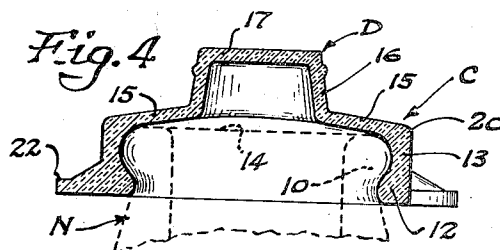
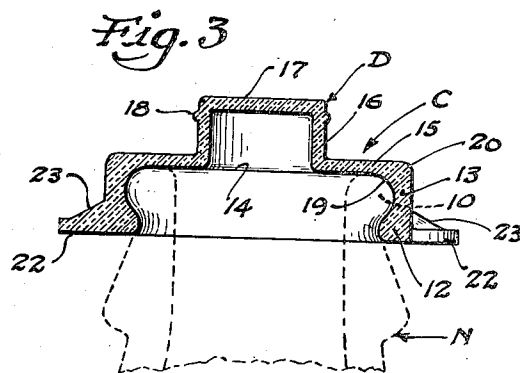
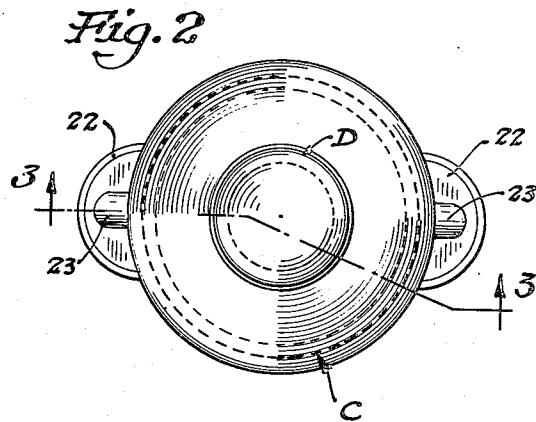
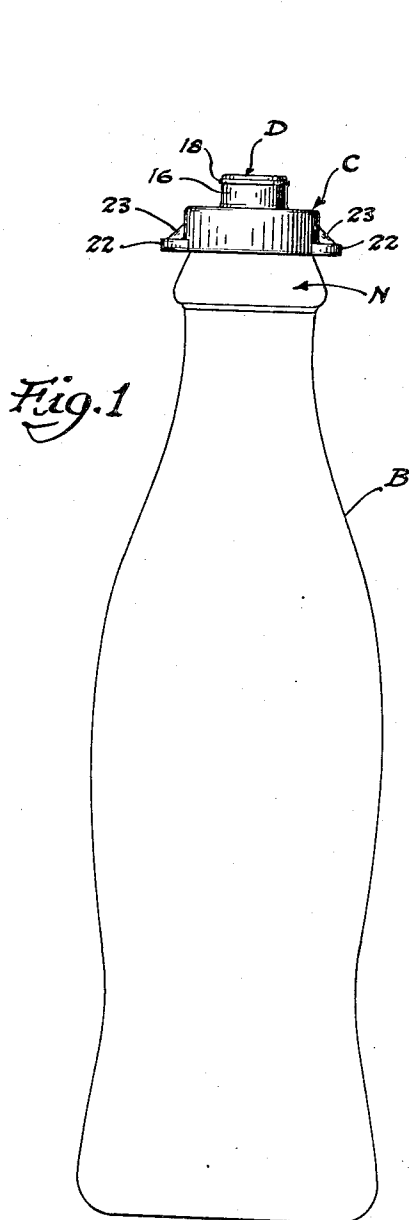


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BOTTLE CLOSURE DEVICE

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BOTTLE CLOSURE DEVICE

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4 Claims. (Cl. 215-41)

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This invention relates to bottle closure devices and particularly to such closure devices that are adapted for use with beverage bottles and the like.

