

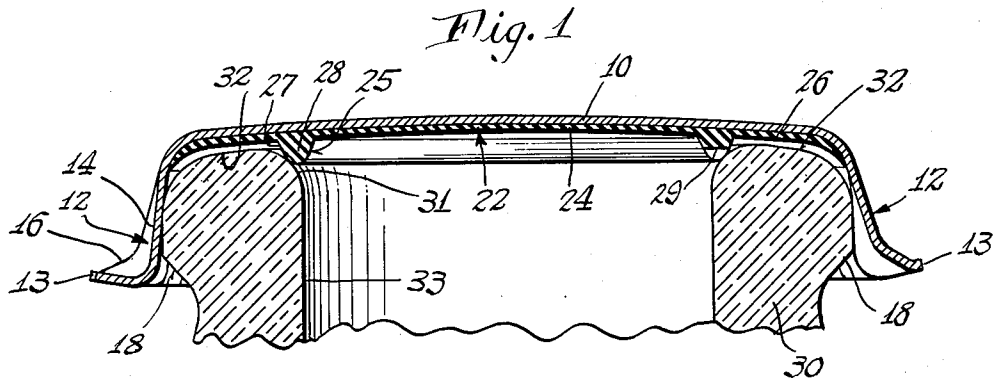
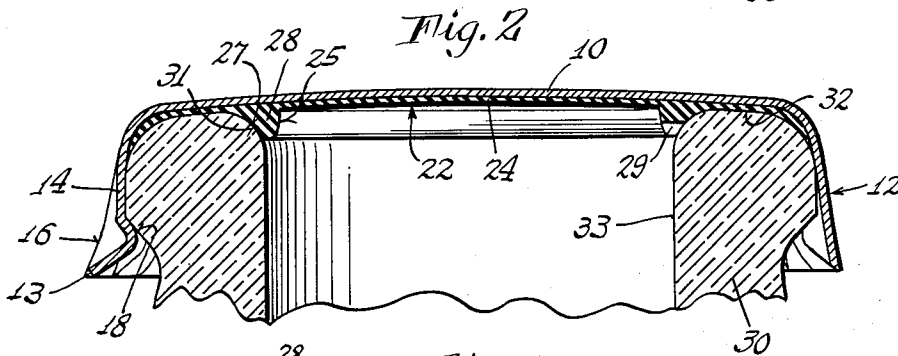
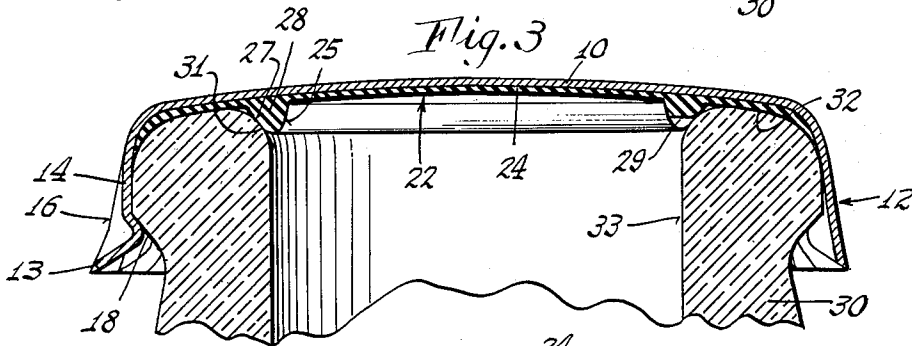
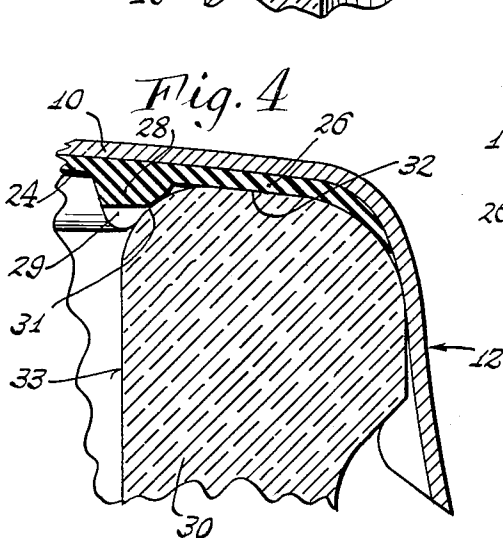
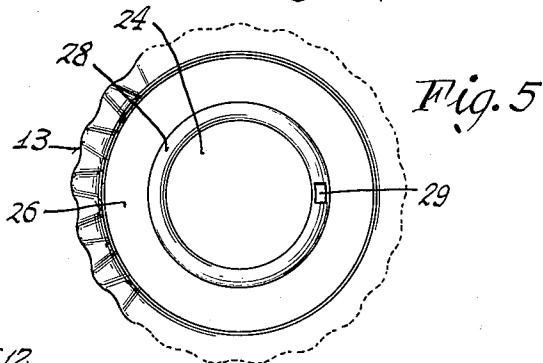
March 27, 1956

