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(54) **COMBINED LIP AND SHOULDER SEAL FOR THREADED CAP**

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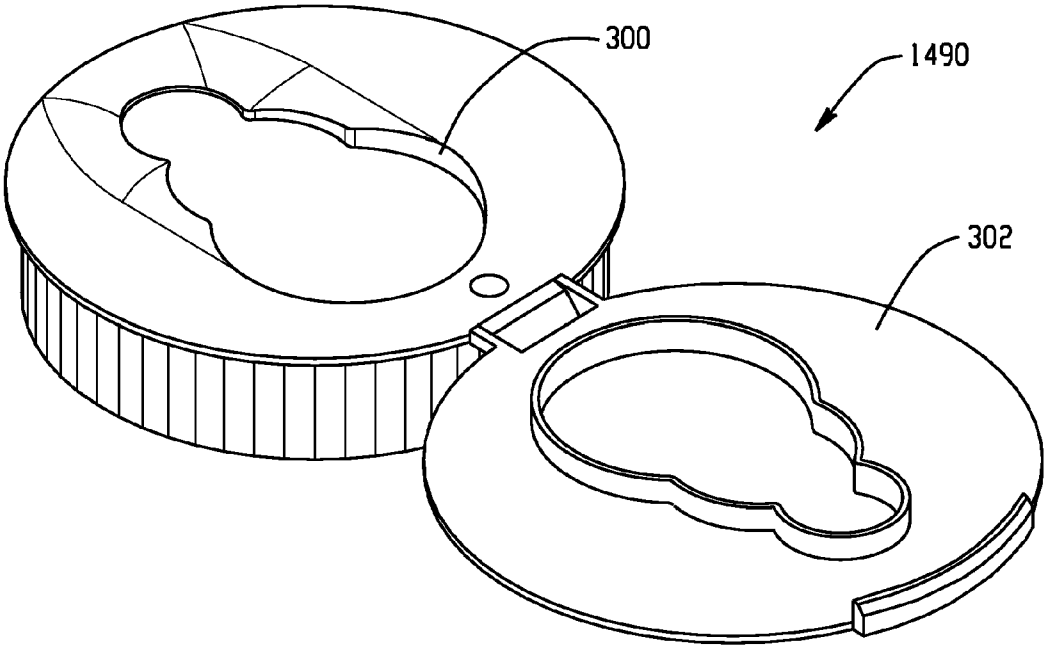
(57) **ABSTRACT**

An improved cap is provided for sealing an opening formed in an associated bottle. The cap is preferably internally threaded for receipt over a threaded portion of the bottle. A flap extends from a planar surface of the cap and is directed for receipt in the associated bottle opening. A shoulder also extends outwardly from the planar surface and is spaced inwardly from the flap to engage the seal flap as the cap is threaded onto the bottle. The cap is preferably formed of a rigid plastic such as high density polyethylene (HDPE).