Many types of beverage bottle caps have been produced for use particularly as replacement closures after the usual metal cap has been removed, and such prior closure devices have in most instances been relatively complicated or have been of such a character that they could not withstand the relatively high internal pressures that are developed within bottles that contain carbonated beverages and the like. It is, therefore, an important object of the present invention to enable a bottle cap to be made in a simple and inexpensive manner and in such a way that the bottle cap will remain in place even when relatively high internal pressures are developed within the bottle. More specifically, it is an object of the present invention to enable bottle caps of the aforesaid character to be made from resilient material in such a way that relatively high internal pressures within the bottle tend to produce a tighter gripping and sealing action about the neck of the bottle, thereby to prevent undesired displacement of the bottle cap under such circumstances. Other and related objects are to enable the internal pressures developed in such bottles to act upon the bottle cap in such a way that the seal between the cap and the bottle is not disturbed, to enable relatively thin walls to be used in such caps so as to thereby attain economy of manufacture, and to enable the top wall of the cap to be distended without destroying the seal between the cap and the bottle.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings, which, by way of illustration, show a preferred embodiment and the principles thereof and what I now consider to be the best mode in which I have contemplated applying those principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a side elevational view of a bottle cap embodying the features of the invention and disposed in its operative position on a beverage bottle;

Fig. 2 is a plan view of the bottle cap;

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Fig. 3 is a sectional view taken substantially along the line 3-3 of Fig. 2; and

Fig. 4 is a view showing the form assumed by the cap when subjected to pressure.

For purposes of disclosure, the invention is herein illustrated as embodied in a cap C that is adapted to be put in position upon the neck N of the bottle B. The neck N is of the conventional form, size and type, having an annular outwardly extended neck bead 10 about its upper edge that is arranged and intended primarily for cooperation with the downwardly extending crimped flange of the usual metal bottle cap.

The present cap C is made by processes of molding from a thermoplastic moldable material that is resilient and yet is semi-rigid in character. I have found that polyethylene resins are admirably suited for this purpose, and in commercial production of the bottle cap I prefer to use such a resin sold under the trade name "Polythene" by E. I. du Pont de Nemours & Company, Inc., of Wilmington, Delaware. The cap C is formed with a lower annular cap bead 12 that is arranged to snugly engage or embrace the bottle neck just below the neck bead 10, and an integral annular wall 13 extends upwardly from the outer edge portion of the cap bead 12 to a point above the upper end or top edge 14 of the neck N, at which point the annular side wall 13 is joined to an integral transverse main top wall 15 that extends across the top of the bottle in a relation that is substantially perpendicular to the axis of the neck N. The wall 15 terminates short of such central axis and has an integral upstanding dome D formed thereon so that the inside of the dome D is in communication with the interior of the bottle. The dome D includes a side wall 16 that is cylindrical in form in the present instance, and an integral upper end wall 17. In the present instance, an annular bead 18 is formed on the upper portion of the annular side wall 16, this bead 18 being utilized merely for the purpose of simplifying the mounting of the bottle cap C on a display card, so that the bead 18 is of no importance insofar as the present invention may be concerned.

The inner surfaces of the annular side wall 13 and the main top wall 15 are joined by an internally filleted corner 19 which conforms substantially to the surface of the neck bead 10, while the outer surfaces of the walls 13 and 15 are joined by a relatively small corner radius 20 so that a relatively thick cross sectional portion is formed at the juncture of the walls 13 and 15.

The cap C is, of course, applied to the neck of

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a bottle by forcing the cap down onto the bottle neck, thereby to stretch or distend the bead 12 of the cap as it is moved down over the neck bead 10, and in order that this may be facilitated, a pair of outwardly extending operating handles 22 are integrally formed at diametrically opposite points on the bead 12. Each such handle includes a horizontal portion and an integral angular bracing portion 23, as will be evident in Figs. 2 and 3 of the drawings. When the cap bead 12 has moved down past the neck bead 10, the cap bead returns toward its original diameter which is such that the cap firmly or snugly embraces the neck N just below the neck bead 10.

