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R. E. KRUEGER
PRESSURE SEALING BOTTLE CAP

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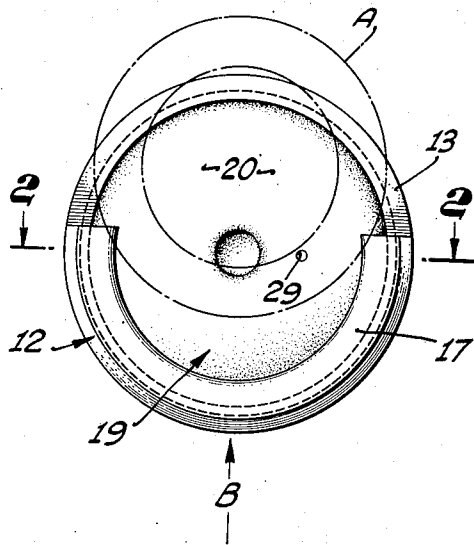


Fig. 1.

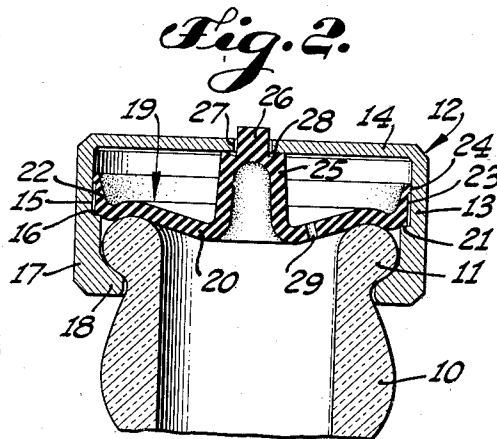


Fig. 2.

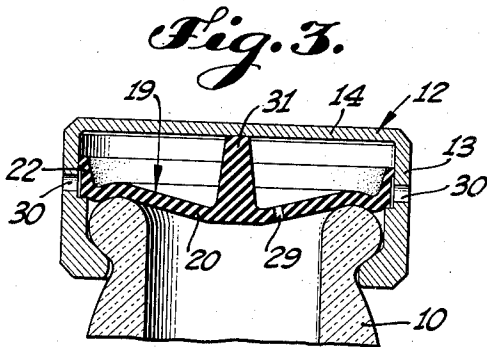


Fig. 3.

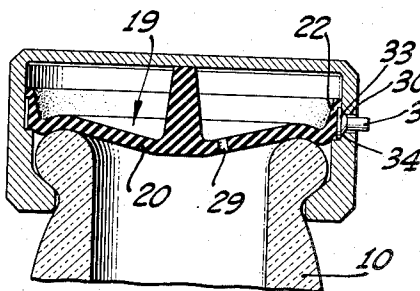


Fig. 4.

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PRESSURE SEALING BOTTLE CAP

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8 Claims. (Cl. 215—38)

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This invention relates to a closure for bottles and particularly pertains to a pressure sealing bottle cap.

In the sale of beverages which are carbonated or are liable to ferment and generate gases it is common practice to seal the bottles into which the beverage is placed by the use of a type of cap generally known to the trade as a "crown cap seal." In such a structure the overhanging flange of a cap is crimped and corrugated to engage the lip of the bottle and to hold the contents of the bottle hermetically tight. It sometimes occurs that the entire contents are not emptied from the bottle and it is desirable to replace the cap over the mouth of the bottle and to hermetically seal the bottle again. In practice it has been found that an hermetic seal is not always obtained by forcing the original cap back onto the mouth of the bottle. Various other structures have been provided to close the mouth of a bottle and to optionally seal it hermetically tight. It is the principal object of the present invention therefore to provide a cap which may be dispensed with a filled bottle when the bottle is sold or which may be applied to a bottle after it has once been opened and thereafter to seal the mouth of the bottle hermetically and to permit the seal to be broken and the cap removed when desired.

The present invention contemplates the provision of a rigid cap structure adapted to fit over the lip of a bottle mouth and which structure includes a rubber diaphragm element acting normally to form a fluid pressure energized hermetic seal and provided with means by which the seal may be broken and which will insure that the cap may be easily removed.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 is a view in plan showing the lower face of a cap with which the present invention is concerned.

Fig. 2 is a view in central vertical section as seen on the line 2—2 of Fig. 1.

Fig. 3 is a view in central vertical section showing a modified form of the invention with the cap sealed.