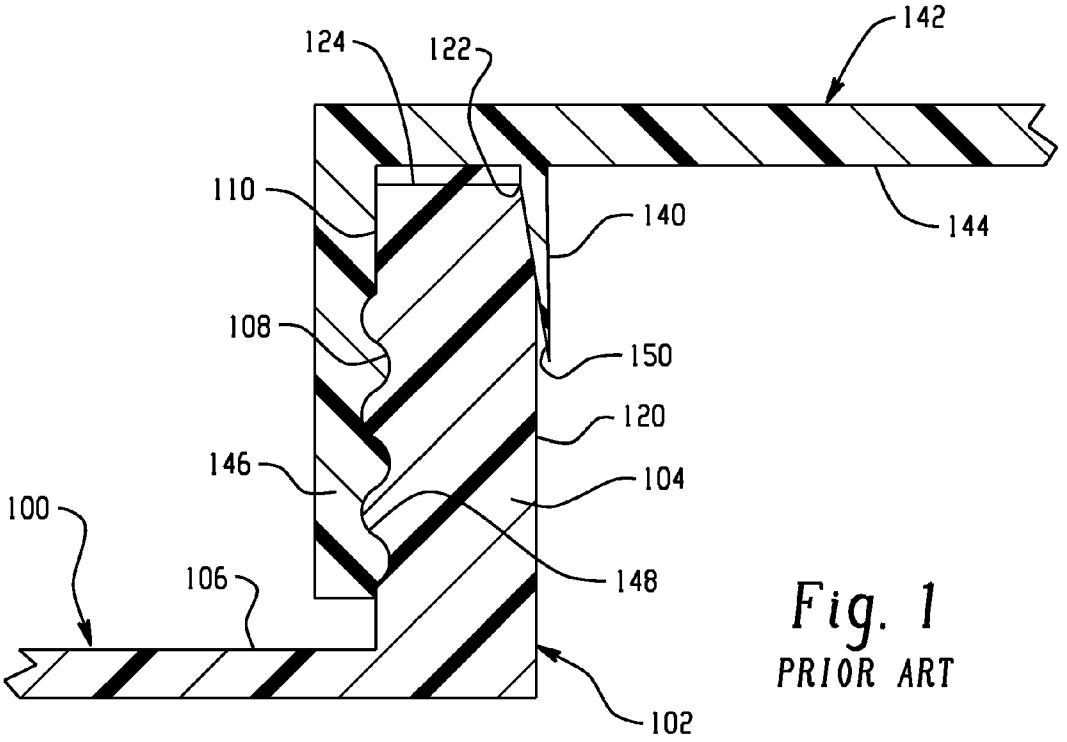


Fig. 1
PRIOR ART

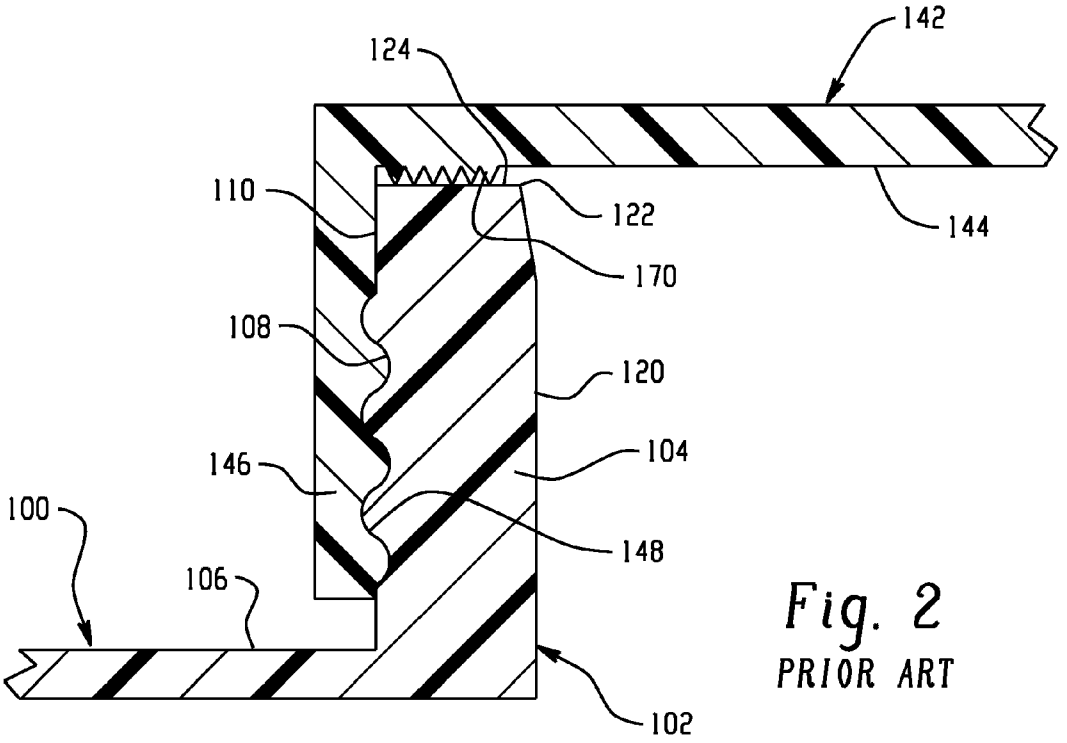


Fig. 2
PRIOR ART

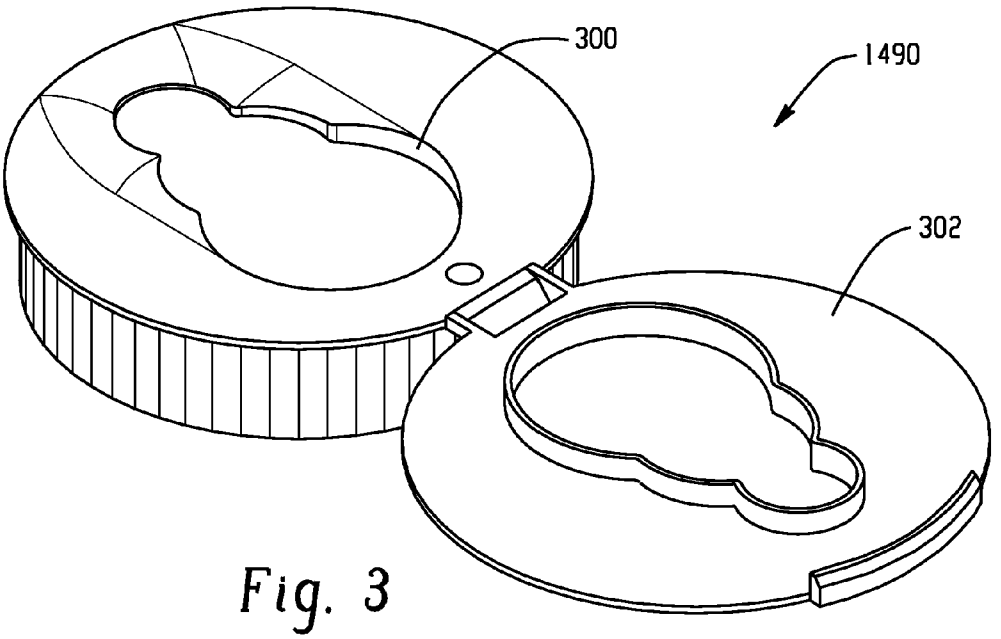


Fig. 3

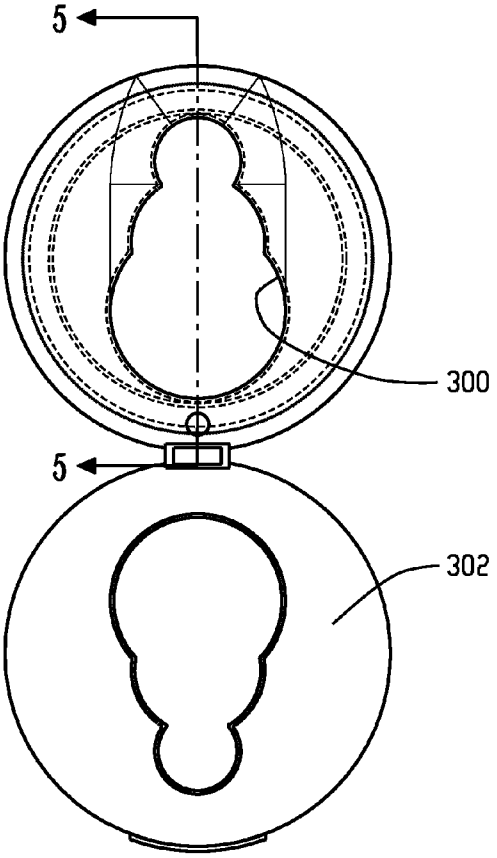


Fig. 4

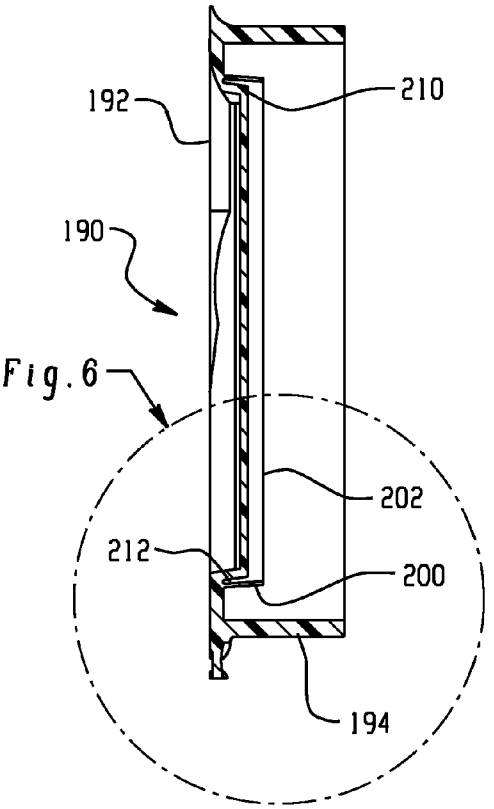


Fig. 5

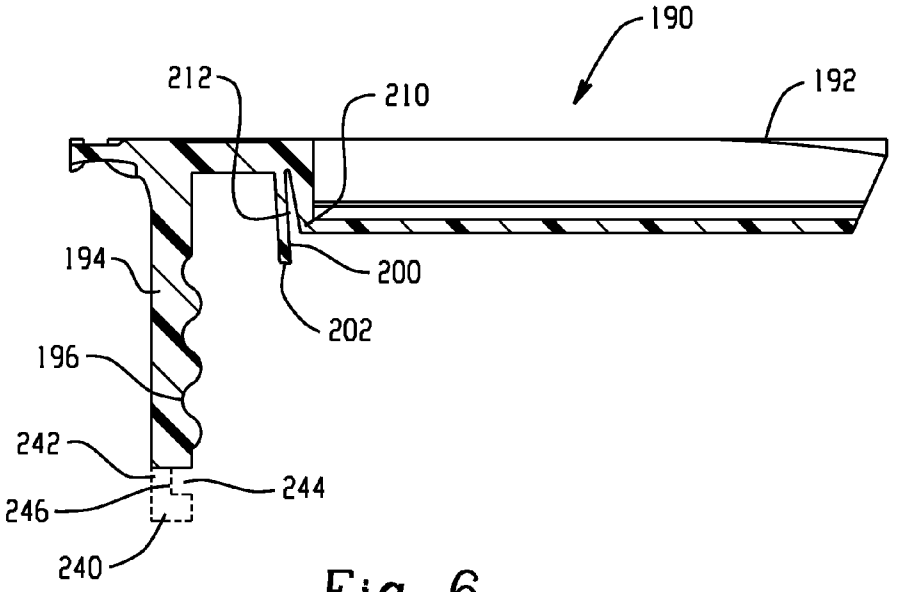

190
212
210
192
194
200
202
196
242
244
246
240

Fig. 6

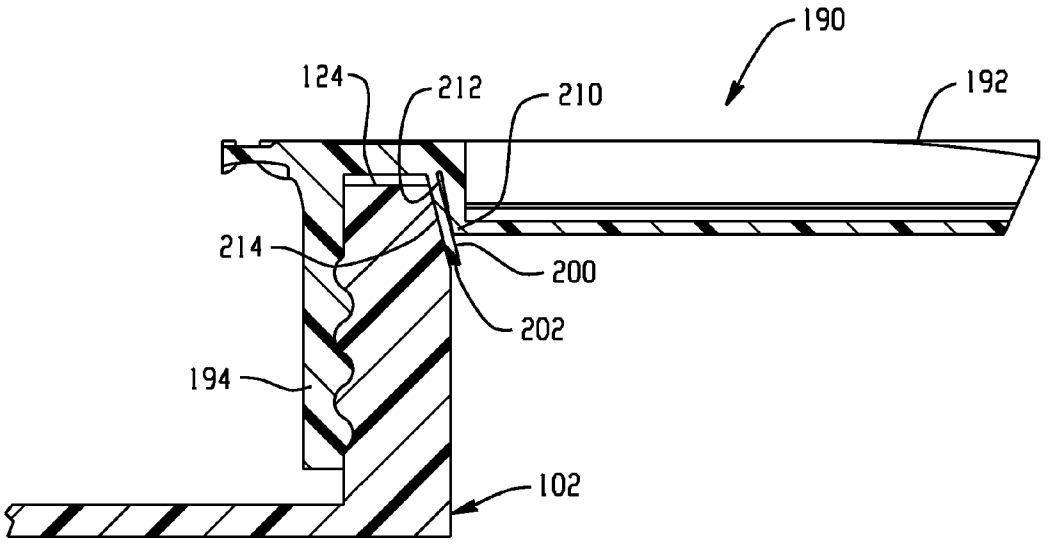

190
124
212
210
192
214
200
202
194
102

Fig. 7

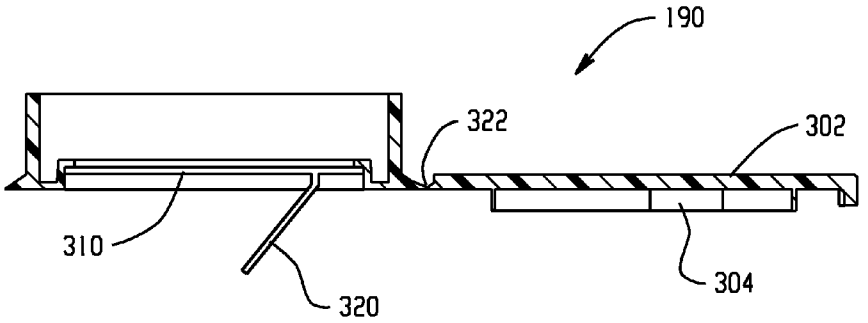


Fig. 10

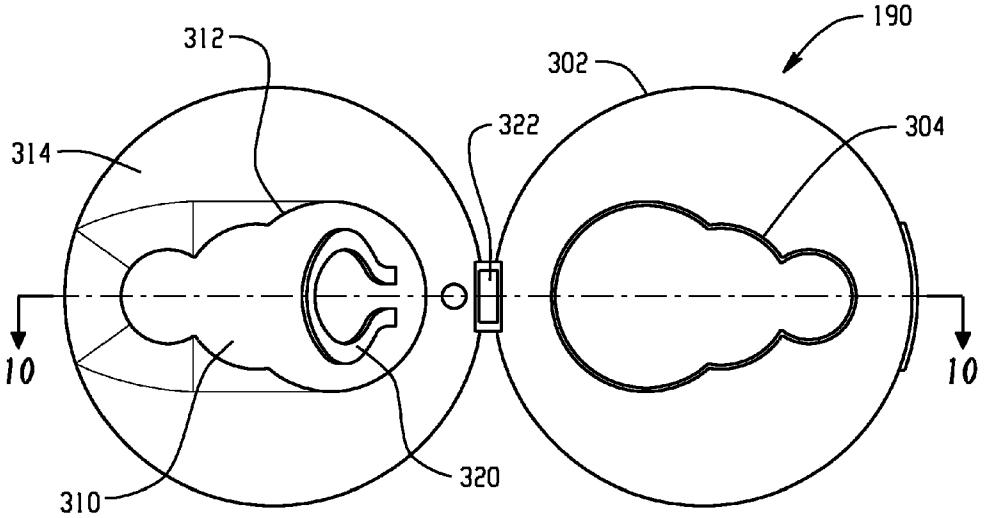


Fig. 8

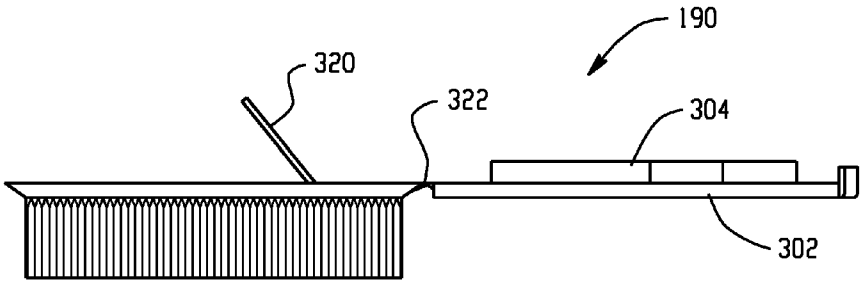


Fig. 9

COMBINED LIP AND SHOULDER SEAL FOR THREADED CAP

BACKGROUND OF THE DISCLOSURE

[0001] Blow molded containers or bottles are used for a wide variety of fluid products, and find particular use in the dairy industry for milk, juices, flavored waters, etc. The bottle typically includes a raised shoulder or neck surrounding an opening that is used for introducing or filling the fluid into the bottle, and likewise the same opening is oftentimes subsequently used for dispensing the fluid from the bottle. In some instances, the opening may be used for only one of filling or dispensing and, in either situation, a closure cap is typically positioned over the opening once the bottle has been filled.

