March 25, 1969 J. LAURIZIO 3,434,620

FRANGIBLE PLASTIC CLOSURE

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Fig. 1.

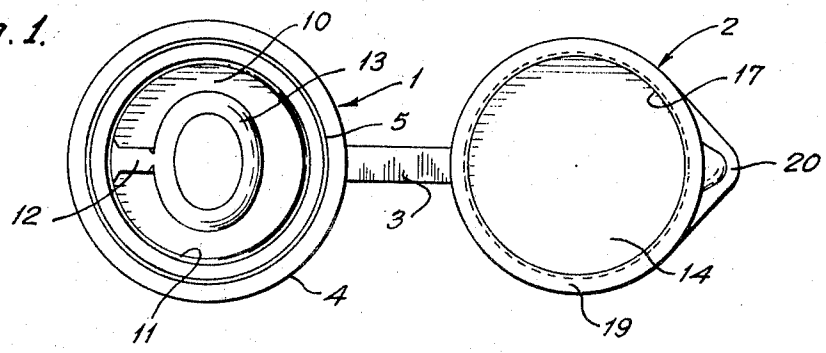


Fig. 2.

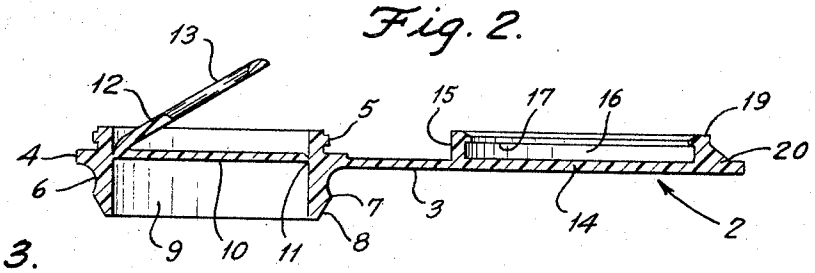


Fig. 3.

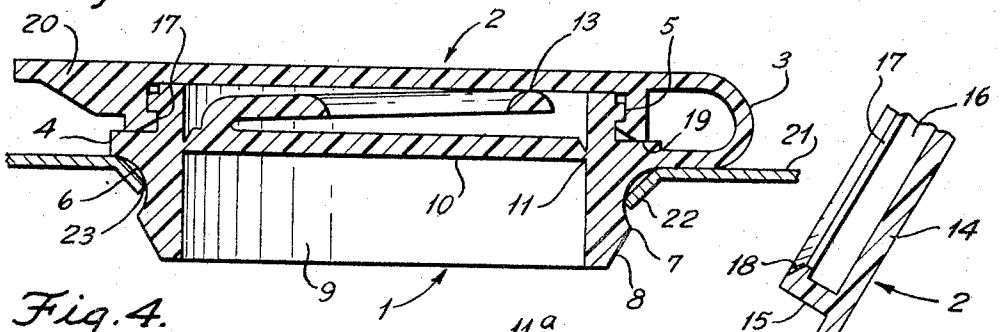


Fig. 4.

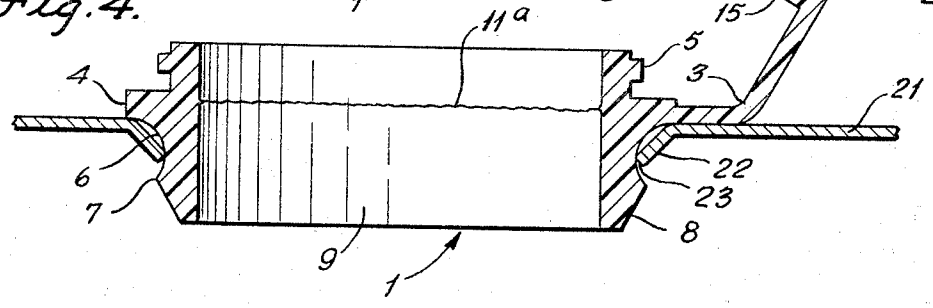


Fig. 5.

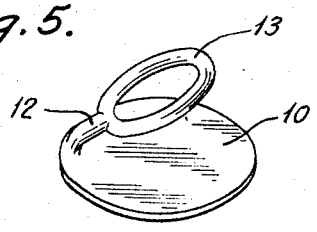


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Fig. 6.

