing element comprises a single piece of molded thermoplastic material and the relatively flexible portions are thinner than the relatively rigid portions.

3. A container according to claim 1 wherein the central portion has a central boss within the annular V-shaped groove portion and said portion within the outline of the annular V-shaped groove portion lies within the boss and is a thin frangible membrane and said boss has a bore therethrough adapted to receive and hold a faucet or such therein.

4. A container according to claim 3 wherein said sealing element including said boss and said membrane comprises a single piece of molded thermoplastic.

5. A container according to claim 4 wherein said annular outer wall portion has its threads on the inner periphery thereof and wherein said closing and operating member for the sealing element is a plug with external threads for receipt by said threads on the sealing element, said plug being formed with a central membrane closed aperture in alignment with and of a similar diameter to said portion of the sealing element within the outline of the annular V-shaped groove portion that is adapted to have the membrane ruptured and an aperture formed therethrough and a second plug element received in said aperture of the plug.

6. A container according to claim 5 wherein said annular outer wall portion has open recesses or pockets about its outer periphery for receiving a tool to assist in removal of the sealing element from said wall opening.

7. A container according to claim 5 wherein said central membrane closed aperture in the plug is formed with threads and on rupture of said membrane therein threadedly receives a faucet therein.

8. A container according to claim 1 wherein the portion within the outline of the annular V-shaped groove portion adapted for forming an aperture therethrough comprises a cylindrical boss having a nozzle slidably mounted therein, said nozzle having rupturable membrane therein.

9. A container according to claim 8 wherein said annular outer wall portion has threads on the outside surface thereof and wherein said closing and operating member for the sealing element has a peripheral wall portion with internal threads for threadedly receipt on said threaded portion of the sealing element and a central annular boss portion for abutting contact with the top of said cylindrical boss to flex the central portion of the sealing element into its generally horizontal position into sealing engagement with said opening in the container.

10. A container according to claim 9 wherein said slidably mounted nozzle has an annular flanged top and said boss on the operating member forms with a central portion thereof a jacket to receive said top flanged end of the nozzle.

11. A closure assembly for use with a container partially defined by a wall having an opening with an upstanding flange thereabout comprising, a sealing element having an annular flange receiving portion for reception by the upstanding flange, a relatively thin and flexible annular portion joining with the annular flange receiving portion and an initially upwardly extending central portion increasing in relative thickness inwardly from the relatively thin and flexible annular portion and having an annular V-shaped groove portion extending inwardly from the top of the central portion and a portion within the outline of the annular V-shaped groove portion adapted for forming an aperture therethrough, said annular flange receiving portion having threads thereon for receiving a closing and operating member for the sealing element, a closing and operating member for the sealing element having a threaded portion for reception by the threaded portion of the sealing element and a central portion for abutment against the top of the upwardly extending central portion of the sealing element so as to push it downwardly as the closing and operating member is threaded onto the sealing element whereby the relatively thin and flexible annular portion and the central portion is flexed into a generally horizontal position with the relatively thin and flexible portion flexed into sealing engagement with the adjacent portion of the upstanding flange and whereupon the V-shaped groove portion closes to form a solid rigid portion with the central portion of the sealing element as that portion flexes into the generally horizontally extending position.

12. A closure assembly according to claim 11 wherein said sealing element comprises a single piece of molded thermoplastic material and the relatively flexible portions are thinner than the relatively rigid portions.

13. A closure assembly according to claim 12 wherein the central portion has a central boss within the annular V-shaped groove portion and said portion within the outline of the annular V-shaped groove portion lies within the boss and is a thin frangible membrane and said boss has a bore therethrough adapted to receive and hold a fitting therein.

14. A closure assembly according to claim 12 wherein said sealing element including said boss and said membrane comprises a single piece of molded thermoplastic.

15. A closure assembly according to claim 14 wherein said annular outer wall portion has its threads on the inner periphery thereof and wherein said closing and operating member for the sealing element is a plug with external threads for receipt by said threads on the sealing element, said plug being formed with a central membrane closed aperture in alignment with and of similar diameter to said portion of the sealing element within the outline of the annular V-shaped groove portion that is adapted to have the membrane ruptured and an aperture formed therethrough and a second plug element received in said aperture of the plug.

16. A closure assembly according to claim 15 wherein said annular outer wall portion has open recesses or pockets about its outer periphery for receiving a tool to assist in removal of the sealing element from said wall opening.

17. A closure assembly according to claim 14 wherein said central membrane closed aperture in the plug is formed with threads and on rupture of said membrane therein threadedly receives a faucet therein.

18. A closure assembly according to claim 11 wherein the portion within the outline of the annular V-shaped groove portion adapted for forming an aperture therethrough comprises a cylindrical boss having a nozzle slidable mounted therein, said nozzle having a rupturable membrane therein.

19. A closure assembly according to claim 17 wherein said annular outer wall portion has threads on the outside surface thereof and wherein said closing and operating member for the sealing element has a peripheral wall portion with internal threads for threadedly receipt on said threaded portion of the sealing element and a central annular boss portion for abutting contact with the top of said cylindrical boss to flex the central portion of the sealing element into its generally horizontal position into sealing engagement with said opening in the container.

20. A closure assembly according to claim **18** wherein said slidably mounted nozzle has an annular flanged top and said boss on the operating member forms with a central portion thereof a pocket to receive said top flanged end of the spout.

21. A closure assembly according to claim **18** wherein said sealing element has on its annular outer wall tool receiving recesses for removal of the sealing element.

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