[0002] Oftentimes, the cap is internally threaded and cooperates with external threads on the neck that surround the bottle opening (see, for example, WO2008/091936 developed by the same inventors, the details of which are expressly incorporated herein by reference). It is desirable for the opening to be sealed from the external environment. This can be accomplished in a number of different ways. For example, a foil or gasket seal is commonly placed over the opening and secured to the bottle. Although this arrangement provides an effective seal, and provides a clear indication of whether the seal has been tampered with, the foil seal represents extra material, i.e., the gasket or foil, as well as additional processing which includes associated equipment, material, and additional time in the processing line to secure the gasket/foil seal over the opening for use in conjunction with the cap.

[0003] In other instances, the opening is sealed in a different manner. For example, an internal surface of the cap includes a series of closely spaced concentric ribs, i.e., a series of concentric projecting surfaces, placed under axial compression as the ribs are essentially compressed or crushed against an outer radial surface of the neck as a result of imposing a high torque on the cap as the cap is threaded onto the bottle. Because the ribs are compressed, the material used is preferably a softer material that is capable of being compressed, for example a polypropylene is commonly used. This arrangement does not provide a tamper evident feature. Further, if the threads are not well formed, the torque developed between the neck and cap may be insufficient to develop the desired force to compress the ribs and provide an effective seal. Similarly, an imperfect neck finish (e.g., a burr or flash remaining on the neck) will prevent the ribs from being properly compressed. As a result, the cap does not properly seal to the bottle.

[0004] An alternative manner of sealing the bottle is to use a flexible flap that extends from the internal surface of the cap and forms an interference seal with a shoulder on the bottle neck. The flap extends downwardly from the inner surface of the cap, and has an outer radial dimension greater than an inner diameter of the bottle opening. The cross-sectional thickness of the flap preferably decreases as the flap extends outwardly from the cap. Moreover, a distal end of the flap is positioned for receipt within the neck that forms the opening of the bottle and advantageously centers or orients the cap in place on the neck. Again, a softer material such as a polypropylene is commonly used for a cap of this type in order to provide sufficient flexibility to the flap as the flap is urged into sealing engagement with the inner wall surface of the shoulder that forms the opening. This seal arrangement also requires a precise fit or else the flap is not properly oriented relative to the neck and there is no other structure in the arrangement that holds or guides the flap into the correct location. Further, this seal arrangement does not provide tamper evidence.

[0005] It is still desirable to locate the seal at the edge of the opening, or preferably inside the throat of the opening. However, this is difficult to do with existing cap designs.

SUMMARY OF THE DISCLOSURE

[0006] An improved cap is provided that provides an effective seal with the bottle opening, and substantially decreases the cost per cap.

[0007] The cap includes a generally planar surface that overlies the bottle opening. A sidewall extends from the planar surface and surrounds the bottle opening. The lip extends from the planar surface and is directed inwardly from the side wall for receipt in the bottle opening. A shoulder extends outwardly from the planar surface and is spaced laterally or radially inwardly from the lip for engaging the seal lip.

[0008] Preferably, the lip has a variable thickness along the length thereof.

[0009] The cap is preferably formed of a rigid plastic such as HDPE. The shoulder extends outwardly from the generally planar surface a dimension less than the lip extends outwardly from the same surface.

