A thin walled, flexible container and a closure is provided for sealing an open mouth of the container. The container is a blow molded, thin walled and flexible bottle. The container includes a cylindrical neck having a multi-lead thread construction on an outer surface. The closure includes a substantially cylindrical cap shell having an end panel that extends into a downwardly depending cylindrical side wall forming a skirt portion. A generally cylindrical gasket is adhered to the end panel of the closure. The gasket includes a generally flat annular surface that cooperates with the sealing surface of the container neck to form a seal and provide support to the container rim for resisting mouth-distorting forces.
CLOSURE FOR THIN-WALLED CONTAINERS HAVING A MULTI-LEAD THREADED NECK

[0001] The present invention relates generally to closures for containers and, more particularly, to a gasketed closure for thin-walled, flexible containers having a multi-lead threaded neck. In this regard, an important aspect of the present invention is directed to a gasketed closure and thin-walled, blow molded bottle combination, wherein the closure and bottle neck have multi-lead threaded construction and the gasket includes a thermoplastic elastomer and has a profile that resists mouth-distorting forces produced by the mating engagement of overlapping end portions of the multi-lead threads on the closure and bottle neck.

[0002] Plastic closures for containers having a thin wall construction, such as, for example, extrusion blow molded bottles, desirably must be capable of high speed application and also of accommodating imperfections in the shape of the neck finish to provide effective sealing of the container. Unlike conventional metal caps, these plastic closures often do not employ a sealing gasket or liner, but instead rely upon the properties of the plastic and the interior cap geometry to effect a seal with the container or bottle to which the closure is applied.

[0003] U.S. Pat. No. 3,901,404 describes a typical linerless plastic closure which utilizes three sealing surfaces which are integrally formed with the cap shell. These sealing surfaces engage the neck of a bottle to which the closure is applied along its inside surface, top surface and outside surface. The closure and bottle neck are of a single-lead, threaded construction. During tightening of the closure onto the bottle neck, the cap deforms or flexes to cause the sealing surface to move into flush sealing engagement with a bottle neck at both its top surface and outside surface. This closure, while suitable in many applications, suffers from the lower capping speeds associated with single-lead threaded constructions and can exhibit a potential for a less than satisfactory leakage rate particularly where there are significant imperfections in the neck finish of the blow molded bottle.

[0004] A relatively recently introduced dairy closure has found success in overcoming some of the problems associated with the closure of U.S. Pat. No. 3,901,404 by employing a thermoplastic elastomer top-seal gasket on the inside of a single-lead threaded closure. As such, this dairy closure provides improved sealing, however, it does not enjoy the higher capping speed rates and other advantages associated with multi-lead threaded closures/container neck finished constructions.

[0005] The utilization of multi-lead threaded constructions, however, while affording increased capping speeds produces mouth-distorting forces on the container neck. In particular, at locations wherein the ends of the multiple individual threads on each of the closure and the container bottle neck are in axially-spaced, overlapping relation, increased forces are imparted to the container neck in comparison to the forces imparted along the periphery of the neck wherein the individual threads are in axially-spaced, non-overlapping relation. This causes the container neck and mouth to ovalize or otherwise distort by exerting forces thereon which urge the non-overlapped thread sections outward and thereby creates a potential for increased leakage sites wherein the out-of-round container mouth does not seal with the circular, non-deformed liner or gasket.

[0006] The present invention overcomes the above-mentioned problems and disadvantages by providing a novel closure/thin-walled container combination wherein both the closure and neck of the thin-walled container are of multi-lead threaded construction and the closure includes a resilient gasket that both forms a top seal with a generally flat annular sealing surface that surrounds the open mouth of the container and resists mouth-distorting forces produced by the mating engagement of overlapping end portions of a multi-lead threads on the closure and bottle neck when the closure is applied to the container.

[0007] It is, therefore, a general object of the present invention to provide a new and improved gasketed closure cap and thin-walled container combination.

[0008] Another object of the present invention is to provide a novel gasketed closure cap which is particularly suited for use with a blow molded, thin-walled container or bottle that both accommodate irregularities and imperfections associated with the end finish of such container or bottle and also allows for high speed capping rates associated with multi-lead threaded constructions on both the interior of the cap skirt and exterior of the neck of the container.

