June 14, 1966 M. BRAUN 3,255,908

ONE PIECE SEALING BOTTLE CAP AND BOTTLE

Original Filed Nov. 4, 1959 2 Sheets-Sheet 1

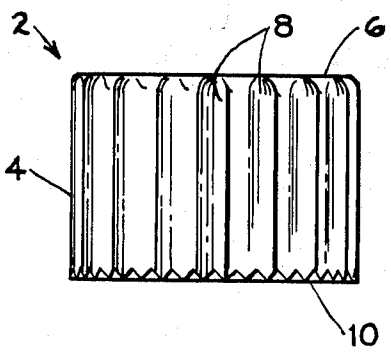


FIG. 1

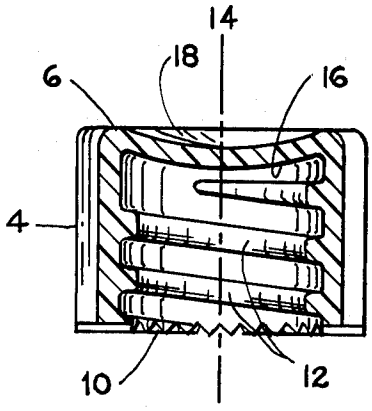


FIG. 2

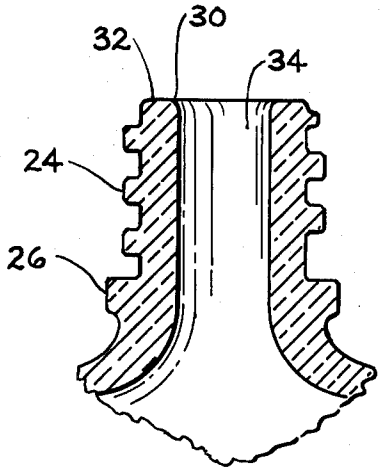


FIG. 3

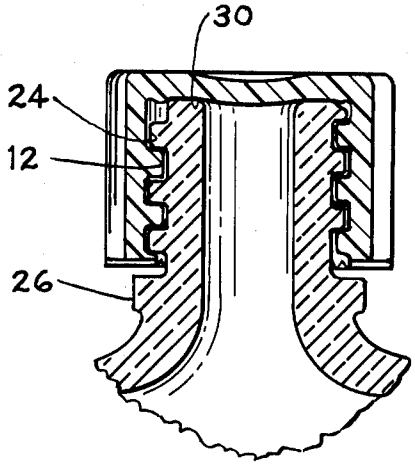


FIG. 4

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ONE PIECE SEALING BOTTLE CAP AND BOTTLE

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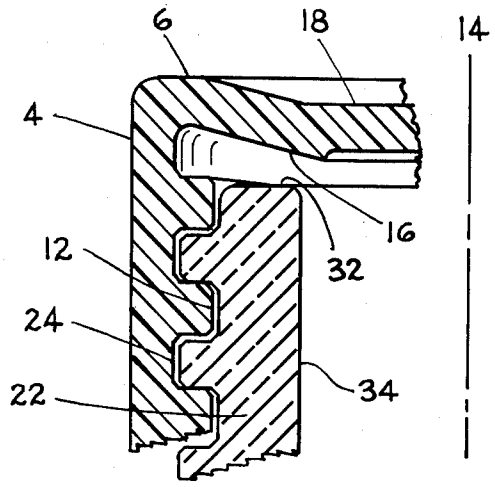


FIG. 5

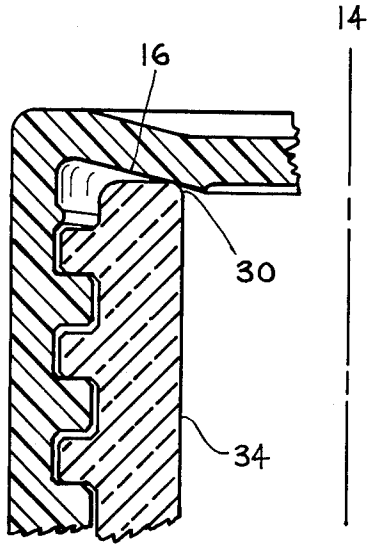


FIG. 6

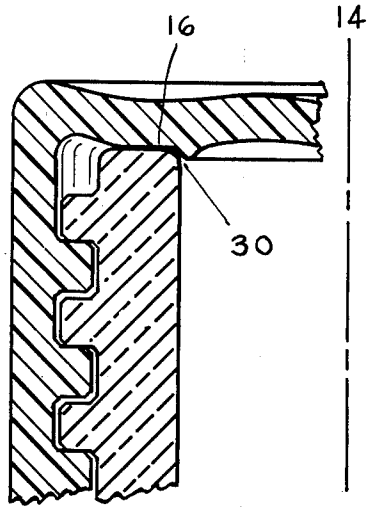


FIG. 7

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3,255,908

ONE PIECE SEALING BOTTLE CAP AND BOTTLE

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Continuation of application Ser. No. 850,835, Nov. 4, 1959. This application Aug. 19, 1963, Ser. No. 302,877
2 Claims. (Cl. 215—43)

This application is a continuation of application Serial No. 850,835, filed November 4, 1959, and now abandoned.