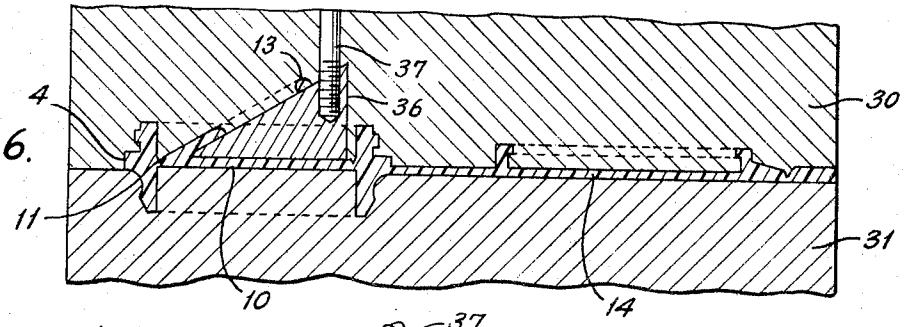


Fig. 7.

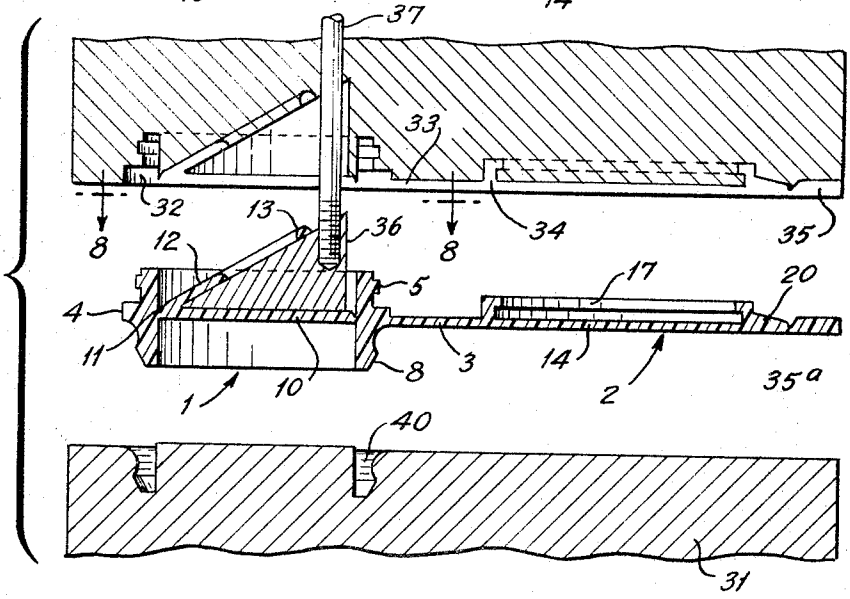


Fig. 8.

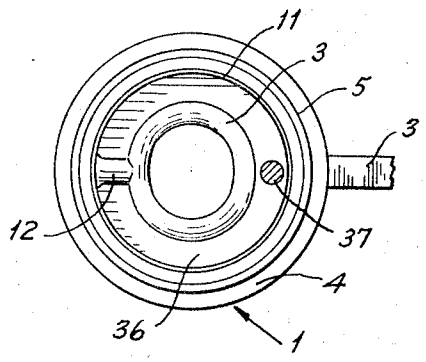


Fig. 9.

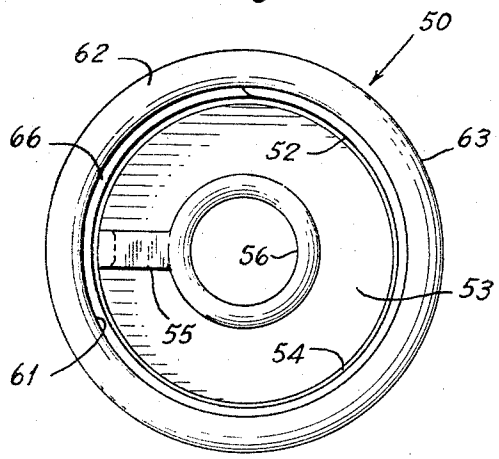


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Fig. 10.