[0009] Another object of the present invention is to provide a thermoplastic elastomer gasketed closure which is especially suitable with use for a blow molded, thin-walled container or bottle composed of high density polyethylene or polyethylene terephthalate wherein both the closure and neck of the container or bottle have a multi-lead threaded construction.

[0010] These and other objects of the present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings wherein like reference numerals refer to like parts and in which:

[0011] FIG. 1 is an exploded perspective view of the closure and container (partially shown) in accordance with a preferred embodiment of the present invention with portions of the closure broken away;

[0012] FIG. 2 is a vertical sectional view illustrating a closure of FIG. 1 applied to the container of FIG. 1;

[0013] FIG. 3 is an elevational view of the closure shown in FIG. 1;

[0014] FIG. 4 is a top plan view of the closure shown in FIG. 1;

[0015] FIG. 5 is a bottom plan view of the closure shown in FIG. 1; FIG. 6 is a sectional view taken along line 6-6 of FIG. 4;

[0016] FIG. 7 is a 360° thread development view showing the two-lead thread construction of the closure cap shown in FIG. 1;

[0017] FIG. 8 is a vertical sectional view illustrating a portion of the container shown in FIG. 1;

[0018] FIG. 9 is a 360° thread development view of the two-lead thread construction of the bottle shown in FIG. 1;

[0019] FIG. 10 is a top plan view of the gasket shown in the closure cap of FIG. 1; and,
FIG. 11 is a sectional view taken along the line 11-11 of FIG. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and with particular reference to FIG. 1, a closure cap embodying the present invention is generally designated by the reference numeral 10. As shown, closure cap 10 includes a skirt 11, an end panel 12, a separate gasket 13 adhered or bonded to an inside surface of the end panel, a tamper-indicating band 14 and a pair of multi-lead threads 15, 16, the end portions of which are in axially-spaced, overlapping relation to each other. As shown in the illustrated embodiment the skirt 11, end panel 12, and tamper indicating band 14 are integrally formed by molding and are composed of a thermoplastic polyolefin such as, for example, polypropylene, polyethylene, and copolymers thereof.

Closure cap 10 is in overlying relation to a bottle 17 having a neck portion 18, the exterior surface of which is provided with a pair of multi-lead threads 19, 20 which are adapted for mating engagement with the threads 15, 16 on the cap 10. A retaining bead 21 is axially-spaced below the threads 19, 20 for cooperative relation with the tamper-indicating band 14 when the closure cap 10 is fully seated on the bottle 17. As shown, the end portions of multi-lead threads 19, 20 are in axially-spaced, overlapping relation to each other and the neck 17 terminates in a generally flat annular sealing surface 22 which surrounds an open mouth 23.

While bottle 17 can be formed by any suitable method of construction, it is preferably formed by extrusion blow molding from thermoplastic materials such as, for example, high density polyethylene, polypropylene or polyethylene terephthalate. As such, the neck 18 and annular sealing surface 22 exhibit flexibility and are subject to minor variations which are characteristic of and inherent in the extrusion blow molding process.

In accordance with an important aspect of the present invention, gasket 13 is composed of a thermoplastic elastomer which possesses easy processability and rubbery mechanical performance. Typically, the gasket or liner combination comprises a thermoplastic component and a torque release modifier component with the thermoplastic component consisting essentially of a moldable, saturated A-B-A thermoplastic elastomer block copolymer. The torque release component can be selected from a variety of well known suitable materials such as, for example, fatty acid amides and mixtures of fatty acid amides.

A particularly suitable thermoplastic elastomer comprises a saturated A-B-A block copolymer derived from styrene and butadiene units such as, for example, a styrene-butylene-styrene (SBS) block copolymer or a styrene-ethylene-butylene-styrene (SEBS) type block copolymer which possesses about twenty to forty percent styrene and sixty to eighty percent ethylene-butylene co-monomers monomers. These SEBS polymers have polystyrene endblocks and ethylene-butylene midblocks. As such, these materials possess excellent direct bonding performance, as well as high temperature hermetic sealing characteristics, even under pasteurization, hot fill, and retort processing conditions. Additionally, they provide a desirable balance of mechanical properties combined with odorless and tasteless performance which is important in food packaging applications.