[0010] In addition, a stop surface may be provided on the cap to operatively engage a corresponding stop shoulder on the bottle to limit or define a maximum force imposed on the lip and shoulder.

[0011] A pour opening may be incorporated into the generally planar member, and a closure lid hinged to the cap.

[0012] The pour opening includes a thin-walled tamper-evident member that is integrally molded with the generally planar member.

[0013] A primary advantage associated with the present disclosure is the improved sealing associated with the new cap.

[0014] Another advantage residing in this disclosure relates to the substantially reduced costs to manufacture.

[0015] Still another benefit is associated with the reduced quality required of the neck finish.

[0016] Yet another advantage resides in the elimination of components (such as a separate gasket or foil seal) as well as reduced processing time in the manufacture of the bottle.

[0017] Yet another advantage is associated with the ability to provide a tamper-evident feature without additional costs.

[0018] Still other benefits and advantages of the disclosure will become apparent from reading and understanding the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** is a cross-sectional view of a portion of a bottle neck and associated cap of a prior art arrangement.

[0020] FIG. **2** is a cross-sectional view of a portion of a cap of yet another prior art arrangement.

[0021] FIG. **3** is a perspective view of the new cap with a hinged lid shown in an open position.

[0022] FIG. **4** is a plan view of an outer surface of the cap of FIG. **3**.

[0023] FIG. **5** is cross-sectional view through the new cap taken generally along the lines **5-5** of FIG. **4**.

[0024] FIG. **6** is an enlarged sectional view of the encircled region of FIG. **5**.

[0025] FIG. **7** is an enlarged view similar to FIG. **6** but illustrating the cap secured to the bottle.

[0026] FIGS. **8-10** illustrate plan, elevational, and cross-sectional views of a tear away panel that may be included in the cap.

DETAILED DESCRIPTION

[0027] FIG. **1** is an enlarged, cross-sectional view of a portion of a cap received on the neck of a known bottle **100**. Particularly, the bottle or container **100** is preferably a thin-walled blow molded plastic bottle as is conventionally used in the dairy industry. The bottle has a weight-to-volume ratio on the order of sixty to seventy grams per gallon and an average wall thickness on the order of 0.010-0.015 millimeters, although the weight-to-volume ratio may be different without departing from the scope and intent of the present disclosure. As noted in the Background, the bottle includes an opening **102** formed by a neck or wall **104** that oftentimes protrudes outwardly from a surface **106** of the bottle. The neck typically includes a thread portion such as helically extending thread portions **108** that extend at least partially about a circumference or outer surface **110** of wall **104** of the neck. An inner surface **120** of wall **104** defines the opening **102** through the bottle. The opening is advantageously used to fill the fluid contents into the bottle, and is oftentimes used to also serve as the pour opening for selectively dispensing the fluid contents from the bottle.

[0028] In the arrangement shown in FIG. **1**, the inner surface **120** forms a sharp corner or edge **122** with an upper surface **124** of the wall **104**. The sharply defined edge **122** is dimensioned for engagement with flap **140** that extends outwardly from cap **142**, particularly the planar portion **144** thereof. The flap typically depends from an underside surface of the planar portion **144** at a region spaced radially inward from sidewall **146** of the cap. The sidewall likewise includes a thread portion **148** such as the internal thread portions that cooperate with the external thread portion **108** of the neck. As the cap is threaded onto the bottle, the flap **140**, and particularly surface **150** thereof, engages the sharp edge **122** of the shoulder. Further axial advancement of the cap onto the shoulder by rotating the cap onto the bottle results in further deflection of the lip **140** and sealing engagement with the edge **122** and interior surface of the neck.

[0029] This interference fit between the flap of the cap with the interior shoulder of the neck encounters the following problems—it is not always a perfect fit and potential leaking can develop at the cap, there is no tamper evidence, and instead requires the additional expense of an additional foil seal.

[0030] An alternative arrangement is shown in FIG. **2**. For purposes of brevity and ease of understanding, like reference numerals will refer to like components, while new reference numerals will identify new components. The flap is eliminated in this embodiment, and instead a gasket or series of ribs **170** extend axially inward from the inner face of planar member **144**, at a location spaced radially inward from the sidewall **146** of the cap. Again, the cap is preferably internally threaded as represented by reference numeral **148**, and the shoulder/wall **104** is preferably externally threaded as represented by thread portions **108**. Upon axial advancement of the cap relative to the shoulder, through selective rotation of the cap relative to the bottle, the upper surface **124** of the shoulder engages the ribs **170**. The ribs are compressed or crushed in order to effect a seal between the cap and the bottle. However, like the embodiment of FIG. **1**, there are drawbacks to this arrangement also (no tamper evidence, imperfect neck finish where a burr would preclude effective sealing, imperfect threads do not generate desired sealing force, etc.).

