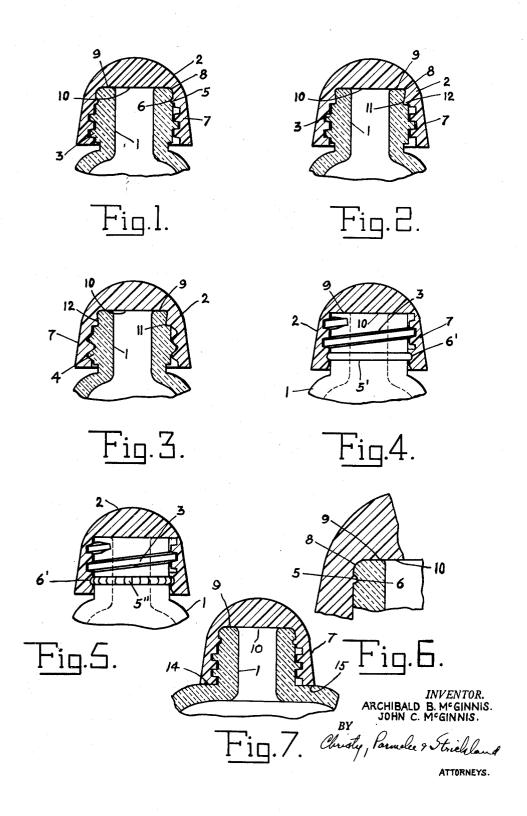
BOTTLE CAP

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BOTTLE CAP

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This invention relates to closures, such as threaded bottle caps, and more particularly, to an improved threaded bottle cap closure constructed from a flexible resilient material which will deform upon the application of force thereto.

More specifically, this invention is concerned with a bottle cap closure constructed preferably from the plastic known as polyethylene. Although the bottle cap closure, in the preferred practice of the invention, will be constructed from $\ 10$ polyethylene, it will be understood that the invention is equally applicable to cap closures constructed from other materials exhibiting similar flexible and resilient characteristics. Other suitable materials, for example, are the various forms 15 of plasticized vinyl resins, natural and synthetic rubber including thickol, butadiene polymers and copolymers thereof, etc. Polyethylene is especially suitable because it is odorless, dense, and has a low coefficient of friction with glass so that 20 it is convenient to screw on and unscrew.

The construction of threaded bottle cap closures from resilient flexible materials of the character referred to, and particularly polyethylene, has been proposed since such materials may be 25 sufficiently rigid to allow for the formation of a screw thread, and yet be flexible enough to seal the bottle without the use of a sealing insert or cap liner. Bottle caps molded in conventional to a thread stripping cap loosening action which takes place when the glass threads are wetted with a liquid, such as oil or liquid soap, contained in the bottle. The conventional molded round thread results in a production of a radially out- 35 ward component of force which distorts the cap skirt radially outwardly to allow it to move out of engagement with the threads on the bottle neck to which the cap is applied. In addition, when the caps are screwed onto a wetted bottle 40 neck with sufficient force to form a seal with the bottle neck, the axial force on the bottle cap results in the cap rotating in a direction effective to loosen itself an amount sufficient to interrupt its seal with the bottle neck.

Polyethylene cap closures may be improved by providing substantially square threads on the cap and bottle neck in place of the rounded threads provided conventionally on molded bottle cap closures. The provision of square threads 50 reduces the radially outward component of force against the cap skirt and thereby the tendency of the skirt to deform when screwed tightly on a bottle neck and thus allow disengagement or stripping of the cooperating threads. By the 55 of a bottle with a cap closure member thereon

provision of a square thread, the tightening force applied to a bottle cap is applied in an axial direction and is effective only to embed the lip of the bottle neck in the structure of the cap to provide a seal. Although the provision of a square thread results in a definite improvement, it is not effective to completely eliminate the selfturning or loosening action of a bottle cap particularly where the threads of the cap are wetted with a liquid such as liquid soap.