H. Z. GORA
SAFETY CROWN CAP

2,739,724

Filed Feb. 16, 1951

2 Sheets-Sheet 1



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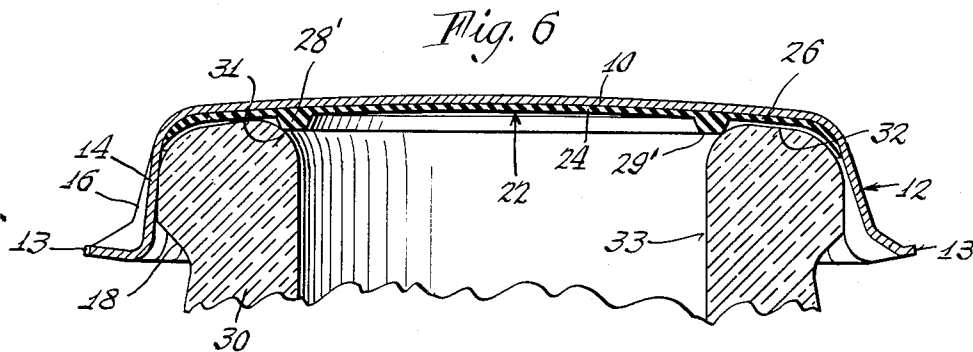
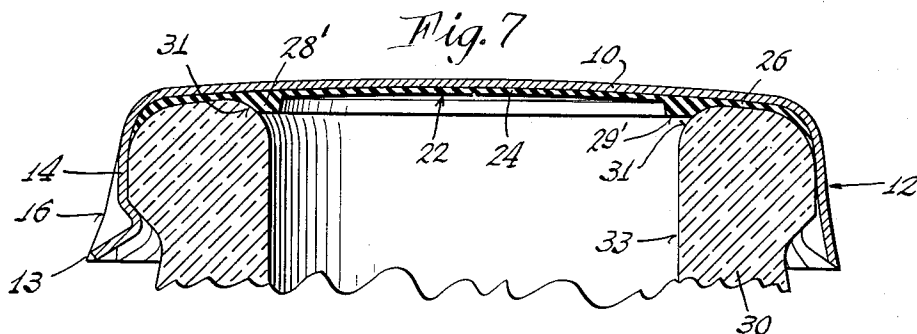
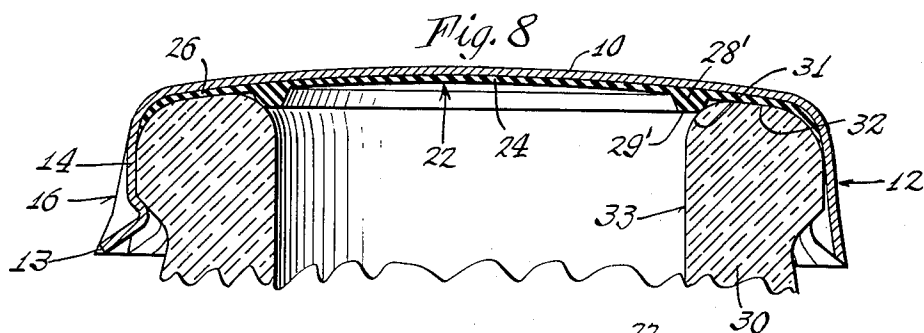
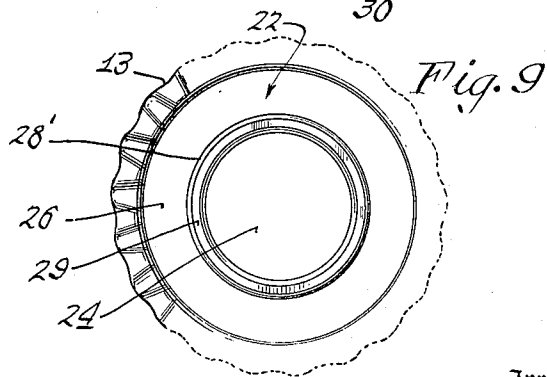
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2 Sheets-Sheet 2