As best shown in FIG. 2, the annular sealing surface 22 of bottle 17 cooperates with a generally flat annular surface 25 on the outer periphery of liner or gasket 13 to form a top seal when the closure 11 is fully seated on bottle 17. Additionally, annular sealing surface 25 of gasket 13 extends inwardly and downwardly forming a tapered circular rim 26 having an inwardly and downwardly inclined surface 27 that engages an inner edge 24 of the annular sealing surface 22 of bottle 17 and serves to stabilize the container mouth during application of the closure 11 to containers or bottle 17 and thereby resist mouth-distorting forces produced by the mating engagement of the overlapping portions of the multi-lead thread constructions on the closure cap and container neck during application of the closure to the container.

Referring to FIGS. 3-6, the sidewall or skirt 13 of closure cap 10, is, in a preferred embodiment, provided with a plurality of closely-spaced vertically extending ribs to facilitate retentional application, removal and reapplication of the closure cap 10 to a container. Skirt 13 extends downwardly into an enlarged cylindrical section 28, the terminal portion of which is connected to tamper-indicating band 14. In the illustrated embodiment, the tamper indicating band is of so-called slit construction, that is, it is secured to enlarged cylindrical section 28 by a discontinuous circumferential slit 29 which readily permits detachment of the tamper indicating band from enlarged cylindrical section 28 when the closure cap is initially removed from the container. It will be appreciated, however, that the tamper indicating band can also be integrally connected to enlarged cylindrical section 28 by a plurality of circumferentially disposed fracturable bridges formed during the molding of the cap shell itself.

As best shown in FIG. 3, a plurality of drain holes 30 are provided in tamper indicating band 14 for facilitating the discharge of liquids during the processing of a container to which the closure cap has been applied. Tamper indicating band 14, as best shown in FIG. 6, includes an upper portion 14a hingedly connected at 24c to a lower foldable band section 14b. As shown in FIG. 2, the terminal portion of the foldable portion 14b of tamper indicating 14 extends radially inwardly and axially upwardly for engagement with retaining bead 21 so that, upon removal of the closure cap from container 17, the tamper indicating band 14 will readily separate and become detached from the remaining portion of the closure cap 10.

FIG. 7 is a 360° thread development view of the multi-lead threads 16 and 17 of closure cap 10. In this regard, it will be appreciated that while the illustrated embodiment includes two threads on the closure cap, additional separate threads are within the scope of the present invention. For example, the two-lead thread construction shown in the illustrated embodiment is particularly suitable for use with closure caps having a nominal diameter of approximately 43 mm. However, multi-lead threaded constructions including 3, 4 or more individual threads can be suitably used in the practice of this invention, particularly with larger diameter closures. FIG. 9 is a 360° thread development view illustrating the two-lead thread construction of the container of the illustrated embodiment. As noted
above with respect to the closure cap, the multi-lead thread construction of the container neck can include 3, 4 or more individual threads.

[0030] As shown in both FIGS. 7 and 9, the individual threads 16 and 17 in the closure cap have their respective end portions in axially-spaced, overlapping relation to each other and the individual end portions of the multi-lead threads 19 and 20 in the container neck likewise have their respective end portions in a similar axially-spaced, overlapping relation. In the illustrated embodiment, the respective overlapped portions of these threads are oppositely disposed from each other along the circumference of the closure cap and bottle neck. As such, increased forces are imparted to the container neck at locations wherein these end portions overlap, causing the container neck and mouth to distort during application of the closure cap to the container. Since the gasket 13 in the closure cap generally retains its circular, as formed condition, distortion of the sealing surface on the container neck can create a potential for increase leakage wherein the out-of-round container mouth does not seal with the circular, non-deformed liner or gasket.

[0031] In accordance with the present invention, the inclined surface 27 of rim 26 of liner or gasket 13 engages with the inner edge 24 of the sealing surface 22 of container 17 and imparts a stabilizing force on the edge 24 which resists distortion of the container mouth caused by full application of the closure cap to the container. Additionally, the support provided by inclined surface 27 of gasket 13 on the edge 24 allows a capping machine to apply increased torque during application and allows improved control of the final position of the closure as well as improved cap application torque control.

[0032] As best shown in FIGS. 10 and 11, in the illustrated embodiment, rim 26 of gasket or liner 13 includes a vertically extending interior facing wall 31 which surrounds a radially interior circular disc-like portion 32. In this regard, however, it will be appreciated that portions of the gasket 13 which are interior of the inclined surface 25 can be varied or modified without affecting the cooperation of the inclined surface 27 of gasket 13 on the inner edge 24 of the container sealing surface 22.