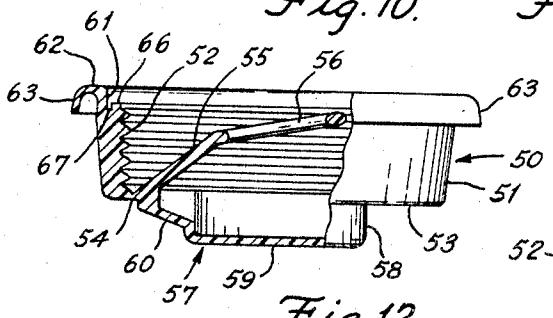



Fig. 11.

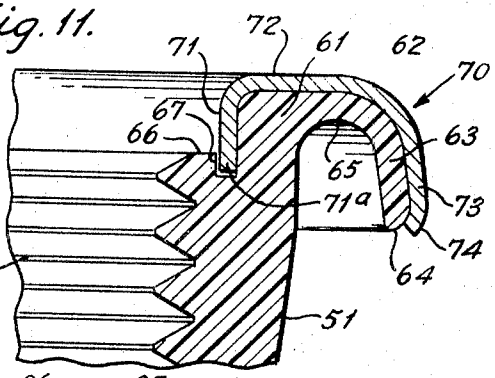



Fig. 12.

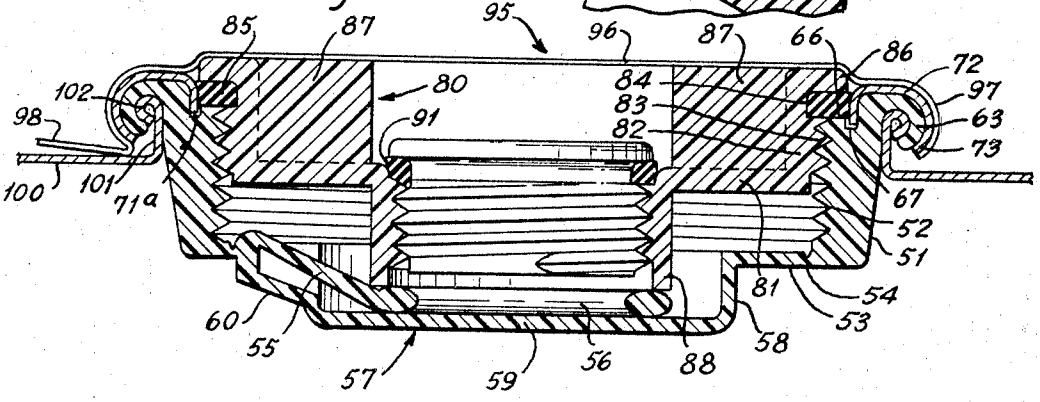
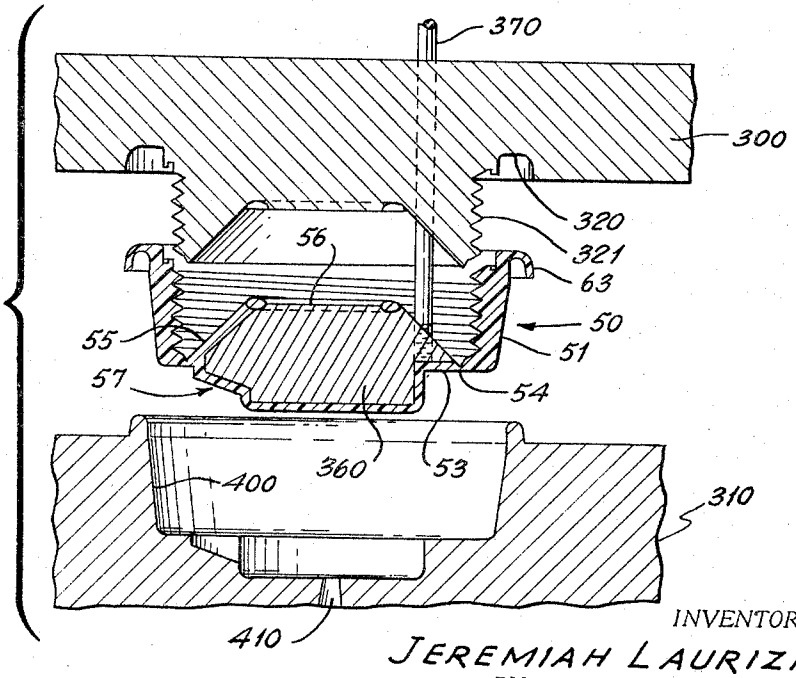



Fig. 13.