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2,739,724

SAFETY CROWN CAP

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Application February 16, 1951, Serial No. 211,219

3 Claims. (Cl. 215—40)

This invention relates to container seals and, in the form illustrated herein is concerned particularly with crown caps for beverage bottles.

Heretofore, in the production of crown caps for containers of carbonated beverages or other liquids capable of exerting internal pressure, the crown shells have been made of tin plate of sufficient thickness and rigidity as to resist substantial flexing or bulging after application and crimping thereof to the container mouth to be firm and unyielding thereon until distorted in the operation of intentionally removing the cap. A cork liner has usually been applied, as by an adhesive, to the inside of the shell to create an intimate seal with the mouth of the container to aid in preventing the escape of carbonation.

When these beverage containers are stored under temperature conditions higher than those existing at the time of application and crimping of the crown cap, the internal pressure within the container will increase considerably and a dangerous and explosive condition could result, especially during handling and shaking of the bottle. Thus, the greatest internal pressure would exist and the most dangerous moment would occur when a person is handling the bottle at which time the need for safety would be greatest.

However, the seal maintained by crown caps using ordinary liners of cork has not been so effective ordinarily as to be dangerous. For example, an internal pressure of slightly over 200 pounds per square inch will compel a separation of the cork liner from the mouth of the container it is in contact with and bring about a compression or compacting of the cork liner with the result that the excess gas will be liberated and will emanate from between the cork liner and the container mouth. The cork liner, lacking sufficient permanent resiliency to return to its original conformation, if deformed in this operation will retain its deformed shape and will not reseal itself properly after the excess gas has escaped and the liberation of the gas will continue until the pressure is completely gone and the result will be a "flat" or spoiled beverage which is wholly unpalatable and undesirable. The possibility of such an occurrence increases with the age of the cork liner and its consequent loss of resiliency.

A purpose of this invention is to provide a container closure which will yield upon a determinate pressure within the container to permit the fluid under excess pressure to be released, but which will immediately return to its original shape to reseal the container upon the pressure being reduced to a value somewhat less than said determinate pressure but sufficiently high to maintain a satisfactory degree of carbonation.

A further purpose of this invention is to provide for the retention of such advantageous properties over sufficiently long periods of time.

According to the present invention, this may be accomplished by (1) making the crown cap so that it intentionally yields or bulges upwardly under safe but unde-

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sirably high pressures within the container and is resilient enough to return to its operative position when the pressure has been reduced, and (2) by providing a sealing disk or liner of yieldable, resilient material such as an elastomeric compound having a normal sealing engagement with the mouth of the container which is more or less modified by the determinate displacement of the cap toward or away from the container mouth so as to become temporarily inoperative to retain internal pressure when the cap bulges abnormally outwardly but to become operative again when the cap returns inwardly to its normal condition.

With this arrangement, the sealing engagement of the liner with the container persists due to the shape and resiliency of the liner as the cap initially yields under normal internal pressures, but ceases when the cap yields farther under abnormal pressures, thereby permitting escape of fluid. When sufficient fluid has escaped so as to permit the cap to return to its normal position, the liner again contacts the mouth of the container and becomes effective to again assume sealing engagement with the container.

A feature of the invention is the provision of a safety crown cap wherein a lighter weight and more flexible material may be employed in the manufacture thereof, but which will nevertheless prevent undesirable loss of internal pressure from the container.