This invention relates to caps and closures for bottles and containers. More particularly it relates to a one piece sealing cap or closure comprised of a flexible and resilient material and the container to which it is sealed.

Caps or closures used for sealing a bottle having an externally threaded neck are comprised of a threaded portion on the inner vertical side wall of the cap to engage the externally threaded neck of the container and a disk type resilient liner positioned beneath the inner surface of the closure to form a seal over the mouth of the container when the cap is fully engaged onto the container.

This type cap requires a separate molding operation to produce the rigid cap, a separate operation to produce the disk and a subsequent assembly of the units.

It is an object of this invention to provide a one piece sealing bottle cap comprised of resilient and flexible material.

It is a further object of this invention to provide a one piece sealing bottle cap comprised of polyethylene.

An additional object of this invention is to provide in combination a container and a one piece screw type sealing bottle cap comprised of a polyolefin adaptable to said container.

Additional and further objects will become apparent from the specifications.

In carrying out the objects of the invention, there is provided the novel construction illustrated in the accompanying drawings and described in the specifications hereinafter.

In the drawings, like parts in the several views are given like reference numerals.

FIGURE 1 is a front view of one embodiment of a cap of this invention.

FIGURE 2 is a cross sectional view taken along the vertical center axis of FIGURE 1 showing the cap with a convex spherical sealing surface.

FIGURE 3 is a cross sectional view of a bottle having a narrow neck and threads on said neck and containing a collar.

FIGURE 4 is a cross sectional view of the cap shown in FIGURE 2 adapted to the threaded neck of a bottle of FIGURE 3 and sealing the contects thereof.

FIGURES 5, 6, and 7 are fragmentary sections of a cross sectional view of another embodiment of a cap of this invention showing the movement involved in the sealing action of the cap when adapted to the neck of a bottle.

In FIGURES 1 and 2, the cap **2** is comprised of a cylindrical shell **4** and a top **6**. The outer surface of the cylindrical shell is provided with vertically extending ribs **8** about its entire periphery as shown, or it can be knurled for ease of gripping. The exact surface topography is not critical, however, it is preferred to have some gripping means to allow for easy application of increased torque when engaging and disengaging the cap from the bottle to which it is adapted.

In a preferred embodiment the cap is provided with a serrated edge **10** at the open end of the cylindrical shell **4** as shown in FIGURE 1. The serrated edge **10** of the cap will lock into position when fully engaged, onto a cooperating serrated edge positioned on a collar

of the neck of a bottle. The engagement of the cooperating serrated edge will prevent unwinding of the cap when the cap is fully engaged due to any reverse torque developed due to vibrations and the like.

The outer surface of the top **6** is provided with a cavity **18** cooperating with the inner convex sealing surface **16** shown in FIGURE 2 and which will hereinafter be described.

In FIGURE 2 there is shown a cross sectional view along the vertical center axis or longitudinal axis of FIGURE 1 of an embodiment of this invention. In FIGURE 2 the one piece sealing cap is symmetrical about the longitudinal axis **14** of the cylindrical shell **4**. Helical threads **12** are integrally molded in the inner side wall of the cylindrical shell. The number, pitch, depth, etc. are selected to conform to the bottle to which it will be adapted. The top **6** of the cap is comprised of an outer concave surface and an inner convex sealing surface which in this embodiment is that of a spherical shell sector having a radius lying on the longitudinal axis **14** of the cylindrical shell. The radius and the thickness of the spherical shell sector are maintained to allow for an upward flexure of the top when the cap is fully engaged with sufficient downward tension developed to maintain the top sealing contact with the lips of the bottle as will be hereinafter described.

In FIGURE 4 is shown the cap illustrated in FIGURE 2 in sealing contact with the container to which it is adapted. The inner rim and lip **30** of the container herein acting as the fulcrum point for the development of the flex-tension forces when the cap is fully engaged. It is to be noted that the outer edge of the top adjacent to the cylindrical shell is pulled downward by tightening the cap while the portion of the top from the fulcrum point to the center is moved upwardly.

In the embodiment wherein the cap is molded of low density (0.92 g./cc.) polyethylene there is a tendency for the cap to distort when the cap is screwed onto a bottle beyond full engagement. There is therefore provided a collar **26**, as shown in FIGURE 3, on the bottle to act as a stop when the cap is fully engaged in sealing contact.