[0031] Turning to FIGS. **3-7**, the present disclosure relates to a new seal arrangement for a cap used on a bottle. Again, for ease of understanding and brevity, like reference numerals will refer to like components where possible, while new elements will be identified by new reference numerals. More particularly, cap **190** is formed entirely of a high density polyethylene, a preferred material of construction. Even using this harder material, the cap is able to effectively seal along an inside region of the neck of the bottle opening. Cap **190** includes a planar portion **192** and sidewall **194** that is disposed substantially perpendicular to the planar portion. The sidewall is preferably internally threaded as represented by threaded region **196** (such as a helical thread) that cooperates with external threaded portion **108** of the shoulder/wall **102** in much the same manner as described above with respect to the prior art arrangements. Here, however, a seal flap **200** (sometimes referred to as a flapper valve) extends downwardly from the cap, preferably from the interior face of planar region **192**, at a region spaced radially inward from the interior surface of the cap sidewall **194**. The flap **200** has a tapering conformation in the preferred arrangement that decreases in thickness as it extends away from the planar portion **192** to an outer terminal end **202**. This tapering conformation provides greater flexibility to the flap adjacent its outer terminal end.

[0032] The interconnecting region of the flap with the interior surface of the cap is preferably spaced radially inward from the sidewall **194** to accommodate the cross-sectional thickness of the shoulder **120** extending from the bottle. Thus, as illustrated in FIG. **6**, the interconnecting region of the flap with the cap interior surface is spaced approximately 0.110 inches from the inner surface of the cap sidewall and the terminal and of the flap in an un-deflected state is spaced a greater distance from the cap sidewall inner surface. By way of example only, the terminal end **202** is spaced approximately 0.117 inches from the cap sidewall inner surface, although these dimensions are meant to be exemplary only and not limiting. The general purpose of the inward bend and the tapering conformation of the flap is to provide centering of the seal flap/cap relative to the bottle opening as the cap is threaded onto the bottle shoulder and the cap axially advances onto the shoulder.

[0033] The seal assembly of the present disclosure also includes a rigid pinch rib or shoulder **210** that is disposed radially inward of the flap. Particularly, the rib is spaced by radial gap **212** from the flap. The pinch rib extends generally normally outward from the underside or interior surface of the cap planar portion at a substantially reduced height relative to the height of the flap. As shown in FIGS. **6** and **7**, the rigid pinch rib has a height approximately one-half the height of the flap. The pinch rib is also illustrated as merging into a central depressed region on the cap although it will be appreciated that the rib can also be formed as an annular projection extending from the underside of the cap and over a limited radial extent if so desired. Preferably, the rigid material of the cap that forms the pinch rib can handle substantial compressive forces. Thus, as the cap is rotated onto the bottle, and significant radially inward forces are imposed on flap **200**, an effective inner diameter seal is formed between the flap and the chamfer or tapered surface **214** of the bottle opening. As

shown, the chamfer **214** is provided along the upper, inner face of the shoulder **104**. That is, the chamfer **214** is preferably defined at the intersection or interface of wall/shoulder **102** and the upper surface **124** of the shoulder. Further inward deflection of the flap, however, is precluded by the abutting engagement between the flap **200** and the rigid pinch rib **210**. Thus, as a radially outer face of the flap sealingly engages with the bottle shoulder along chamfer **214**, the opposite or inner face of the flap sealingly engages with the pinch rib **210**.

[0034] This arrangement allows significant torque to be imposed on the cap to create the seal. The chamfer of the body shoulder serves as a self-centering or lead-in portion for the flap to assure proper location of the cap on the neck opening. Moreover, the pinch rib **210** serves as a stop to limit the torque imposed on the flap.

[0035] Moreover, because a sufficient torque on the order of about 20 inch pounds can be imposed on the cap (as compared to a approximately 2-5 inch pounds in the prior art), there is no need for a separate foil seal, no need for a gasket, and if desired, the structure can be made so that the cap is never removed from the bottle. That is, it is contemplated that the opening may be used only for filling the bottle, the cap then positioned in place, and an anti-taper member or ring to **240** (shown in dotted line in FIG. **6**) provided on the lowest extension of the sidewall **194** of the cap. The anti-tamper ring **240** is secured by circumferentially spaced frangible portions **242**. An undercut region **244** snaps into place over a radial protrusion **246** extending from the shoulder, but if the cap is subsequently removed from the shoulder, the frangible connections will break, and thus provide clear indication of attempted removal of the cap, i.e., tampering.

[0036] Alternatively, the arrangements of FIGS. **3-7** can also be used in a dispensing opening. For example, with additional reference to FIGS. **3-5**, a pour opening and pour lip are provided in a hinged cap (see co-pending PCT application Serial No. PCT/US09/057336, filed 17 Sep. 2009, the disclosure of which is incorporated herein by reference). By moving the pouring edge outwardly to the surface that extends radially outward from the sidewall, the overall height of the bottle can be reduced, and thus less plastic required in the total bottle.