Another feature of this invention is the provision of a beverage crown in which by predetermining the shape of the sealing member and resiliency of the shell, the crown can be made to respond to release predetermined fluid pressure in the bottle.

The safety crown cap of the present invention can be used with containers of carbonated beverages, beer, ale, or any similar substances or materials wherein the problem of accumulating internal pressures is present.

Other purposes, advantages and uses will appear in the following description of the preferred embodiment of the invention referring to the accompanying drawing, wherein:

Figure 1 is a fragmentary cross-section of a container with a safety crown cap according to the present invention, prior to the capping operation.

Fig. 2 is a fragmentary cross-section similar to Fig. 1 but showing the container and safety crown cap, after the completion of the capping operation.

Fig. 3 is a fragmentary cross-section similar to Fig. 1 but showing the flexing or bulging effect due to the creation of high internal pressures within the container.

Fig. 4 is a fragmentary cross-sectional view of the right-hand end of Fig. 3 but in increased scale to show the conformation of the resilient annular ridge.

Fig. 5 is a plan view of the safety crown cap of the present invention.

Fig. 6 is a fragmentary cross-section in elevation of a container showing a modification of the safety crown cap of Figs. 1 to 5.

Fig. 7 is a fragmentary cross-section in elevation similar to Fig. 6 but showing the container and modified safety crown cap after the completion of the capping operation.

Fig. 8 is a fragmentary cross-section in elevation similar to Fig. 6 but showing the flexing or bulging effect due to the creation of high internal pressures within the container.

Fig. 9 is a plan view of the modified safety crown cap of the present invention.

This invention in its broader aspects is directed to an improved safety container seal and will be particularly described with reference to a safety crown cap for a beverage container inasmuch as the invention is of par-

ticular applicability to such containers of carbonated beverages or similar liquids capable of exerting internal pressure against the crown cap.

In the accompanying drawings, as particularly shown in Fig. 1, the safety crown cap comprises a shell normally of sheet metal having a plate 10, and an axially-projecting, peripherally-fluted skirt or rim 12, which is capable of being deformed or crimped to provide a clinching or retaining skirt which will mechanically grip an external ledge 18 surrounding the mouth of a container 30, as shown in Fig. 2.

The skirt 12 has inwardly curved flutes, or depressions 14 which alternate with rib-forming outwardly-projecting pleats 16, which rise from the upper portion of the skirt, vary in height as shown in Fig. 1, left-hand side, and disappear at the outer periphery 13 of the skirt 12.

Such a cap has been illustrated and described in my copending application Serial No. 80,185, filed March 8, 1949, now Patent No. 2,543,774, March 6, 1951, but it is to be pointed out that the application of the present invention is not limited to such a cap but may find use with other caps, provided the shell possesses the requisite flexibility.

Heretofore, the caps of the standard carbonated beverage type have been manufactured from sheets of approximately 103 pound tin plate of a thickness of .012 inch, in order to secure satisfactory capping and sealing results. As a consequence of the advantages of my invention, equally satisfactory capping and sealing results can be obtained with a lighter stock material of only 80 pound tin plate of a thickness of only .009 inch approximately. This represents a saving of almost twenty-five per cent in costs of material and results in a more flexible crown cap than hitherto used, without any sacrifice in dependability or operativeness.

The safety crown cap as illustrated herein may be applied to a standard beverage container having a mouth with a top surface 32 and an inner edge surface 31 which is flared into an annular vertical wall 33. In standard beverage containers, the internal diameter of the mouth of the container is normally 0.64 inch substantially and the external diameter normally 1.03 inches substantially.