In FIGURES 5, 6, and 7 there are shown sequential views of a fragmentary cross section of another embodiment of this invention taken about the longitudinal axis **14** of the cylindrical shell **4**. In FIGURE 5 there is shown the cap when first engaged on the neck **22** of the container before the sealing surface **16** is engaged. In FIGURE 6 there is shown the embodiment wherein the sealing surface **16** of the cap of FIGURE 5 first engages the inner rim **30** of the mouth of the container. In FIGURE 7 there is shown the cap of FIGURE 5 in full sealing engagement with the inner rim **16** and the lips **32** of the container.

Referring now to FIGURE 5 there is shown the container which is comprised of the neck **22** having threads **24** formed thereon, the throat of the container **34**, the inner rim **30** positioned where the lips **32** join the throat **34** of the container; and the cap **2** molded of polyethylene and which is comprised of the cylindrical shell **4**, internal threads on said shell **12** and a top **6**, the critical details of which will hereinafter be described. In the embodiment shown, the top **6** is comprised of an outer recessed surface **18** forming a cavity and an inner convex sealing surface **16**. In the embodiment the sealing means is comprised of an annular spherical shell segment, the center of said spherical shell lying on the longitudinal axis **14** of the cylindrical shell. The area contained within the annular spherical shell segment is recessed and follows the contour of the outer recessed surface. It is to be noted that the width of the annular spherical shell segment extends from the cylindrical shell to at

least the inner rim **30** of the container to which it is adapted.

In FIGURE 6 there is shown the cap engaged onto the neck of the container just at the point of minimal sealing contact. The inner rim **30** of the container is now in point contact with the annular spherical shell segment **16** and is a fulcrum point wherein the further engagement of the cap onto the neck of the bottle will cause the annular spherical shell segment to flex upwardly.

In FIGURE 7 is shown the cap **2** fully engaged in sealing contact with the inner rim and lips of the mouth. It is to be noted that the annular spherical shell segment **16** has been distorted by the forces applied and is held in sealing contact by the downward forces of flex-tension developed in the segment.

The cap or closure can be comprised of a flexible and resilient material such as polymer and copolymers of ethylene, propylene, butene and mixtures of said monomers, natural and synthetic rubbers, nylon, polyurethanes, vinyl type polymers, and the like. The top of the cap is flexible in the shape and thickness described to allow for flexing and the development of sealing flex-tensions when the cap is fully engaged. Further, the material is resilient to yield and allow it to conform to the circular fulcrum point of the mouth of the container since the containers are not truly circular or level and the material being resilient will conform to the slight irregularities present.

It is understood that the fulcrum point of the container can be the inner rim about the mouth of the container, the lips of the container, or can be a ring positioned on the lip of the container and integrally molded therewith.

In the following examples a cap as shown in FIGURE 2, was molded using polyethylene resin having a density of 0.92 g./cc. with the following dimensions: height of outer side wall 5/8"; inner diameter 3/4"; thickness of outer side wall 1/16" to 3/32" varying to provide the ribbed surface as shown in FIGURE 1; thickness of top varied from 1/16" at a point closest to the outer side walls to 3/32" in the center. The inner convex spherical sealing surface had a radius of 0.937", the center point lying on the longitudinal axis of the cylindrical shell compressing the side wall of the cap.

The dimensions given are for one cap which will effectively seal the contents of a bottle to which it is adapted. If more flex tension is required this can be done by either increasing the thickness of the sealing section, and/or using less flexible material such as high density polyethylene. The optimum variations for each particular size cap and the torque required in tightening to produce the sealing flex tension can be readily ascertained by those in the art with a few empirical tests.

Since it is obvious that various changes and modifications may be made in the above description without departing from the nature or spirit thereof, this invention is not restricted thereto except as set forth in the appended claims.

What is claimed is:

1. In combination a bottle having a neck, a threaded portion on the neck, and substantially flat lip, and a one piece flexible and resilient sealing cap adapted to be secured onto the threaded portion on the neck of the bottle, said cap comprised of a cylindrical shell closed at one end thereof; the said cylindrical shell internally threaded on the inner vertical wall to cooperate with the threaded portion on the neck of the bottle; the said closed end of the cap comprised of an inner convex surface shaped to prevent entrance into the mouth and against the neck of the bottle and an outer concave surface; said convex-concave end having a slight gradual incline forming a spherical shell segment having a radius substantially greater than the distance from the wall of the cylindrical shell to the longitudinal axis of said shell, said segment being flexible and capable to bend upwardly about the lip of the bottle so that said slight gradual incline at an annular portion of said spherical segment adjacent the lip of the bottle straightens out to make a straight line flush contact with the substantially flat lip of the bottle to cause sealing tension between the cap and the bottle when the cap is fully engaged on the bottle while still maintaining substantially a concave-convex structure inwardly of said annular portion.

2. The one piece sealing cap of claim **1** wherein the flexible and resilient material is comprised of polyolefins.

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