

Dec. 13, 1966

V. MORRIS

3,291,332

CLOSURE DEVICE

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Fig. 1

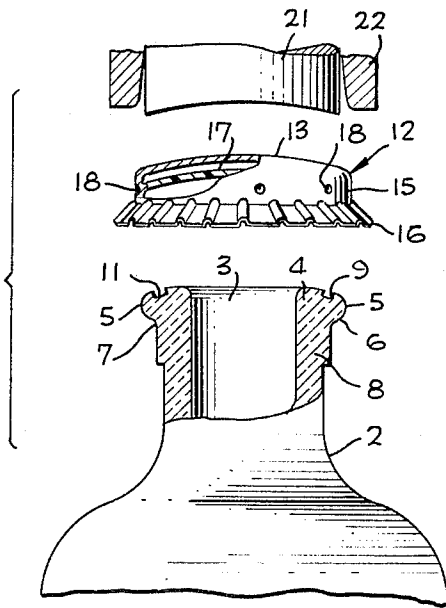


Fig. 4

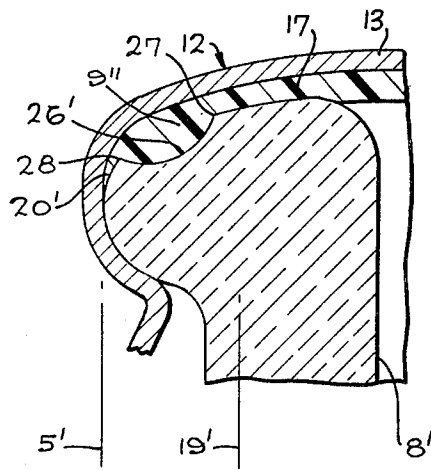


Fig. 2

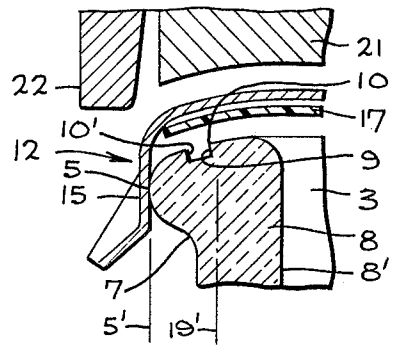


Fig. 5

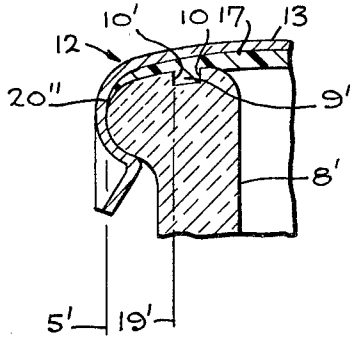
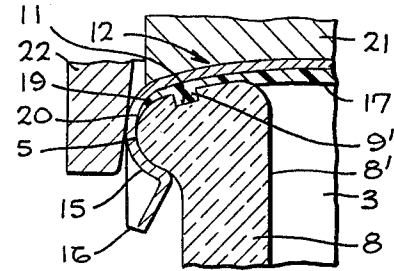


Fig. 3



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3,291,332

CLOSURE DEVICE

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3 Claims. (Cl. 215—39)

This application is a continuation-in-part of application Serial No. 170,368, filed February 1, 1962, now abandoned.

This invention relates to closures for containers such as bottles and jars employing crimped-on or screw closures.

It is more particularly directed to crown closures of bottles in which fluid under superatmospheric pressure is to be maintained. Such closures are well known in this art. Essentially, they are comprised of a bottle having a locking head adjacent the mouth of the bottle. A crown seal formed of a cap having a crimped circumambient locking flange is positioned on the bottle end with the locking flange crimped about and underneath the locking head. A gasket is placed between the bottle end and the underneath side of the cap top.

A conventional gasket seal is made of cork. In order to overcome the disadvantages arising from the absorptive quality of the cork, its porosity and its tendency to fracture, various expedients have been employed. A usual one is to glue a small circular disc of aluminum foil centrally of the gasket to cover the open mouth of the bottle. Proposals have been made to employ seals of rubber or rubber latex instead of cork. These, in many cases, have the disadvantage of imparting a taste to the material. It has been proposed to use more inert, non-absorbent synthetic plastics such as polyethylene or polybutylene sheet material to form the gasket.