[0033] The present invention has been described in the context of a preferred embodiment with various modifications thereof. It will be apparent to those skilled in this art, however, that modifications and variations therefrom can be made without departing from the spirit and scope of this invention. Accordingly, this invention is to be construed and limited only by the scope of the appended claims.

1-9. (Cancelled).

10. In combination, a thin walled, flexible container and a closure for sealing an open mouth of said container;

said container being a blow molded thin walled and flexible bottle said container including a cylindrical neck having a multi-lead thread construction on an outer surface thereof, said neck being flexible, said multi-lead construction of said neck including at least two separate threads, the end portions of which are in axially-spaced, overlapping relation to each other, said neck also including a generally flat annular sealing surface, said generally flat annular sealing surface of the neck being flexible and having an inner edge that extends into an inner-cylindrical rim that defines a generally circular container mouth;

said closure including a substantially cylindrical cap shell having an end panel that extends into a downwardly depending cylindrical side wall forming a skirt portion thereof, said cylindrical side wall having an inner surface which includes a multi-lead construction sized and positioned to mate with the multi-lead thread construction of said container neck, said multi-lead thread construction of said end cap including at least two separate threads having end portions which are in axially-spaced, overlapping relation to each other; and,

a generally cylindrical gasket adhered to said end panel, said gasket including a generally flat annular surface that cooperates with the generally flat sealing surface of said container neck to form a seal therewith when said closure is applied to said container, said generally flat annular surface of said gasket extending into an inwardly and downwardly inclined surface sized and positioned to engage the inner edge of the container rim to provide support to said container rim for resisting mouth-distorting forces produced by the mating engagement of the respective overlapping portions of said multi-lead thread constructions on said cap shell and container neck during application of said closure to said container.

11. The combination of claim 10 wherein said container is a blow molded bottle.

12. The combination of claim 10 wherein said container comprises a polyolefin.

13. The combination of claim 10 wherein said container comprises polypropylene.

14. The combination of claim 10 wherein said container comprises high density polyethylene.

15. The combination of claim 10 wherein said container comprises polyethylene terephthalate.

16. The combination of claim 10 wherein the overlapping end portions of said multi-lead thread construction on the outer surface of the container neck are oppositely disposed from each other along the circumference thereof.

17. The combination of claim 10 wherein the overlapping end portions of said multi-lead thread construction on said cap shell are oppositely disposed from each other along the circumference of said cylindrical side wall.

18. The combination of claim 10 wherein said gasket comprises a thermoplastic elastomer.

19. The combination of claim 10 wherein said thermoplastic elastomer is a styrene/ethylene/butylene/styrene block copolymer.

20. In combination, a thin walled, blow molded bottle and a closure for sealing an open mouth of said bottle;

said bottle being blow molded, thin walled and flexible, said bottle including a cylindrical neck having a multi-lead thread construction on an outer surface thereof, said neck being flexible, said multi-lead construction of said neck including at least two separate threads, the end portions of which are in axially spaced, oppositely disposed, overlapping relation to each other, said neck also including a generally flat annular sealing surface, said generally flat annular sealing surface of the neck being flexible and having an inner edge that extends into an inner-cylindrical rim that defines a generally circular container mouth;
said closure including a substantially cylindrical cap shell having an end panel that extends into a downwardly depending cylindrical side wall forming a skirt portion thereof, said cylindrical side wall having an inner surface which includes a multi-lead construction sized and positioned to mate with the multi-lead thread construction of said container neck, said multi-lead thread construction of said end cap including at least two separate threads having end portions which are in axially spaced, oppositely disposed, overlapping relation to each other; and,

a generally cylindrical gasket adhered to said end panel, said gasket including a thermoplastic elastomer and having a generally flat annular surface that cooperates with the generally flat sealing surface of said container neck to form a seal therewith when said closure is applied to said container, said generally flat annular surface of said gasket extending into an inwardly and downwardly inclined surface sized and positioned to engage the inner edge of the container rim to provide support to said container rim for resisting mouth distorting forces produced by the mating engagement of the respective overlapping portions of said multi-lead thread constructions on said cap shell and container neck during application of said closure to said container.

21. The combination of claim 20 wherein said container comprises high density polyethylene.

22. The combination of claim 20 wherein said thermoplastic elastomer is a styrene/ethylene/butylene/styrene block copolymer.

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