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3,434,620

# FRANGIBLE PLASTIC CLOSURE

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Int. Cl. B65d 17/00, 47/10
U.S. Cl. 220—27 10 Claims

## ABSTRACT OF THE DISCLOSURE

A closure member found of synthetic plastic material for insertion in an opening in a container wall. The closure member defines a dispensing passage which is initially sealed off by a hand removable tear out diaphragm.

This invention relates to plastic closures for containers and is particularly concerned with such closures provided with a hand removable tear out diaphragm and method for forming the same.

It has become highly desirable in the plastic closure field to provide an integrally formed destructable diaphragm across the dispensing opening. Such a diaphragm construction not only insures against the possibility of leakage during shipment and handling of the container but in addition makes unauthorized tampering readily detectable. A secondary closure is at the same time provided to effect reclosing after the initial seal has been broken.

Various schemes have been presented whereby the integrally formed seal may be readily broken by the end user. Among these are puncturing with a sharp instrument, cutting out with a knife, pulling a tearing ear with a pair of pliers, all of which require the ready availability of some sort of tool or implement. Easily hand removability of such closure tear out diaphragms has been a problem the practical solution to which, has not until the instant disclosure been brought forth. One approach has been to reduce the thickness of the tearing zone in the diaphragm to an absolute minimum with the hope of breaking through that zone with force applied by one's fingers through a simple pull tab integrally formed with the diaphragm. However, even if the tearing zone could be accurately maintained at a few thousandths of an inch under production molding conditions, the force required to commence tearing of a commonly used plastic such as polyethylene is substantially more than can be applied by one's fingers gripping a simple pull tab.

Another approach to the problem of providing easy hand removability is to form the tab with suitable gripping means so that a sufficient pulling force can be applied by one's fingers to commence tearing. This is the approach taken by the instant invention and the resulting successful construction embodies a finger loop integrally formed with the diaphragm. The new and novel method herein disclosed enables formation of a tear out diaphragm finger pull loop in a very simple and economical manner. Furthermore, through the invention method, the diaphragm can be molded within the dispensing passage with the finger loop extending angularly outwardly for easy accessibility while at the same time positioned to allow closing off of the dispensing passage with a secondary reusable closure.

It is accordingly a principal object of the invention to provide new and improved plastic closures for containers.

Another object is to provide a new and improved method for making such closures.

Still another object is to provide the dispensing opening of plastic closures with an improved integrally formed tear out diaphragm.



A further object is to provide improved plastic closures having an integrally formed, easily hand removable tear our diaphragm.

A still further object is to provide an integrally formed plastic closure tear out diaphragm having improved finger gripping means for tearing.

A still further object is to provide an integrally formed plastic closure tear out diaphragm having a finger loop pull member for tearing.

A still further object is to provide a method of forming an integral tear out diaphragm and finger loop pull member in recessed position within a dispensing opening.

A still further object is to provide a plastic closure member having a new and improved gasket seat.

Further and more detailed objects of the invention will in part be obvious and in part pointed out as the description of the invention taken in conjunction with the accompanying drawings proceeds.

In that drawings:

FIG. 1 is a top plan of a captive cap type closure embodying a tear out diaphragm formed in accordance with the invention;

FIG. 2 is a vertical section of the closure of FIG. 1.

FIG. 3 is a vertical section of the closure of FIG. 1 secured within a container wall;

FIG. 4 is a view similar to FIG. 3 with the closure in open position and the diaphragm removed;

FIG. 5 is a perspective view of the removed diaphragm and finger pull loop;

FIG. 6 is a vertical section of the mold in closed position for forming the closure of FIG. 1;

FIG. 7 is a view similar to FIG. 6 with the mold in open position;

FIG. 8 is a sectional view taken on lines 8—8 on FIG. 7 and looking in the direction of the arrows;

FIG. 9 is a top plan view of a closure member adapted to receive a plug and formed in accordance with the invention;

FIG. 10 is a part section part elevational view of the closure member of FIG. 9;

FIG. 11 is an enlarged fragmentary sectional view of a portion of the partly assembled closure;

FIG. 12 is a vertical section of a complete closure assembly secured within a container wall; and

FIG. 13 is a vertical section of the mold in open position for forming the closure member of FIG. 10.