Fig. 4 is a view similar to Fig. 3 showing special releasing means applied to the structure indicated in Fig. 3.

Referring more particularly to Figs. 1 and 2 of the drawings, 10 indicates the neck of a bottle such as is used to contain carbonated beverages. The end of neck 10 constitutes an annular seat for sealing engagement with the cap of my invention, said seat defining the open mouth of the bottle. The end of neck 10 also is provided with an exterior locking projection which, in the bottle herein illustrated, is in the form of a radially outwardly extending bead or lip 11. To close the mouth of the bottle, the invention provides a cap

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12. This cap comprises a cylindrical skirt 13 closed at its outer end by an integral head 14. The skirt 13 has an internal wall 15 of relatively large diameter terminating at an inwardly offset shoulder 16 parallel to the head 14. The skirt 13 is formed with a locking means which, for a container such as the bottle herein illustrated, is preferably in the form of a U-shaped extension 17 of skirt 13, having a similarly shaped inwardly projecting locking flange 18 which is designed to engage the lower face of the bottle lip 11. The U-shape of locking means 17, 18 provides a pair of generally parallel arms the spaced ends of which define an opening in one side of the cap. Mounted within the cylindrical cavity defined by the wall 15, the head 14 and the plane of the shoulder 16, is a sealing element 19 which comprises a flexible diaphragm 20, at the outer end of which is a shoulder 21 designed to rest against the shoulder 16 of the cap. Formed integral with the periphery of the flexible diaphragm and contiguous to the shoulder 21 is a flexible cylindrical flange 22 which fits within and bears against the inner face of the cylindrical inner wall 15 of the cap 12. It may be desirable to undercut the outer face of the flange 22 as indicated at 23 to provide a lip 24 which will be free to bear against the inner wall 15 of skirt 13. It will now be apparent that the diaphragm 20 is disposed in axially spaced relation to head 14, traversing the space encircled by wall 15, with its periphery sealed to skirt 13, whereby to define a pressure chamber within the cap. Formed centrally of the diaphragm 20 is a strut or post section 25. This extends upwardly and terminates in a stem 26 which projects through a vent 27 in the head 14 of the cap 12. The main body of the post is of larger diameter than the opening 27 and is formed with an undercut valve shoulder 28 which may be brought to rest against the inner face of the head 14 of the cap. In order to conserve the material from which the sealing element 19 is made the post 25 may be hollow. Formed through the diaphragm 20 is a bleed aperture 29 for a purpose to be hereinafter described.

In the form of the invention shown in Fig. 3 the head 14 of the cap 12 is solid and does not have the vent 27. The skirt 13 however may be formed with one or more vents 30 which are normally sealed by the peripheral flange 22 of the sealing element 19. In the structure shown in Fig. 3 a post 31 is formed integral with the flange and abuts against the inner face of the end wall 14 of the cap to limit the flexure of the diaphragm 20. In the form of the device shown in Fig. 4 of the drawings the cap structure is identical with that shown in Fig. 3 with the exception that all of the vents 30 are eliminated, save one, which is fitted with a release pin 32 having an outwardly extending shank and an enlarged head 33. Head 33 normally seats against a seat 34 occur-

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ring at the inner end of the vent 30 and may also be forced against the flange 22 of the sealing element 19 for a purpose to be hereinafter described.