[0037] As generally illustrated in FIGS. **3** and **4**, the cap **190** includes an opening **300** that is selectively closed by hinged lid **302**, and particularly a seal member **304** that extends outwardly from the lid **302** for receipt in the opening **300**. A removable or tear-away seal panel **310** in the cap (of the type generally shown and described in the co-pending PCT application identified above) is preferably integrally molded with the cap. The panel **310** is segregated about a periphery by a frangible, thin walled portion **312** where the tear-away panel interconnects with the closing surface **314** of the cap. A tab, such as ring tab **320**, is secured to the tear-away panel **310**, and once a consumer opens the lid **302** of the cap assembly, by rotating the lid about the hinge **322** to an open position (FIG. **8**), the tab **320** is exposed and the consumer can remove the tear-away panel **310** by rupturing along the frangible connection. Once the tear-away panel is removed, the opening **300** is formed in the cap assembly. Likewise, seal **304** extending from the underside of the lid **302** is dimensioned for a sliding sealing fit as an original seal, and subsequent re-sealing of the contents of the fluid container. Tamper-evident protection is also provided by way of the tear-away panel **310**, i.e., a consumer can readily recognize if the tear-away panel is missing and whether the contents of the container have been possibly compromised. Use of the tear-away panel which may be easily removed by pulling on the ring tab **320** and removing the panel **310** from the remainder of the cap assembly **190**, advantageously eliminates the need for a separate foil seal, gasket, or similar structure.

[0038] The price of each cap can be reduced by approximately fifty percent (50%) with the present cap, while still maintaining the ability to effectively seal along the inside of the neck, providing for tamper-evident capability, and providing an effective seal that allows substantial torque to be imposed on the cap to create the seal.

[0039] The disclosure has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the exemplary embodiment be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

Having thus described the invention, it is now claimed:

1. A cap for selectively sealing an opening formed in an associated bottle that includes an external thread portion around the opening, the cap comprising:

a generally planar surface dimensioned to overlie the associated bottle opening;

a sidewall extending from the planar surface including internal thread portions thereon dimensioned for cooperative threaded engagement with the associated bottle thread portion;

a lip extending from one of the planar surface and the sidewall and directed inwardly from the sidewall for receipt in the associated bottle opening; and

a shoulder extending outwardly from the planar surface and spaced inwardly from the lip for engaging the seal lip as the cap is threaded on to the associated bottle.

2. The cap of claim **1** wherein the lip has a variable thickness along a length thereof.

3. The cap of claim **2** wherein the lip has a thicker cross-sectional dimension adjacent an interconnecting region with one of the planar surface and the sidewall.

4. The cap of claim **1** wherein the lip has a thicker cross-sectional dimension adjacent an interconnecting region with one of the generally planar surface and the sidewall.

5. The cap of claim **1** wherein the cap is formed of a rigid plastic such as HDPE.

6. The cap of claim **1** wherein the lip extends from the generally planar surface and is spaced radially inward from the sidewall.

7. The cap of claim **6** wherein the shoulder is spaced radially inward of the lip.

8. The cap of claim **7** wherein the shoulder extends outwardly from the generally planar surface a dimension less than the lip extends outwardly from the generally planar surface.

9. The cap of claim **1** wherein the shoulder extends outwardly from the generally planar surface a dimension less than the lip extends outwardly from the generally planar surface.

10. The cap of claim **1** wherein the shoulder is spaced radially inward of the lip.

11. The cap of claim **1** further comprising a stop surface on the cap that is located to operatively engage a corresponding stop shoulder on the associated bottle to limit forces imposed on the lip and shoulder.

12. A molded plastic cap for a fluid bottle having an opening, the molded plastic cap comprising:

a generally planar member dimensioned for covering receipt over the bottle opening;

a sidewall extending outwardly in a first direction from adjacent a perimeter of the generally planar member and surrounding the opening;

a contoured lip extending a first dimension from an interior surface of the generally planar member and inwardly from adjacent a perimeter thereof; and

a shoulder extending a second dimension from the interior surface of the generally planar member and spaced further inwardly from the perimeter than the lip for sealingly engaging the lip to the associated bottle.

13. The cap of claim **12** wherein the lip has a reduced thickness at a distal end relative to a proximal end.

14. The cap of claim **12** wherein the cap is formed of a rigid HDPE material.

15. The cap of claim **12** wherein the lip first dimension is greater than the shoulder second dimension.

16. The cap of claim **12** wherein the sidewall includes a thread portion along an inner surface thereof for cooperative threaded engagement with an external thread portion around the opening of the associated bottle.

17. The cap of claim **12** further comprising a stop surface for limiting advancement of the cap onto the bottle over the opening.

18. The cap of claim **12** further comprising a pour opening in the generally planar member and a closure lid hinged thereto.

19. The cap of claim **18** wherein the pour opening includes a thin walled tamper evident member integrally molded with the generally planar member.

* * * * *