Secured to the inner surface or underside of the plate 10 is a liner 22 which consists of a layer of compressible, molded resilient material. Preferably, the composition used will be primarily rubber, either natural or synthetic, or a suitable thermoplastic or elastomeric material so compounded as to be odorless and tasteless, and to be free from effects on, or to be affected by, ordinary foods or liquids which may be stored in the container 30. The liner 22 has a centrally located circular diaphragm 24 which is preferably extremely thin, serving mainly to prevent contact of the contents of the container with the metallic plate 10. At the periphery of the liner 22 is an annular portion or zone 26 which is thicker than the circular diaphragm 24. The annular portion or zone 26 extends to the periphery of liner 22 which fully covers the underside of plate 10 and underlies a small portion of the fluted rim or skirt 12. The annular zone 26 is positioned to engage the top surface 32 of the mouth of the container 30 and to exert a sealing effect therewith. At the juncture of the circular diaphragm 22 and the annular zone 26 is an annular ridge 28 extending downwardly from said liner 22. The ridge 28 has a downwardly tapered cross-section and at its base is somewhat larger in outer diameter than the internal diameter of the container 30, as measured at the vertical wall 33.

As shown in the left-hand portion of Fig. 1, an outer wall 27 of the annular ridge 28 meets the annular zone 26 at an obtuse angle and an inner wall 25 of the ridge 28 extends inwardly and meets the central diaphragm 24 at an obtuse angle. Both walls meet at an apex which forms an annulus of a diameter less than the opening

of the mouth of the container but not that much less as to enter said mouth any substantial distance.

Inasmuch as the central diaphragm 24 is thinner than the annular zone 26, the ridge 28 will meet the central diaphragm 24 at a point closer to the plate 10 than the point at which it meets the annular zone 26.

The liner 22 is firmly adhered or attached to the plate 10, preferably by pressure molding, in situ. In this way, the extremely thin central portion of the liner is formed in place at once and requires no further handling which might damage the same. This also obviates the necessity for an adhesive to secure the liner 22 to the plate 10. However, this does not preclude the use of a liner of similar conformation which may be separately formed and adhered in place thereafter, if desired, within the general principles of this invention.

The cap, having the liner 22 firmly secured therein, is placed upon the mouth of a container 30, as shown in Fig. 1, the apex or lowermost edge of the ridge 28 being the portion of the liner to engage the flared inner edge surface 31 of the mouth of the container 30 and to support the cap thereon. As shown in Fig. 2, when the cap is pressed to sealing position and crimped, or otherwise secured to the container 30, the ridge 28 is forced into more intimate engagement with the downwardly and inwardly curving inner edge 31 of the container mouth, and is resistingly deflected radially inward so that its tendency is to press outwardly against the adjacent portion of the flared inner edge surface 31 of the mouth of the container 30 and maintain a radial pressure thereon.

Upon further consideration of Fig. 2, it is apparent that when the contents of the container are such as to exert gas pressure in excess of atmospheric, the ridge 28 operates in the manner of a check valve flap and its seal becomes more effective as the internal pressure in the container increases to press the ridge 28 more and more tightly against the surface 31. When the containers are stored under temperature conditions greater than those existing at the time of application of the cap, the internal pressures may build up considerably. However, each increase in internal pressure will be accompanied by a corresponding increase in the effectiveness of the seal between the ridge 28 and the surface 31 and the possibility of leakage or loss of internal pressure will actually be lessened.

As a result of such an effective seal between the liner and the mouth of the container, considerable pressures may be built up within the container. Such a type of liner has been found very effective for containers able to withstand such pressures and is illustrated and described in my copending application Serial No. 84,810, filed April 1, 1949, now Patent No. 2,543,775, March 6, 1951. However, in many cases the containers used are thinner walled or unable to stand such high pressures and therefore some means must be provided whereby the effectiveness of the seal be controlled or modified, so that such a seal may be used with containers of average or less than average strength.

The cap of the present invention constitutes an improvement over that disclosed in the above identified application in that the liner disclosed herein controls, in effect, the maximum pressure possible within the container and thus provides for a safety release for any excessive or dangerous pressures.

The present invention avoids the building up of any undesired or excessive internal pressures by relieving or removing at least a portion of the periphery of the ridge 28 so that when the internal pressure increases to a point wherein the crown cap flexes or bulges upwardly sufficiently, the relieved portion of the ridge 28 will lift from the flared inner surface 31 of the container mouth and permit the escape of fluid under the excess pressure. When the internal pressure has been lowered sufficiently and the crown cap has returned to its normal condition

due to the resiliency of the shell, the relieved portion of the ridge 28 will again be seated on the flared inner surface 31 of the container mouth to reseal the contents and prevent any further escape of fluid.