One of the principal objects of this invention is to provide a bottle cap closure member molded from a resilient flexible material of the character referred to, and particularly the plastic material polyethylene, which will be effective to form a liquid seal with the bottle when turned tightly down on the neck thereof, and in which means is provided for preventing the cap from loosening itself on the bottle neck even though the threads are lubricated by a liquid material. To this end, the cap and bottle neck are provided with cooperating and interlocking sealing parts comprising an annular bead and a groove, the annular bead being formed on either the internal surface of the cap or on the external surface of the bottle neck and being movable into the annular groove to form a seal between the cap and bottle neck. In order to move the bead and groove into interlocking engagement, the cap shapes from polyethylene are not satisfactory due 30 must be turned down on the bottle neck, and in so doing, the skirt of the bottle cap is deformed outwardly before the bead can move inwardly into interlocking engagement with the groove provided therefor. As the bead moves into interlocking engagement with the groove, the tension due to the deformation of the cap skirt is lessened, but the groove is provided with smaller dimensions than the dimensions of the bead so that tension will be maintained in the material of the cap skirt for holding the abutting surfaces of the annular bead and groove in sealing engagement with each other. In addition to the seal provided by the bead and groove, an interlocking action is had which is effective to prevent a self-turning action of the bottle cap on the bottle neck in a direction to disengage the cap from the bottle neck due to the interlock preventing axial movement of the cap on the bottle neck.

Other objects and advantages of the invention will become apparent from the following description.

In the drawings, there is shown a preferred embodiment of the invention. In this showing: Fig. 1 is a fragmentary vertical sectional view

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illustrating a preferred embodiment of the invention;

Fig. 2 is a view similar to Fig. 1 illustrating a modified embodiment of the invention;

Fig. 3 is a view similar to Fig. 2, but showing 5 conventional round threads on the cap and bottle neck in place of the square threads shown in Fig. 2;

Fig. 4 is a view similar to Fig. 1 showing the interlocking bead and groove in different posi- 10 tions:

Fig. 5 is a view similar to Fig. 4 in which the bead on the bottle is illustrated as having a corrugated surface:

Fig. 6 is an enlarged fragmentary sectional view 15 of a part of the structure shown in Fig. 1; and

Fig. 7 is a view similar to Fig. 1 illustrating a structure in which the bottle and the base of the cap skirt have abutting surfaces.

In the drawings, the numeral I designates the 20 neck of a glass bottle having threads on the external surface thereof for engagement with cooperating threads formed on the internal surface of a threaded opening in a cap closure member 2. The cap closure member 2 is constructed 25 by molding from resilient flexible material, such as the preferred plastic material, polyethylene, although other materials exhibiting similar properties may be used as pointed out above. The bottle neck I may be provided with either square 30 threads 3 for engagement with similar threads on the internal surface of the cap 2 or conventionally-shaped round threads 4 as illustrated in Fig. 3. The use of square threads 3 is preferred since such threads minimize the self-stripping action 35 or possibility of thread disengagement.

In order to provide a seal between the bottle cap and the bottle neck, there is provided an annular bead 5 for movement into interlocking engagement with an annular groove 6. Engage- 40 ment of the bead 5 in the groove 6 provides an interlock to prevent axial movement of the cap on the bottle neck. As shown in Fig. 1, the bead 5 is formed on the internal surface of the cap skirt 7 for engagement in a groove 6 formed on 45 the external surface of the bottle neck adjacent the bottle lip 8. Alternatively, as shown in Fig. 4, the bead 5' may be formed on the bottle neck for engagement in a groove 6' in the cap skirt 7, and positioned on the bottle side of the threads $_{50}$ 3 rather than the lip side of the threads 3 as shown in Fig. 1.

In order for the bead 5 to move into interlocking engagement with the groove 6, it is necessary to deform the skirt 1 of the cap 2 radially out- 55wardly before the bead can move into the groove 6. Referring to Fig. 1, for example, when the cap 2 is screwed onto the neck 1, the threads 3 will move the cap axially downwardly until the bead 5 strikes the pour-lip edge 8 of the bottle. Con- $_{60}$ tinued downward movement of the cap 2 will cause the skirt 7 opposite the bead 5 to deform radially outwardly. This deformation of the skirt 7 will tension the skirt, and the bead 5 will move into the groove 6 when the cap moves to the posi- $_{65}$ tion shown in Fig. 1. The dimensions of the groove 6 are made less than the dimensions of the bead 5 so that all the tension on the skirt 7 will not be released when the bead 5 moves into the groove 6. The tension remaining in the 70 skirt 7 will thus be effective to maintain abutting surfaces of the bead 5 and groove 6 in sealing engagement with each other.