Considering first the captive cap type closure shown in FIGS. 1–4 the basic components thereof are seen to include a body portion **1**, a cap **2** and a flexible hinge strap **3** connecting the cap and body. The entire closure is integrally molded as a single piece, in a manner hereinafter disclosed, from a suitable synthetic plastic material of which polyethylene is a nonlimiting example. The body **1** is a short tubular member surounded by an annular flange **4**. Extending above the flange **4** is a cap receiving neck provided with an annular locking and gasketing shoulder **5**. Extending below the flange **4** is a concave surface **6** which commences at the undersurface of flange **4** curving radially inwardly downwardly and then radially outwardly terminating in a zone **7** of maximum wall thickness. The exterior surface of the lower body portion terminates in a short downwardly and inwardly tapered pilot portion **8** to facilitate insertion in a container wall opening as hereinafter described. The inner surface **9** of the body **1** defines a passageway through which the container contents may be dispensed and which is initially closed off at an intermediate position by an integrally formed diaphragm **10**. A circular tearing zone **11** of reduced thickness forms the juncture between the dia-

phragm **10** and the inner body surface **9**. Integrally attached to the diaphragm **10** adjacent its outer periphery is a finger loop pull member which extends upwardly and radially inwardly from the diaphragm in a short neck **12** and terminates in a circular loop **13**. The size of the loop **13** is such that a person's finger can be easily inserted therethrough for pulling. In the embodiment of the invention here shown the finger loop pull member is positioned to extend outwardly in diametrical alignment with the hinge strap **3** as seen in FIG. 1. This relationship although advantageous in the mechanical handling of the cap, could be varied without departing from the scope of the invention. Of importance however is the fact that the pull member extend upwardly at an angle so as to be easily accessible for pulling. The approximate 45 degree angle shown, although by no means limiting, projects the loop **13** outwardly well beyond the upper end of body **1**.

The cap **2** comprises a flat top panel **14** surrounded by a depending skirt **15**. Extending radially inwardly from the inner surface **16** of the skirt **15** is an annular rib **17** which has its outer surface tapered as indicated at **18** and joining the end surface **19** of the skirt. The flexible hinge strap **3** integrally joins the flange **4** of the body **1** with the top panel **14** of the cap **2**. To facilitate opening of the cap a lift tab **20** extends outwardly from the skirt **15** as a continuation of the top panel **14** and diametrically opposed to the hinge strap **3**.

In FIGS. 1 and 2 the closure is shown as it comes out of the mold with hinge strap **3** in a flat condition. The cap is then closed in a subsequent operation folding over the hinge strap **3** and, as shown in FIG. 3, the finger loop pull member is depressed by the cap top panel **14** so as to be enclosed within the upper portion of the body **1**. Here it can be seen how the inclination of the pull member allows the same to be easily pushed down by the cap into its stored position. The tapered surface **18** on the cap skirt **15** aids in camming the skirt rib **17** over the locking shoulder **5** on the body **1** where the cap is thus held with the skirt end surface **19** in engagement with the upper surface of the body flange **4**.

The closed unit can then be inserted in a container wall **21** provided with an opening surrounded by a short neck **22** extending downwardly and radially inwardly from the wall **21** and terminating in a free edge **23**. In forcing the closure into the container wall opening the tapered body portion **8** aids in positioning the body **1** in the opening and squeezing the zone **7** of maximum wall thickness past the free edge **23** of the opening neck **22**. Continued downwardly movement of the body **1** causes the undersurface of the flange **4** to seat against the upper surface of the container wall **21**. Upon relieving the downward pressure the slight axial spring back of the body **1** due to the resilience in the flange **4** causes the neck free edge **23** to bite into the concave surface **6** effecting a permanent leakproof engagement. Any minor dimensional variation which may occur under production conditions in the inside diameter of the container wall opening is readily compensated for by the curved surface **6** which provides an infinite number of seating positions for the free edge **23**. Variations due, for example, to wear in the container wall perforating and neck forming dies and different container wall thickness only cause the biting or digging in of the free edge **23** to occur at a slightly different position along the curved surface **6**. The sealing remains completely effective however despite these variations. The container is now completely sealed against leakage either through or around the closure and any unauthorized tampering through destructive removal of the entire closure or the diaphragm **10** is readily detected.