The problems arising from the sealing of bottles by crown closures of the above type become magnified where material is bottled under high pressure as is the case with beer and carbonated liquids. The permissible pressures are limited by the nature of the seal obtained with conventional bottles and crown seals.

The attempted prior art solutions have been to design the bottle top so that the seal between the cork gasket and the bottle top occurs at a point where the tangent to the bottle mouth is about 45° to the horizontal. Another solution is to make the sealing area have a specified ratio to the area of the bottle mouth. These placed restrictions on the design of the crown and on the bottle mouth.

Another solution was to provide gaskets with thickened portions at the bottle end. Another means was to provide deformation on the cap of the crown. These expedients produced localized circumferential pressure points on the gasket at the smooth bottle end.

Reference is made to U.S. Patents 1,129,578; 2,327,455; 2,823,422; 2,829,790; 2,901,139; 3,001,568; and 3,033,407.

All of these solutions have disadvantages.

I have devised a bottle which, when acting with a crown closure which may be of the conventional design, will provide an improved seal.

It is one of the advantages of my invention that I may employ a conventional crown cap having a smooth, i.e., an undeformed, top cap surface. Such a crown cap provides a surface on which advertising by lithography may be applied. This has an advantage over the crown seals whose cap surfaces are deformed in order to enhance the sealing effect, since it does not reduce the space available for such advertising and permits of the use of conventional equipment for making the crown seals, the printing of the advertising and the applying of the cap to the bottle.

I obtain the above objectives by employing a container whose wall at the mouth of the container has a circum-

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ambient groove. The groove is placed on the end or edge portion of the wall portion of the mouth.

I provide a container having a capped end. The cap has a circumambient flange locked over the end of the container. An extrudable gasket is placed between the interior of the cap and the end of the mouth wall. The cap is firmly connected to the container under pressure which molds the gasket to the surface of the wall portion of the mouth end and molds the plastic into the circumambient groove. The wall end thus forms the female die into which the plastic is forced by the pressure applied by or through the cap.

The circumambient groove is preferably designed so that the pressure inside the bottle acts in a direction to compress the gasket against a sealing surface.

The provision of a groove provides for a material increase in the sealing effect. A further improvement is obtained by positioning the groove to the side of the center line, through the end of the container, away from the interior of the container.

While I do not wish to be bound by any theory of why my seal is so highly efficient, I believe that the major sealing effect is the O-ring seal obtained by the rib of plastic molded into the circumambient groove. An additional seal is obtained by the extrusion of the rim of the plastic gasket over the outer rim of the bottle mouth to form a sealing wedge between the bottle rim and the underneath portion of the cap top adjacent the locking flange.

It is therefore an object of my invention to provide a crown seal for a container end having a locking flange with a circumambient groove in the end of the container and a plastic gasket between the cap and the bottle end, extruded as a bead into the groove and feathered into the wedge volume adjacent the locking flange cap and the exterior edge of the locking head.

It is a further object, in a preferred form of my invention, to position the groove to the exterior of the center line of the locking head.

It is a further object of my invention to position the groove adjacent the exterior edge of the locking head.

This invention will be further described by reference to the drawings, in which:

FIG. 1 is an exploded view partly in section of one form of bottle end of my invention and one form of crown cap which may be employed;

FIG. 2 shows an initial position of the sealing procedure;

FIG. 3 illustrates a later stage in the sealing procedure;

FIG. 4 shows a fragmentary sectional view of a modified form of bottle end and the form of seal formed therewith; and

FIG. 5 shows another form of closure.

The form shown in FIG. 4 is the form of my invention which I now contemplate to be the best mode for carrying out my invention.

In FIG. 1 the bottle 1 has a mouth 3 at the end of the neck 2. The wall portion 8 of the neck 2 has a top end 4. The neck has a circumferential locking head 6 having a longitudinal convex outer surface 5 and a locking neck 7. For many forms of bottles the inside surface of the neck 2 meets the top in a curved convex surface. The end portion 4 carries a circumferential circular channel groove 9, having side walls 10 and 10' which meet a bottom 11.

In the form illustrated, the walls 10 and 10' are at an approximate right angle to the bottom 11. The juncture of the walls 10 and 10' and the bottom 11 or top 4 need not be rectangular, and normally would not be rectangular, due to normal forming tolerances. Some small radius would normally be present. I refer to such grooves as rectangular grooves.