The bead 5 and groove 6 are so axially located with respect to the lip 9 of the bottle that they 75

move into interlocking engagement at about the same time the inner surface 10 of the cap 2 moves into abutting engagement with the surface of the lip 9 of the bottle. In this manner a seal will be provided both by the abutting surfaces 9 and 10 and by the abutting surfaces on the bead 5 and groove 6. In order to insure that the surfaces 9 and 10 will be maintained in abutting and sealing engagement, the axial distance between the bead 5 and the surface 10 is made a trifle less than the axial distance between the groove 6 and the bottle lip 9, as shown in Fig. 1. In this manner, the tension moving the bead 5 into the groove 6 will set up a force in the cap in an axial direction which will be effective to maintain the surface 10 in sealing engagement with the bottle lip 9. Due to the stretching action on the material of the cap 2 by reason of the force holding the surface 10 in engagement with the surface 9, the cap 2 will also have sealing engagement with the bottle in an annular area about the pour-lip 8. With the bead 5 engaged in the groove 6, the cap will have a sealing engagement with the bottle neck at three different points; namely, between the abutting surfaces of the bead 5 and the groove 6, in the annular area about the pouring lip 9, and between the abutting surfaces 8 and 10. Regardless of how tightly the cap 2 is screwed on a bottle the sealing engagement will always be effective in at least one of the three points named in connection with the modification shown in Fig. 1.

In addition to the sealing action provided by the abuttingly engaged surfaces of the bead 5 and groove 6, movement of the bead 5 into the groove 6 sets up an interlock between the cap 2 and bottle neck 1 which is effective to prevent movement of the cap 2 in an axial direction with respect to the bottle neck 1. This interlocking action is thus effective to prevent accidental rotation of the cap 2 with respect to the bottle neck 1. This interlock is effective to prevent any self-loosening action of a polyethylene cap on a bottle even though its threads are wet with a lubricating liquid.

In the modification shown in Fig. 2, the cap 2 and bottle neck I are provided with a dove-tail interlock in place of the cooperating groove 6 and bead 5 of Fig. 1. The dove-tail interlock is provided by a tapered under-cut groove () on the outer surface of the bottle neck adjacent its pour-lip 9 and an annular ridge 12 with reverse under-cut on the inner surface of the cap skirt 7 for mating engagement with the groove 11. In order to move the ridge 12 into the groove 11, the skirt 7 must be deformed outwardly opposite the ridge before the ridge 12 can move into the groove 11. Due to the reverse tapers of the engaging surfaces on the groove 11 and ridge 12, an axial component is set up tending to maintain the surfaces 9 and 10 in engagement with each other. This structure will provide the same action as is provided by the arrangement of the bead 5 and groove 6 of Fig. 1.

As pointed out above, the structure shown in Fig. 3 is the same as that shown in Fig. 2 except that conventional round threads 4 are provided in place of the square threads 3 of Fig. 2. The operation of the structure shown in Fig. 3 will function to provide seals and to prevent self-loosening of the cap 2 on the bottle neck 1 in the same manner as described in connection with the structure shown in Fig. 2.

In the modification shown in Fig. 4, an inter-

locking bead 5' is formed on the bottle neck ! in place of on the internal surface of the skirt 7 as shown in Fig. 1. In this modification, the groove 6' is formed on the internal surface of the skirt 7 and is adapted to receive the bead 5' when the cap is screwed down on the bottle neck. In this medification, the skirt 7 will flex outwardly as the cap 2 is moved into a position in which the bottle bead 5' will move into the cap groove §'. The bottle bead 5' is so located with respect to the bottle lip 9 that it moves into interlocking engagement with the cap groove 6' when the bottle lip 9 moves into abutting and sealing engagement with the surface 10 of the cap. In this modification, reliance is placed 15 mainly on the seal provided by abutting engagement between the surfaces 9 and 10 although the engagement of the bottle bead 5' in the cap groove & will function as a seal to prevent leakage of any fluid which may get past the seal at 20 the bottle lip 8. Engagement of the bottle bead 5' in the cap groove 6' provides an interlock to prevent axial and rotational movement of the cap 2 on the bottle I as described above. In this modification, the bead 5' is provided with larger 25dimensions than the groove 6' so that tension will be maintained on the skirt 7 to keep the surfaces of the bead 5' and groove 6' in sealing engagement with each other.