Authorized access to the container contents is easily accomplished by flipping the cap **2** off of the body portion **1** by means of the lift tab **20**. The pull member then springs back to its elevated position whereby one's finger can be inserted through the loop **13** and sufficient pulling force applied to commence tearing of the diaphragm **10** along the weakened tearing zone **11**. FIG. 5 illustrates the diaphragm with its finger loop pull member after removal leaving only slightly roughened edge **11***a* on the inner surface **9** of the body **1** where the tearing occurred. After initial opening the cap **2** remains in raised position as shown in FIG. 4 due to the partial set taken by the hinge strap **3** when in closed position. Subsequent closing and sealing off of the dispensing opening is effected by again snapping the cap **2** in closed position.

A unique method for injection molding the above described captive cap type closure is illustrated in FIGS. 7–8 which show a mold comprising an upper member **30** and a lower member **31**. The upper member **30** is provided with a cavity portion **32** corresponding to the upper portion of the closure body **1**, a portion **33** corresponding to the hinge strap **3** and a portion **34** corresponding to the cap **2**. Numeral **35** indicates a sprue cavity portion for filling the mold. Completing the upper half of the mold is a moveable segment **36** connected to a vertically slideable pin **37**. The segment **36** fills that part of the mold necessary for creating the cavity wall corresponding to the upper surface of the diaphragm **10** and the under surface of the pull loop **13** and connecting neck **12**. The segment **36** is thus moveable axially away from the upper mold member **30** by means of the pin **37** with the cavity portions corresponding to the weakened tearing zone **11** and the remaining surfaces of the pull member being part of the upper member **30**. The lower mold member **31** is provided with a cavity **40** for forming the lower tubular portion of the body **1** including the under surface of the diaphragm **10**.

FIG. 6 illustrates the mold in closed position showing the mold parting line as lying in a plane corresponding to the lower surfaces of the flange **4**, the hinge strap **3** and the cap top **14**. The cavity is then filled and upon completion of the molding cycle the upper and lower members separate and the segment **36** moves away from the member **30**. The molded piece is then removed preferably by suitable mechanical ejecting means from the segment **36**. Removal of the sprue **35***a* may be carried out automatically in the mold or subsequently removed by hand, completing the formation of the finished piece. It should be noted that a number of arrangements could be employed in the relative movement of the above described mold members. For example, either of the members **30** and **31** could move axially while the other remains fixed and the segment **36** moves axially relative to the member **30** either after or simultaneously with the separation of members **30** and **31**. Alternatively the segment could remain fixed and the members **30** and **31** separate relative thereto or of course all three members could also move simultaneously. What is important is the fact that the finger loop pull member is formed within the body of the closure in a very simple and economical manner employing only three mold members; upper member **30**, lower member **31** and the segment **36**. These members move only in an axial direction relative to each other in a unique manner thus forming a novel plastic closure which would on its face appear to require a much more complicated and expensive molding method.

FIGS. 9–12 illustrate another type of closure formed in accordance with the invention comprising a molded plastic plug receiving member generally indicated at **50** and having a downwardly extending wall **51** internally threaded at **52** and terminating at its lower end in a tear out diaphragm **53**. Connecting the diaphragm **53** and the lower end of neck **51** is a weakened tearing zone **54** of reduced thickness. Integrally formed with that diaphragm and closely adjacent the tearing zone **54** is a finger loop pull member having a short upwardly and radially inwardly extending neck **55** terminating at its upper end in a circular pull loop **56**. In the center of the diaphragm **53** a pocket **57** is formed having a side wall **58**, a bottom wall **59** and a downwardly and inwardly inclined radial channel portion **60** extending between the tearing zone **54**

and the wall **58**. The upper end of the threaded wall **51** is provided with a peripheral securing lip having an inner wall **61**, a top wall **62** and an outer wall **63** which extends downwardly and radially outwardly at a slight angle and terminates in a rounded free end **64**. The interior surface **65** of the securing lip performs an effective gasketing function as hereinafter described. Also formed on the plug receiving member **50** at the upper end of the thread **52** is a gasket seat **66** which is radially spaced from the inner wall **61** by a circumferential upwardly opening groove **67**.