When the cap C is molded from an elastomeric material having the tensile and compressive strength and a modulus of elasticity such as that possessed by Polythene, it has been found that the cap may be made the usual size with the walls 15 and 16 having a thickness of substantially .040 inch, the wall 13 having a thickness of substantially .050 inch, and the bead 12 having a maximum horizontal thickness of substantially .090 inch. In such usual size, the internal diameter of the bead 12 is substantially .940 inch, the external diameter of the dome D is .50 inch, and the height of the dome D in its external dimension is 0.25 inch. This internal diameter of the cap bead 12 is somewhat smaller than the smallest dimension usually encountered in the portion of the bottle neck that is to be engaged thereby, so that when the cap is in place on a bottle, the cap bead 12 is under tension and snugly embraces the neck N below the neck bead 10 so as to afford an effective seal for the bottle at ordinary low internal pressures.

When such normal low gas pressure is effective within the bottle, the cap C retains the normal form shown in Fig. 3, but when the internal pressure increases due to heat, shaking of the bottle, or like causes, it is found that such pressure alters the form of the cap, as shown in Fig. 4, and actually increases the sealing action of the cap bead 12 by forcing the cap bead 12 axially into firm sealing contact with the lower face of the neck bead 10, and under the present invention this is accomplished in such a way that the forces that would normally be applied in such a way as to stretch and release the cap bead 12 are so reduced and minimized that the cap is held securely in place even when extremely high pressures are encountered. In such alteration in form of the cap C, the wall 15 is distended upwardly so as to take the form of a truncated cone, Fig. 4, while the lower end of the wall 16 of the dome D assumes an appreciably greater diameter, the entire wall 16 in such an instance being gradually tapered to a greater diameter at such lower end.

The upward bowing of the wall 15 as shown in Fig. 3 is, of course, inherent in such a wall when the extremely thin wall section is used, and were it not for the presence of the dome D, this bowing of the wall 15 would tend to pull the upper end of the side wall 13 inwardly and upwardly over and about the neck bead 10, with the result that the cap bead 12 would be correspondingly drawn upwardly on the neck bead 10. This would, of course, tend to break the seal between the neck bead 10 and the cap bead 12, and would cause early release or discharge of the cap.

Under the present invention, however, the same pressure which bows the top wall 15 upwardly also serves to expand the lower end of the side wall 16 of the dome, so that the bowing

of the wall 15, instead of applying an inward radial force and movement to the upper edge of the side wall 13, is actually caused to maintain the upper edge of the side wall 13 in substantially its original position. Moreover, the upward bowing of the top wall 15 acts somewhat as a lever on the side wall 13 through the thick corner afforded between the internal radius 19 and the outer radius 20 to counteract or react against any forces that are at this time tending to expand or stretch the cap bead 12 to a larger diameter.

The net result of the cooperation of the dome D and the thick corner between the walls 15 and 13 is that the cap of the present invention, despite its thin walled and economical construction, is effective to maintain a tightly sealed relationship even at extremely high internal pressures. Thus, when the cap is made in the form and dimensions hereinbefore described, and from the material specified, it is capable of maintaining an effective seal almost indefinitely against an internal pressure of fifty pounds per square inch, and yet when either the dome D or the thick, leverage transmitting corner 19-20 are eliminated, the seal is maintained for but about one minute or less. As to relative importance of the dome D and the thick, leverage transmitting corner, it has been determined that the dome is most important, but in the absence of the thickened corner 19-20, the increased effectiveness imparted to the cap by the dome is for all practical purposes insignificant at high pressures such as about fifty pounds per square inch. Thus, at high internal pressures, the dome D and the thick corner 19-20 complement and augment each other to enable a continued effective sealing action to be attained despite the thin wall sections utilized in the cap of the present invention.

From the foregoing description it will be evident that the present invention materially simplifies the provision of efficient bottle caps, and enables such caps to be made in one piece and from the minimum of material.