In the modification shown in Fig. 5, the bottle 30 bead 5" is illustrated as having a corrugated surface. The provision of a corrugated surface on the bead 5" is desirable in that it functions to additionally prevent rotational movement of the cap 2 on the bottle neck 1.

The structure shown in Fig. 7 is similar to that illustrated in Fig. 1 and like numerals have been employed to designate like parts. In this showing, the bottle is shown as having a planar surface 14 for engagement with the surface 15 at 40 the base of the cap skirt 7. The surfaces 14 and 15 are arranged to move into abutting engagement just after the surfaces 9 and 10 move into sealing engagement. The purpose of having the surfaces 14 and 15 move into abutting engage- 45 ment is to prevent tightening of the cap, with consequent stretching of the skirt 1, an amount effective to enable a thread skipping or jumping action. Although the cap and bottle in Fig. 7 are illustrated as having square threads, it will 50 be understood that action provided by the surfaces 14 and 15 is best adapted to the prevention of thread skipping where the cap is provided with conventional round threads as in Fig. 3.

The operation of the cap of this invention will 55 be apparent from the foregoing, but attention is directed to the fact that the interlock against axial movement is effected automatically by the conventional operation of screwing the cap on a bottle neck. This operation is operative first to 60 automatically expand the skirt 7, and the resulting tension in the skirt will move the parts, such as the bead 5, ridge 12, or groove 6', inwardly into interlocking engagement. By making these parts of larger dimension than the cooperating 65 parts on the cap, the skirt 7 is kept under tension to maintain the interlocked surfaces in liquid sealing engagement. As in the modifications shown in Figs. 1 and 2, this tension reacts to produce a pull in an axial direction on the cap for 70 maintaining the surfaces 9 and 10 in liquid sealing engagement.

While I have illustrated and described one specific embodiment of my invention, it will be tration, and various changes and modifications may be made therein within the contemplation of my invention and under the scope of the following claims.

We claim:

1. A threaded closure element of integral construction formed of elastic deformable and stretchable material for a threaded bottle neck element, one of said elements having an annular ridge thereon and the other of said elements having an annular groove for the reception of said ridge, said groove and ridge having reversely tapered surfaces engageable in a dove-tail fashion to provide an interlock to prevent axial movement of the closure element off of the neck element, the surfaces of said elements defining said ridge and groove being operable to expand said closure element in its application to said neck element to provide tension for maintaining said ridge and groove in abutting engagement to provide a liquid seal therebetween.

2. For use on a glass bottle having a neck with a pour lip at its end, external threads spaced inwardly of said lip, and an annular groove on the external surface of the bottle neck between said lip and external threads, a closure formed of elastic and deformable material having an end portion for abutting and sealing engagement with said lip and an integral cylindrical skirt portion with internal threads for engagement with said external bottle neck threads to move said end portion into abutting engagement with said lip upon rotation of the closure on the bottle neck, tightening of said closure on said neck being effective to compress said lip into the material of said end portion to form a fluid seal therewith, and an annular ridge on the inner surface of said skirt portion between said internal threads and end portion for fluid sealing engagement with the bottle neck annular groove, said ridge being spaced axially from said end portion a distance less than the distance between said lip and bottle neck groove, the tightening of said closure on said neck to form a seal between said lip and end portion being effective to stretch said skirt axially to position said ridge for movement into said groove, said ridge having an internal diameter less than the external diameter of the bottle neck so that said skirt is stretched radially in the application of the closure to the bottle neck, the tension of the skirt from said radial stretch and said axial stretch being effective to maintain said ridge engaged tightly in said groove to provide an additional fluid seal, and to prevent uncontrolled axial and rotational movements of said closure on the bottle neck.