In operation of the present invention any one of the forms of the cap is applied by inserting the end of the bottle neck, in the position indicated by dotted lines at "A" in Fig. 1 of the drawings, into the opening in the side of the cap. The cap is then moved in a plane normal to the axis of the bottle as indicated by the arrow "B" in Fig. 1 of the drawing. This will move the flange 18 under the lip 11. When the cap has assumed a position concentric with the axis of the lip the gases liberated from the liquid within the bottle will pass upwardly through the bleed aperture 29 and will create in the pressure chamber a counterpressure against the diaphragm 20. Attention is directed to the fact that the diaphragm 20 is formed so that it flexes downwardly below the plane of the shoulder 16 on the cap. This will tend to force the central portion of diaphragm 20 upwardly and at the same time will establish a firm contact between the mouth of the lip 11 and the sealing face of the diaphragm 20. This flexure will be resisted by the post 25 shown in Fig. 2 or the post 31 shown in Figs. 3 and 4. In the case of the structure shown in Fig. 2 the undercut valve face 28 will be forced upwardly against the inner face of the head 14. This will close and seal the vent 27. In the case of the structure shown in Figs. 3 and 4 the annular flange 22 will cover and close the vents 30. The gases liberated from the fluid sealed in the bottle upon which the cap is applied will then pass upwardly through the bleed aperture 29 and due to the fact that the area of the central portion of the diaphragm 20 defined within the annular area of contact with the seat at the end of neck 10, is materially less than the exposed opposite face of the diaphragm 20 there will be a pressure built up within the pressure chamber within the cap which will tend to force the diaphragm 20 against the seat and create a seal. As gas continues to be liberated from the fluid within the bottle this pressure will be increased so that sealing pressure will always be sufficient to hold the cap in its sealed position and insure that in the case of carbonated beverage, the beverage will not be "flat." When it is desired to release the cap of Fig. 2 the pin 26 is depressed to flex the diaphragm 20 and move the undercut valve face 28 away from contact with the head 14. Thus the gas pressure which has been built up within the interior of the cap and against the diaphragm 20 will be released and the cap may then be easily removed by movement in a counter direction to that indicated by arrow B in Fig. 1. In the event it is desired to release the cap shown in Fig. 3 a pointed element such as an ice-pick may be inserted in one of the vents 30 to flex the flange 22 to break the seal from the bottle to atmosphere. In Fig. 4 pressure on the pin 32 will flex the flange 22 and break this seal from the bottle through the opening 29 to the atmosphere.

Attention is called to the fact that the construction of the cap is such as to insure that when it is in place fluids which are not under pressure may be sealed in the bottle due to the pressure of the diaphragm against the end of the bottle mouth, and it is also to be pointed out that the cap may be released even though the fluid under pressure in the container does not completely pass to atmosphere when the vent is opened. There might be an occasion when the

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vent to atmosphere is smaller than the bleed aperture in the diaphragm. This will relieve the pressure without the necessity of allowing it to be dissipated entirely by venting to atmosphere.

By the structure here disclosed it will be possible to easily place the cap in a locking position over the mouth of the bottle and to thereafter utilize the external fluid pressure within the bottle to positively seal the cap and to increase the degree of sealing action as an increase in pressure prevails within the bottle or like container.

It will thus be seen that the structure here disclosed is simple in construction and operation, does not require any mechanical tightening means, and will act as a self-sealing closure when applied to the mouth of a bottle.

While I have shown the preferred form of my invention, it is to be understood that various changes may be made in the combination, construction and arrangement of parts, by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A removable and replaceable self sealing cap for closing the mouth of a pressure fluid containing bottle having a neck terminating in an end seat defining said mouth and a lip projecting radially outwardly therefrom, said cap comprising: a cap body having a head, an integral skirt on said head to encircle said lip, and a locking means comprising a U-shaped axial extension of one side of said skirt, having an inwardly extending flange axially spaced from said head for releasable engagement beneath said lip in interlocking relation therewith to secure said cap to said container in closing relation to said mouth; a flexible diaphragm in said cap, diametrically traversing the space encircled by said skirt and peripherally sealed to said skirt in a position axially spaced from said head to define a pressure chamber and to seat against said end seat when said cap is in said closing relation to the container; said diaphragm including a central portion defined within the annular area of engagement of the diaphragm against said seat and an annular marginal portion extending outwardly beyond said annular area of seating engagement; said central diaphragm portion having a bleed aperture through which fluid pressure from the container may enter said chamber; said chamber being of greater transverse area than the area of said central diaphragm portion, whereby the fluid pressure in said chamber will act upon said central diaphragm portion to balance the fluid pressure in the bottle applied to the underside of said central portion within said mouth, and will act upon said annular marginal portion to press said diaphragm against said seat; the head having therein a vent for venting said chamber so that said cap may be removed from the bottle; said central diaphragm portion having a valve element projecting axially across the chamber and seating against said head at said vent to normally close the vent, said valve element further functioning as a strut between said head and said central diaphragm portion to press the diaphragm against said seat in the absence of fluid pressure in said chamber; and manually operable means for unseating said valve element with reference to said vent, whereby to release fluid pressure from said chamber.

2. A cap as defined in claim 1, wherein said last mentioned means comprises a stem on said valve element projecting through said vent and

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engageable by manual finger pressure externally of said cap.