The alteration of the periphery of the ridge 28 may be accomplished in several ways. For instance, as shown in Figs. 1 to 5, a slot or indentation 29 is formed in the periphery of ridge 28, preferably during the molding operation. Normally, as shown in Fig. 2, the outer side of the ridge 28 is forcibly urged against the flared inner surface 31 to seal the contents of the container. When, however, the excessive internal pressure has increased in the container and has caused the plate 10 to flex and bulge upwardly, as shown in Figs. 3 and 4, the ridge 28 also is raised therewith and the contact between the ridge 28 and the surface 31 lessens until eventually escape of the fluid, usually the gas, is possible through the slot 29 and past the ridge 28 and the annular plate 32. After sufficient pressure has been released the inherent flexibility of the shell will assert itself and the curvature of the crown cap will return to a normal position. The resilient ridge 28 will be concomitantly returned to a more intimate contact with the flared surface 31 and thus an effective seal will be re-established.

The depth of the slot or indentation 29 determines the pressure at which the excessive gas will be released. The deeper the indentation 29, i. e. the closer its bottom surface approaches the base of the ridge 28, the lower will be the pressure at which the release occurs, assuming the resiliency of the shell is uniform. By a suitable selection of the size and shape of the ridge and the elasticity of the shell, the release may be predetermined for the maximum safe working pressure of the beverage container.

The width of the indentation 29 should not be too small as to invite the possibility of its side walls being pressed together during the capping process. The minimum width will depend upon the nature of the material used for the seal. For most usable materials, a width of $\frac{1}{16}$ of an inch has been found satisfactory.

The indentation may be made as wide as desired and may even cover the entire periphery of the ridge 28, to form a flat surface 29', as shown in Figs. 6 to 9. However, it has been found that when a ridge 28' is relieved throughout its entire periphery so that the pressure may be released at many points thereof, release of the excess pressure has occasionally been at too low a value in the case of beverage bottles which had imperfect mouths and possessed nicks or fissures on the flared inner surface 31.

In the case of "throw-away" bottles, or bottles being used for the first time, the relieving of the ridge 28' throughout its entire periphery has produced excellent results without any releases at too low pressures, no doubt due to the more perfect mouths of these bottles.

The release of the internal pressure in this case will depend on the thickness or height of the annular ridge 28' for shells of the same resiliency. Therefore, by a selection of heights, it is possible to control the exact point of release of pressure.

It has been determined that, when a narrow slit is used, as disclosed in the embodiment illustrated in Figs. 1 to 5, and the relieved portion of the ridge 28 is made sufficiently small, the possibility of the slit 29 coinciding with a nick or fissure is negligible, and in such case there have been few, if any, releases at lower than the determinate pressure.

Thus the escape of excess gas which causes a rise in the internal pressure within beverage containers is controllable and such can be done by relieving or cutting down more or less of the periphery of the sealing ridge in at least a portion of its circumference. One of the unusual and unexpected results of the present invention is the fact that when the excess pressure has been reduced to slightly below the determinate value, the seal again becomes effective and will continue so until the pressure