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Where the walls 10 and 10' are steep, approaching the perpendicular to the base 11, they may approximate and be included within the designation of the rectangular grooves. However, the groove may be concave, as illustrated below. I desire that there be a substantial area of contact between the gasket and the bottom surface of the groove.

In certain of the forms of bottles, where the inside of the bottle neck meets the top, for example, as illustrated in the figures, I prefer to place the groove so that there be a substantial area of top such as 4 between the groove and the curved surface such as 5, for purposes to be more fully described below.

The groove 9 is preferably positioned so that the interior wall 10' is at or to the outside of the vertical center line 19' between the wall 8 of end 4 and the tangent 5' of the locking head which is parallel to the axis of the opening of the mouth 3. The groove is shallow, that is, it is preferable that its depth be not more than approximately equal to and preferably less than the distance between the walls, e.g., of the order of the thickness of the gasket or somewhat less. It is positioned, as shown, entirely to the exterior of the center line 19' of the locking head. The center line extends midway between the tangent 5' and the wall surface 8' at the locking head end.

Merely as an illustration and not as a limitation of my invention, the following dimensions are given as orders of magnitude to illustrate one form of my invention. Thus, for a conventional bottle and crown seal employing my invention, I may employ the following.

The crown 12 has a cap top 13 formed usually, but not necessarily, as a dished disc. A six-inch radius dished cap is one conventional form. The cylindrical skirt 15 ends in a corrugated locking flange 16 formed at an angle to the skirt 15. The angle may be at substantially 90° but is usually at an obtuse angle as shown. A thin, deformable gasket 17 is positioned on the interior of the cap against the underneath side of the cap 13. If it is made substantially of or less than the inside diameter of the skirt 15, so that it may fall out readily, it may be retained by a plurality of small dimples 18 placed in the skirt 15 at spaced points about the circumference of the skirt 15. Usually such dimples are not necessary. If the gasket 17 is made slightly larger than the inside diameter of the skirt 15, it may be held in place frictionally.

The gasket 17 is made of a moldable material. It may be of any elastomer, but need not be an elastomer if the gasket material is otherwise moldable, as described herein. It may be made of natural or synthetic rubber, or of any moldable synthetic plastic formable into sheets as described herein. For use in packaging food or beverages, it is desirable that the material be chemically inert and not contain plasticizers or other ingredients of such form and content as to react with or be leached by the contents of the bottle, to affect the contents of the bottle deleteriously. A suitable material is a polyolefinic plastic sheet, for example, a polyethylene, polybutylene or polypropylene sheet material. Particularly useful are the low-density polyolefinic plastic sheets, such as low-density polyethylene sheet material.

It is desirable that the material be deformable by pressures of the order of those used in crown sealing of bottles. It should, therefore, have a suitable Shore hardness. For example, 800 pounds per square inch is conventionally used in crowning bottles. It is thus desirable that this force be sufficient to induce plastic flow of the gasket at ordinary atmospheric temperatures.

When sealed as described below (see FIG. 3), the gasket is molded to the top 4, into the groove 9, and is thinned and drawn into the wedge shape at 19 into the corner 20 at the junction of the cap 13 and skirt 15, where the cap is drawn over the curvature 5 of the locking head of the bottle end.

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FIGS 2 and 3 illustrate the manner by which this molding operation occurs employing conventional bottle capping equipment.

The pressure foot 21 is set on top of the cap, which is in turn placed over the bottle end. The pressure foot is pressed down, forcing the cap into position on top of the bottle end with the skirt 15 forced over the curvature 5 of the locking head 6. The locking flange 16 depends below locking neck 7. The sealing throat 22 is conventionally made up of a plurality of wedge-shaped blocks set circumferentially about a pressure foot and crown and so shaped that, as they descend, with the pressure foot pressing on top of the cap 13, the action of the sealing throat against the corner 20 and the flange 16 causes a force to be exerted generally radially of the curved surface 5. This force has a component of action which is horizontal and one which is vertical. A bending and forming action occurs whereby the cap is formed around the curved surface 5 of the locking head 6, and the flange 15 is forced under the neck 7. Thus, the flange 15 is drawn downward and about the locking head 6. This action of the sealing throat, aided by the pressure foot 21, molds the plastic about the top 4, forces the plastic into the groove 9 to form a depending circumferential circular head 9' integral with the gasket, and into the wedge volume 20. The area of deformation of the plastic is thus in the area adjacent the groove 9 and between the groove 9 and the interior circumference of the skirt 15 adjacent the tangent 5'.