3. A removable and replaceable, self sealing cap for closing the mouth of a pressure fluid container having an annular wall terminating in an end seat defining said mouth and an external locking projection adjacent said end seat, said cap comprising: a cap body comprising a head, a skirt joined to the periphery of said head; and locking means projecting inwardly from the margin of said skirt in spaced relation to said head and releasably engageable beneath said locking projection in interlocking relation therewith to secure said cap to said container in closing relation to said mouth; a flexible diaphragm in said cap, diametrically traversing the space encircled by said skirt and peripherally supported upon and sealed to said skirt in a position axially spaced from said head to define a pressure chamber and to seat against said end seat when said cap is in said closing relation to the container; said diaphragm including a central portion defined within the annular area of seating engagement of the diaphragm against said seat and an annular marginal portion suspending said central diaphragm portion and extending outwardly beyond said annular area of seating engagement; said central diaphragm portion having a bleed aperture through which fluid pressure from the container may enter said chamber; said chamber being of greater transverse area than the area of said central diaphragm portion, whereby the fluid pressure in said chamber will act upon said central diaphragm portion to balance the container pressure applied to the underside of said central portion within said mouth, and will act upon said annular marginal portion to press said diaphragm against said seat; said cap having a vent communicating directly with atmosphere for venting said chamber so that said cap may be removed from the container; and a manually operable valve for normally closing said vent.

4. A cap as defined in claim 3, wherein said vent is in said head, and said valve element is in the form of an integral post projecting axially from said central diaphragm portion, having an annular offset shoulder engageable against the inner face of said head around the vent, to seal the vent, and having an integral reduced stem portion projecting through said vent and manually engageable by finger pressure exteriorly of the cap to move said shoulder out of contact with said head and thereby open the vent.

5. A bottle cap as defined in claim 3, wherein said diaphragm has an integral marginal axially extending flange adapted to make sealing engagement with the inner wall of said skirt under the pressure in said chamber, and wherein said vent is in said skirt and is normally closed by said sealing engagement between said diaphragm flange and inner skirt wall, said diaphragm flange being adapted to be engaged by an instrument inserted through said vent for unsealing said vent.

6. A bottle cap as defined in claim 3, wherein said diaphragm has an integral marginal axially extending flange adapted to make sealing engagement with the inner wall of said skirt under the pressure in said chamber, and wherein said vent is in said skirt and is normally closed by said sealing engagement between said diaphragm flange and inner skirt wall, and an operating stem extending through said vent and engaged

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against said diaphragm flange, for transmitting thereto manual pressure to unseat the same so as to open said vent.

7. A removable and replaceable self sealing cap for closing the mouth of a pressure fluid containing beverage bottle having a neck terminating in an end rim of substantially semi-circular cross-section defining said mouth, an end seat and a radially outwardly projecting locking lip adjacent said seat, said cap comprising: a cap body including a head, a substantially cylindrical skirt integral with and projecting axially from the periphery of said head, and locking means projecting inwardly from the margin of said skirt in spaced relation to said head and releasably engageable beneath said lip in interlocking relation therewith to secure said cap to said bottle in closing relation to said mouth; said skirt having an inner wall adapted to surround said lip and to define therewith an annular space lying outwardly of and below the plane of said seat; a sealing member of flexible material in said cap, including a generally disc-shaped diaphragm diametrically traversing the space within said skirt and axially spaced from said head to define a pressure chamber and to seat against said end seat when said cap is in said closing relation to the mouth, said sealing member further including an integral flange extending axially toward said head from the periphery of the diaphragm and adapted to make sealing engagement with said inner skirt wall; said diaphragm including a central portion defined within the annular area of engagement thereof against said seat and an annular marginal portion extending outwardly beyond said annular area of seat engagement and traversing said annular space; said central diaphragm portion having a bleed aperture through which fluid pressure within the bottle may enter said chamber; said chamber being of greater transverse area than the area of said central diaphragm portion, whereby the fluid pressure in said chamber will act upon said central diaphragm portion to balance fluid pressure applied to the underside thereof within said mouth, and will act upon said annular marginal portion to press the same downwardly into said annular space and to seal said diaphragm against said seat; said cap having a vent for venting said chamber so that said cap may be removed from the bottle; and a manually operable valve means for normally closing said vent.

8. Cap as defined in claim 7, including an integral post member projecting from the center of said diaphragm across said chamber and seated against the inner side of said head to act as a strut for establishing pressure of said diaphragm against said seat in the absence of fluid pressure in said chamber.

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