again becomes excessive, when the flexible nature of the crown cap shell and the resilient nature of the liner will again permit a controlled release of the excess internal pressure.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A pressure releasing safety cap for a container having a mouth formed with a transversely curved lip therearound having an end surface with an annular curved inner edge, said cap comprising a top plate having inherent flexibility and a skirt depending therefrom to fit over the mouth of the container and grip a retaining ledge on the exterior of the container adjacent the mouth, and a sealing member on the undersurface of the plate and positioned to be interposed between the plate and the lip of the container to seal the mouth, said sealing member comprising a unitary thin disk of resiliently deformable elastomer completely covering said plate and secured thereto to move therewith and having an annular contacting surface adapted to engage the end surface of the lip and conform thereto with slight deformation of its material when the cap is secured to the container and an integral preshaped depending annular ridge, a substantial portion of which is adapted to overlie and engage the inner portion of the end surface and extend downwardly into the mouth of the container to engage the annular curved inner edge of the lip, the ridge being adapted to be flexed inwardly by the lip as the cap is applied to grip the ledge, the resiliency of the flexed ridge, when applied to a container, causing the same to press against an inner portion of the end surface of the lip and the inner edge of said lip in sealing engagement therewith and fill the space between the lip and top plate for various predetermined flexed positions of said plate in response to normal pressures in the container, the improvement wherein at least a part of the exposed lower edge of the ridge is positioned a predetermined distance from the plate to move out of sealing relation with the annular curved lip when the top plate and liner is flexed upwardly more than said predetermined amount due to abnormal excessive pressures within the container and releases said abnormal pressure within the container while the cap remains on the container, the resiliency of the plate and ridge causing the ridge to return to normal position and again become effective to seal the container when the abnormal pressure in the container is released and the pressure returns to normal.
2. A pressure releasing safety cap for a container having a mouth formed with a transversely curved lip therearound having an end surface with an annular curved inner edge, said cap comprising a top plate having inherent flexibility and a skirt depending therefrom to fit over the mouth of the container and grip a retaining ledge on the exterior of the container adjacent the mouth, and a sealing member on the undersurface of the plate and positioned to be interposed between the plate and the lip of the container to seal the mouth, said sealing member comprising a unitary thin disk of resiliently deformable elastomer completely covering said plate and secured thereto to move therewith and having an annular contacting surface adapted to engage the end surface of the lip and conform thereto with slight deformation of its material when the cap is secured to the container and an integral preshaped depending annular ridge of substantially triangular cross-section, a substantial portion of which is adapted to overlie and engage the inner portion of the end surface and extend downwardly into the mouth of the container to engage the annular curved inner edge of the lip, the ridge being adapted to be flexed inwardly by the lip as the cap is applied to grip the ledge, the resiliency of the flexed ridge, when applied to a container, causing the same to press against an inner portion of the end surface of the lip and the inner edge of said

lip in sealing engagement therewith and fill the space between the lip and top plate for various predetermined flexed positions of said plate in response to normal pressures in the container, the improvement wherein the exposed lower edge of the ridge is provided with a transversely extending indentation positioned a predetermined distance from the plate to move out of sealing relation with the annular curved lip when the top plate and liner is flexed upwardly more than said predetermined amount due to abnormal excessive pressures within the container and releases said abnormal pressure within the container while the cap remains on the container, the resiliency of the plate and ridge causing the ridge to return to normal position and again become effective to seal the container when the abnormal pressure in the container is released and the pressure returns to normal.

3. A pressure releasing safety cap for a container having a mouth formed with a transversely curved lip therearound having an end surface with an annular curved inner edge, said cap comprising a top plate having inherent flexibility and a skirt depending therefrom to fit over the mouth of the container and grip a retaining ledge on the exterior of the container adjacent the mouth, and a sealing member on the undersurface of the plate and positioned to be interposed between the plate and the lip of the container to seal the mouth, said sealing member comprising a unitary thin disk of resiliently deformable elastomer completely covering said plate and secured thereto to move therewith and having an annular contacting surface adapted to engage the end surface of the lip and conform thereto with slight deformation of its material when the cap is secured to the container and an integral preshaped depending truncated annular ridge, a substantial portion of which is adapted to overlie and engage the inner portion of the end surface and extend downwardly into the mouth of the container to engage the annular curved inner edge of the lip, the ridge being

adapted to be flexed inwardly by the lip as the cap is applied to grip the ledge, the resiliency of the flexed ridge, when applied to a container, causing the same to press against an inner portion of the end surface of the lip and the inner edge of said lip in sealing engagement therewith and fill the space between the lip and top plate for various predetermined flexed positions of said plate in response to normal pressures in the container, the improvement wherein the exposed lower edge of the truncated ridge is positioned a predetermined distance from the plate to move out of sealing relation with the annular curved lip when the top plate and liner is flexed upwardly more than said predetermined amount due to abnormal excessive pressures within the container and releases said abnormal pressure within the container while the cap remains on the container, the resiliency of the plate and ridge causing the ridge to return to normal position and again become effective to seal the container when the abnormal pressure in the container is released and the pressure returns to normal.

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