3. For use on a glass bottle having a neck with a pour lip at its end, external threads spaced inwardly of said lip, and an annular groove on the external surface of the bottle neck between said lip and external threads, a closure formed of elastic and deformable material having an end portion for abutting and sealing engagement with said lip and an integral cylindrical skirt portion with internal threads for engagement with said external bottle neck threads to move said end portion into abutting engagement with said lip upon rotation of the closure on the bottle neck, tightening of said closure on said neck being effective to compress said lip into the material of said end portion to form a fluid seal therewith, and an annular ridge on the inner surface of said skirt portion between said internal threads and end portion for fluid sealing engagement with understood that this is merely by way of illus- 75 the bottle neck annular groove, said ridge being

spaced axially from said end portion a distance less than the distance between said lip and bottle neck groove, the tightening of said closure on said neck to form a seal between said lip and end portion being effective to stretch said skirt axially to position said ridge for movement into said groove, said internal and external threads being substantially square whereby the tightening force applied to said skirt portion is applied substantially entirely in an axial direction, said ridge 10 having an internal diameter less than the external diameter of the bottle neck so that said skirt is stretched radially in the application of the closure to the bottle neck, the tension of the stretch being effective to maintain said ridge engaged tightly in said groove to provide an additional fluid seal, and to prevent uncontrolled axial and rotational movements of said closure on the bottle neck.

4. The combination comprising a bottle and a closure therefor, said bottle having a neck with external threads, a pour lip at its outer end, and an annular groove on its external surface intermediate said lip and external threads, said closure 25 being formed of elastic and deformable material having an end portion for abutting and sealing engagement with said lip and an integral cylindrical skirt portion with internal threads for engagement with said external bottle neck threads, rotation of said closure on said neck being effective to move said closure axially to compress said lip into the material of said end portion to form a fluid seal therewith, and an annular ridge on the inner surface of said skirt portion between 35 said internal threads and end portion for fluid sealing engagement with the bottle neck annular groove, said ridge being spaced axially from said end portion a distance less than the distance between said lip and bottle neck groove, rotation 40 bottle neck. of said closure on said neck after sealing engagement of said end portion with said lip being effective to stretch said skirt axially to position said ridge for movement into said groove, said internal and external threads being substantially 4 square whereby the tightening force applied to said skirt portion is applied substantially entirely in an axial direction, said ridge having an internal diameter less than the external diameter of the bottle neck so that said skirt is stretched radially 5 in the application of the closure to the bottle neck, the tension of the skirt from said radial stretch and said axial stretch being effective to maintain said ridge engaged tightly in said groove to provide an additional fluid seal, and to pre- 5 vent uncontrolled axial and rotational movements of said closure on the bottle neck.

5. For use on a glass bottle having a neck portion with a pour lip at its end and external threads spaced inwardly of said lip, a closure formed of elastic and deformable material having an inner end surface for abutting and sealing engagement with said lip and an integral cylindrical skirt portion with internal threads for engagement with said external bottle neck threads to move said end surface into abutting engagement with said lip upon rotation of the closure on the bottle neck, tightening of said closure on said neck being effective to compress said lip into the material forming said end surface and into fluid sealing engagement therewith, said neck skirt from said radial stretch and said axial 15 and skirt portions respectively having annular and concentric facing surfaces one of which is provided with an annular ridge and the other of which is provided with an annular groove in which the annular ridge is receivable, the axial spacings of said ridge and said groove on said portions with respect to said pour lip and to said end surface being relatively different whereby said skirt portion must be stretched in an axial direction to position said ridge for engagement in said groove, tightening of said closure on said neck to form a seal between said lip and end surface being effective to stretch said skirt axially to position said ridge for engagement in said groove, said ridge having a radial depth greater than the radial depth of said groove and projecting beyond the said annular surface in which said groove is formed so that said skirt is stretched radially in the application of the closure to the bottle neck, the tension of the skirt from said radial stretch and said axial stretch being effective to maintain said ridge engaged tightly in said greove to provide an additional fluid seal and to prevent uncontrolled axial and rotational movements of said closure on the

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