The gasket is thinned over the top 4 and is thicker over the opening of the mouth 3.

The provision of a substantial area at the top 4, between wall 10' and the curved surface 5, permits of a full extrusion of the plastic into the groove and into the wedge volume formed between the crown cap and the convex surface of 5 adjacent the tangent line 5'. Because of the positioning of the groove entirely to the exterior of the center line 19', a suitable area is provided over the surface of the end 4 of the neck so that a suitable seal is provided over this surface to the interior of the groove. This results in a clamping of the plastic between the underneath of the cap top and the surface of 4 at such surface portion of 4.

This clamping action results in an extrusion of the plastic into the groove and the wedge volume and a deformation of the plastic to the exterior of the opening of the mouth 3. In the form of FIGS. 1-3 the groove is entirely to the exterior of the center line 19' with the wall 10 at the center line.

Illustrating the character of seal which may be obtained with this form of closure, the following example is given as an illustration but not as a limitation of my invention.

The crown as shown in FIGS. 1-5 is one having a 1.050-inch inner diameter at the skirt 15 and a 6-inch radius for the cap, and is a conventional crown for bottles. I may employ a gasket having an outer diameter of 1.055 inches and a thickness of 0.030 inch. The bottle end has a wall with a maximum thickness at the locking head 6 of wall 8 of 0.200 inch.

In FIGS. 3 and 5 the groove is 0.015 inch deep and 0.020 inch wide.

In the form of FIG. 3, the groove 9 is entirely exterior of the center line 19, with the wall 10 of the groove at the center line.

In the form shown in FIG. 5, which is otherwise identical with FIG. 3, the groove is to the interior of the center line, with the wall 10' at the center line 19'.

By positioning the groove so that an end thereof be positioned at a distance from the interior wall 8 at least equal to the distance from 8 to the center line of the locking head, and by making the width of the groove not more than a quarter of the width of the locking head, I provide sufficient room on both sides of the groove to form a suitable seal between the top 4 and the

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cap and on both sides of the groove. (See FIGS. 3 and 5.)

An alternative form is shown in FIG. 4. In FIG. 4, the bottle top 4 at the mouth at the end of the neck 23 carries a circumferential edge groove 26 having a concave bottom 26' which intercepts the top 4 at 27 and the locking head at 28. The edge 27 is exterior of the center line 19' of the locking head 5.

It will be observed that the outer surface of the locking head 5 in the various forms has the greatest radius of curvature in the portion interior of the center line and becomes convex as it approaches the tangent line 5'. The groove in the top, as shown in FIGS. 1-3 and 5, is positioned on a flatter portion of the end and may be termed an end groove. The groove as shown in FIG. 4 is positioned in the convex portion of the end surface of the locking head, spaced from the tangent line 5' to provide a wedge volume at 20'. I term such a groove an edge groove.

The crown seal is set on the end of the bottle as described in connection with FIGS. 1, 2 and 3.

Because, in FIG. 4, the cap is formed about the bottle end with the end groove at the corner 20', the plastic gasket 17 is molded to fill the edge groove in the form of a peripheral bead 9'', and the wedge volume is filled as at 29'. The groove may be turned at a radius of 0.05 inch, with the edge 27 to 0.05 inch to the exterior of the center line 19'. The sector of its cross section may have a height of about 0.015 inch.

It is to be understood that the dimensions given are only one form of my invention, and their absolute values will change as the dimensions of the bottle and cap are altered.

Illustrating the results obtained, the following examples are given by way of illustration.

A tubular fixture was formed of aluminum and shaped in the form of a bottle neck, having a configuration illustrated by items 2-11 shown in FIGS. 1, 2 and 3, and had the dimensions of the illustrative bottle end whose dimensions are given above. It was sealed in the manner described above, employing a polyethylene disc gasket 1.055 inches in diameter and 0.030 inch thick. The pressure was removed and the cap removed and the disc inspected. The disc showed an increase in diameter. The diameter averaged about 1.07 inches. The circular edges were extruded into and filled the wedge volume 20. The disc at the wedge was feathered to fill the wedge volume and had a thickness adjacent the bead 9' of about 0.025 inch. This is a thinning of .005 inch as a result of the clamping and extrusion action. The bead 9' had a height from the surface of the gasket of 0.015 inch and was a circumferential bead corresponding to the position and size and shape of the groove 9.