Thus, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a bottle closure adapted for sealing co- operation with a bottle neck having an outwardly projecting annular neck bead at its end, a one-piece cap member formed from a relatively stiff elastic material to afford an annular cap bead adapted to be stretched about and moved downwardly beyond the neck bead of a bottle neck and to snugly embrace the bottle neck just below such neck bead, an integral annular wall extended upwardly from the outer portion of said cap bead, a main top wall formed integrally with said annular wall and extended toward the central axis of the annular wall and substantially perpendicular to such axis, said top wall and said annular wall being connected by an internal fillet arranged to conform substantially to the opposed surfaces of such a neck bead, and the outer surfaces of said top wall and said annular wall being joined by a slightly rounded surface to afford a relatively thick corner portion at the juncture of such walls, said

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top wall terminating short of the central axis and having an integral imperforate dome formed thereon comprising relatively thin upwardly extending annular side walls of a thickness that is not greater than the thickness of said main top wall and a secondary top wall closing the upper end of said last mentioned annular side walls.

2. In a bottle closure adapted for sealing cooperation with a bottle neck having an outwardly projecting annular neck bead at its end, a one-piece cap member formed from a relatively stiff elastic material to afford an annular cap bead adapted to be stretched over and moved downwardly past the neck bead of a bottle and to snugly embrace the bottle neck just below such neck bead, an integral annular wall extended upwardly from the outer portion of said cap bead, a main top wall formed integrally with said annular wall and extended toward the central axis of the annular wall and substantially perpendicular to such axis, said top wall and said annular wall being connected by an internal fillet arranged to conform substantially to the shape of such a neck bead, and the outer surfaces of said top wall and said annular wall being joined by a slightly rounded surface to afford a relatively thick corner portion at the juncture of such walls, said top wall terminating in a circular inner edge spaced from said axis, an integral relatively thin annular side wall of a thickness that is not greater than the thickness of said main top wall joined to said inner edge and extending upwardly therefrom, and an integral and imperforate top wall joining the upper edge of said last mentioned annular side wall.

3. In a bottle closure adapted for sealing cooperation with a bottle neck having an outwardly projecting annular neck bead at its end, a one-piece molded cap member formed from a relatively stiff elastic material to afford an annular cap bead adapted to be stretched about and moved downwardly over and past the neck bead of a bottle and to snugly embrace the bottle neck just below such neck bead, an integral annular wall extended upwardly from the outer portion of said cap bead, a relatively thin main top wall formed integrally with said annular wall and extended toward the central axis of the annular wall and substantially perpendicular to such axis, said top wall and said annular wall being connected by an internal fillet arranged to conform substantially to the shape of such a neck bead, and the outer surfaces of said top wall and

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said annular wall being joined by a slightly rounded surface to afford a relatively thick corner portion at the juncture of such walls, said top wall terminating short of the central axis and having an integral and imperforate dome formed thereon comprising a relatively thin upwardly extending annular side wall of a thickness that is not greater than the thickness of said main top wall and a top wall connecting the upper end of said annular side wall of said dome.

4. In a bottle closure adapted for sealing cooperation with a bottle neck having an outwardly projecting annular neck bead at its end, a one-piece cap member formed from a relatively stiff elastic material to afford an annular cap bead adapted to snugly embrace a bottle neck just below the neck bead of such a bottle neck, an integral annular wall extended upwardly from the outer portion of said cap bead, a main top wall formed integrally with said annular wall and extended toward the central axis of the annular wall and substantially perpendicular to such axis, said top wall and said annular wall being connected by an internal fillet arranged to conform substantially to the shape of such a neck bead, and the outer surfaces of said top wall and said annular wall being joined by a slightly rounded surface to afford a relatively thick corner portion at the juncture of such walls, said top wall terminating short of the central axis and having an integral and imperforate closed dome formed centrally thereon and including side walls that are of a thickness that is not greater than the thickness of said main top wall to prevent application of radially inward forces to said annular wall in the event of outward flexure of said main top wall.

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