The plug receiving member **50** thus described is permanently sealingly engaged about a container wall opening by means of a metal clamping ring **70** comprising an inner wall **71**, a top wall **72** and an outer wall **73** terminating at its lower free end in an inwardly turned portion **74**. The plastic member **50** and the clamping ring **70** are snapped together so that the ring **70** overlies the lip walls **61**, **62** and **63** with the wall **71** having its lowermost free edge **71***a* extending below the gasket seat **66** into the groove **67**. The inwardly turned end portion **74** of the ring **70** engages the end **64** of the outer lip wall **63** thus acting to retain the two members together as an assembly.

As seen in FIG. 12 the plug receiving member **50** is fitted with a closure plug **80** also formed of a synthetic plastic material and comprising a bottom wall **81** and a side wall **82** having an externally threaded portion **83**, a seat **84** for retaining the gasket **85** and terminating at its upper end in a circumferentially enlarged head **86**. Formed inwardly of the wall **82** is a pair of wrench engaging lugs **87**. The bottom wall **81** of the plug **80** is formed with a downwardly extending internally threaded neck **88** which in turn receives a threaded plug **90** provided with a gasket **91** and generally similar to the plug **80**. This type of combination plug lends a desirable degree of versatility to the closure in that the container contents may be dispensed through a pump or spigot adapted for use in either the large or the small threaded opening.

The assembly is completed with the provision of an overlying metal cap seal **95** having a top panel **96** and a depending skirt **97**. To facilitate easy hand removal of the cap seal, gripping ear **98** extends away from the lower free edge of the skirt **97** and forms the commencement of a suitable tear strip (not shown) of the type defined by a pair of score lines extending across the skirt and top. The function of this lightweight seal is to prevent the entry and accumulation of dirt and water in and around the plug **80** and the gasket **81**. This feature is desirable since the contents must be dispensed through the closure opening without contamination when such containers are stored under varied conditions over long periods of time.

In practice the closure manufacturer first assembles the closure receiving member **50** and the clamping ring **70**. The combination plug **80** is then threaded into the member **50** with the gasket **85** being compressed against the gasket seat **66** and the inner ring wall **71**. The provision of the groove **67** within which the lower end **71***a* of the inner ring wall **71** is housed, prevents the gasket **85** from being pinched in underneath the end **71***a* when the plug is tightened down. It has been found that when this end **71***a* is left exposed the gasket squeezes underneath the ring so that upon removal of the plug the gasket is caught by the end **71***a* and pulls right off the plug.

Continuing with the description of the assembled closure, the finger loop pull member is compressed into the diaphragm pocket **57** by the lower end of the plug wall **88** so that its neck **55** is housed within the channel portion **60** and the loop **56** is pressed down against the wall **59**. The cap seal **95** is then placed over the plug and ring and the entire assembly supplied as a unit to the container filler. The filler then places the assembly over the opening of the container after the same has been filled through that opening. In FIG. 12 a container wall **100** is shown having an opening surrounded by an upwardly extending neck **101** which terminates at its upper end in an outward curl or bead **102**. Hhere it can be seen that the slight outward inclination of the wall **63** acts as a lead for quick and accurate positioning of the assembly on the opening neck. The assembly is permanently sealingly engaged to the neck **101** by simultaneously crimping or otherwise forming the outer walls **63**, **73** and **97** radially inwardly underneath the bead **102**.

To subsequently gain access to the container contents the cap seal **95** is torn off and the plug **80** removed whereupon the pull member springs back to its raised position as shown in FIG. 10. The loop **56** is then accessible for insertion by one's finger whereupon sufficient pulling force can be easily applied to commence tearing of the diagram **53** along the tearing zone **54**. Complete removal of the diaphragm **53** with its integrally formed pocket **57** and finger loop pull member unseals the container for initial dispensing after which tight reclosing may be effected by means of either of plugs **80** or **90**.