The forms shown in FIGS. 1-3 and also in FIG. 5, employing the aluminum fixture as described above, and with the dimensions as given above, were capped as described and held at 155 pounds per square inch without leakage.

Where the fixture end had no groove but had a smooth end surface at 4, the maximum pressure without leakage was 50 pounds.

With the above groove and all dimensions the same, except that the groove was 0.03 inch wide and 0.030 inch deep, but its wall closest to the center line 19' at a distance of 0.04 inch from the center line and the other wall .030 inch from the wall 8, the maximum pressure which it could hold was 100 p.s.i.

The form of FIG. 4, having the above dimensions, held 160 p.s.i. without leakage.

All tests were conducted over a twenty-four hour period.

It will be recognized that the form of the crown cap described above is merely one conventional form of crown seal which may be employed. Any conventional similar cap may be employed, since in all of them the plastic gasket will deform substantially as described above

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when employed with container ends as described above. It will also be recognized that the container need not be a bottle with a bottle neck, but may be any form of container sealable as described above.

The characteristic feature of my invention is the creation of a sealing head employing the container end as a mold carrying a groove into which the plastic gasket is molded. The resultant bead is retained in the mold groove and forms a ring seal which acts on the O-ring principle. Pressure applied at the seal by the contained gas acts to deform the bead in its constraining groove, and thus causes it to press more tightly against the opposing constraining side of the groove into which it has been molded.

It will be seen that, in the seal of my invention, pressure inside the bottle is exerted in the direction of the bead 9, which is forced against the opposing wall, e.g., 10', and against the base 11. By positioning the groove preferably externally of the center line, there is a material portion of the gasket pressed against the top 4 between the groove and the mouth. This aids in the seal. The forming pressure also crowds the thinned section further into the wedge volume at the corner 20 or 20' or 20''. This improves the sealing action. Similarly, the other forms seal in like manner, as will be clear from the foregoing.

While I have described a particular embodiment of my invention for purposes of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention, as set forth in the appended claims.

1. A closure for an open ended container,

(1) said container having an end surface and an interior wall, defining the open mouth of said container, said surface having an exterior convex surface adjacent one end of said wall defining a locking head;

(2) a groove in said end surface spaced from said interior wall;

(3) a crown seal cap having a cap top, a depending skirt and a locking flange;

(4) said cap mounted over the said end wall with the locking flange in locking relation to said locking head;

(5) a polyolefinic plastic gasket, a portion of said gasket pressure clamped between said cap top and said end surface and between said depending flange and the exterior convex surface of the said locking head, the clamped portion of said gasket extending in contact with and across the end surface and said cap top and between the exterior convex surface of said locking head and said depending flange, the space between the exterior convex surface of said locking head and said depending flange having a wedge volume, and the edge portion of said clamped portion of said gasket extending into said wedge volume and clamped between said depending flange and the exterior surface of said locking head across the entire surface of said gasket in said wedge volume;

(6) said gasket having a depending solid circumferential bead integral with said gasket and extruded into said groove,

(7) said groove being positioned exteriorly of the center line of said locking head.

2. The closure of claim 1, said groove being an end groove positioned in the convex surface of said locking head.

3. A closure for an open ended container,

(1) a wall of said container having an end surface defining an axially extending open mouth of said container, said wall having an exterior convex surface adjacent one end of said wall defining a locking head, said surface being tangent to a line parallel to the axis of said mouth;

(2) an edge groove in said end surface;

(3) a crown seal cap having a cap top, a depending skirt and a locking flange;

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(4) said cap mounted over the said end wall with the locking flange in locking relation to said locking head;

(5) a plastic gasket, a portion of said gasket pressure clamped between said cap top and said end surface and between said depending flange and the exterior convex surface of the said locking head, the clamped portion of said gasket extending in contact with and across the end surface and said cap top and between the exterior convex surface of said locking head and said depending flange, the space between the exterior convex surface of said locking head and said depending flange having a wedge volume, and the edge portion of said clamped portion of said gasket extending into said wedge volume and clamped between said depending flange and the exterior surface of said locking head across the entire surface of said gasket in said wedge volume;

(6) said gasket having a depending solid circumferential bead integral with said gasket and extruded into said groove;

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(7) said edge groove positioned in the convex surface of said locking head, one end of said groove spaced from said tangent line and positioned adjacent said wedge volume, and the other end of said groove positioned exteriorly of the center line of said locking head.

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