The method of molding the plastic plug receiving member **50** is illustrated in FIG. 13 and is basically the same as that employed in forming the captive cap type closure shown in FIG. 1–4. This mold comprises an upper member **300** and a lower member **310**. The upper member being provided with a cavity portion **320** corresponding to the peripheral securing lip and gasket seat **66**. Also provided in the upper member **300** is a thread forming portion **321**. Moveably mounted in the upper member **300** is segment **360** connected to a slideable pin **370**. The segment **360** fills that part of the mold necessary for creating the cavity wall corresponding to the upper surface of the diaphragm **53** and the under surface of the pull loop **56** and connecting neck **55**. The segment **360** is thus moveable, in the same manner as described in connection with FIGS. 6 and 7, away from the upper member **300** with the cavity portions corresponding to the weakened tearing zone **54** and the remaining surfaces of the pull member being part of the upper member **300**. The lower mold member **310** is provided with a cavity **400** for forming the wall **51** and the diaphragm **53** of the member. Numeral **410** indicates a sprue cavity portion for filling the mold. The mechanical forces applied to the pull member during the ejecting operation cause the difference in inclination of the loop **56** as seen comparing FIGS. 10 and 13.

The foregoing disclosure as embodied in the two different types of closures now makes it possible to provide an integrally molded plastic closure member having a tamperproof tear out diaphragm which can be easily removed with the unaidet hand. In terms of convenience this feature is of course most meritorious however, just as important is that fact that the use of implements for puncturing and cutting frequently causes contamination of the container contents. The invention eliminates this possibility. Furthermore, through the method therein presented the finger loop pull member can be formed in a simple and economical manner within a closure wall where it can be depressed to accommodate an overlying secondary closure for reuse and also raised outwardly for easy access.

It is, of course to be understood that various changes may be made in the construction and method described and shown and that various other embodiments of the invention can be made without departing from the spirit and scope thereof. It is accordingly intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention what I claim is new and desire to secure by Letters Patent is:

**1**. In closure construction, an annular body member molded of synthetic plastic material, said body member defining an axial dispensing passage, an integrally formed diaphragm closing of said passage, a weakened tearing zone connecting said diaphragm and said body member, a pull member integrally connected to said diaphragm adjacent said tearing zone, said pull member formed with

an annular finger loop adapted to receive a single finger to enable hand removability of said diaphragm by tearing.

2. In closure construction as in claim 1, said diaphragm formed within said dispensing passage with said tearing zone below the upper end of said body member.

3. In closure construction as in claim 1, said pull member comprising an upwardly and radially inwardly extending neck connected at its lower end to a peripheral portion of said diaphragm and terminating in said finger loop.

4. In closure construction as in claim 1, including closure engaging means formed on said body member about said diaphragm.

5. In closure construction as in claim 4, said pull member extending above said closure engaging means.

6. In closure construction as in claim 4, including a closure member secured to said closure engaging means and confining said pull member between said closure member and said dispensing passage.

7. In closure construction as in claim 6, wherein said pull member is axially depressed by said closure.

8. In closure construction as in claim 1, including an annular container neck engaging surface formed on the exterior of said body member having a concavely curved cross sectional configuration.



9. In closure construction as in claim 8, including a container wall opening surrounded by a downwardly and radially inwardly extending conical neck terminating in a free edge, said free edge biting into said concavely curved surface thereby effecting a permanent leakproof engagement between said container wall and said body member.

10. In closure construction as in claim 1, wherein said weakened tearing zone has a reduced cross-sectional thickness and a substantially V-shaped cross-sectional configuration whereby the tearing force is concentrated at the reduced section at the apex of the V-shape.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,127,064 | 3/1961 | Fairchild | 220—38.5 |
| 3,135,441 | 6/1964 | Wise et al. | 222—541 |
| 3,239,112 | 3/1966 | Porcelli | 222—541 |

GEORGE T. HALL, *Primary Examiner.*

U.S. Cl. X.R.

220—38.5; 22—541