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SELF-VENTING CLOSURE CAP, CUSHION DISK THEREFOR,
AND METHOD OF MANUFACTURE

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FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

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This invention relates to receptacle closures of the self-venting type and to a method of manufacturing and assembling such closures.

In the packaging of certain types of materials, a serious difficulty arises as a result of the tendency of such materials to liberate gases under particular conditions of shipment, storage or the like. When such gases are liberated, as a result of chemical or physical changes in the materials, the pressure within the container necessarily increases, and, if the liberation of gases continues, the pressure may increase toward or past the danger point, whereupon the container may be broken or the closure seal destroyed, with the result that the contents of the receptacle are spoiled or otherwise rendered worthless, and persons in the vicinity of the containers are liable to injury.

The prior art has attempted to avoid these difficulties, and to overcome the problems presented, by designing special types of caps and/or liners having vents associated therewith, adapted to permit the escape of the liberated gases when the internal pressure in the container reached a predetermined point. For the most part, however, the prior art efforts have been directed toward slits, holes, rupturable areas, passages, or the like in the cap or the liner, or to caps having special structural features, to enable them to vent gases from such receptacle. The slit type liner, for instance, has not proved generally satisfactory, because of the likelihood of leakage of the receptacle contents (if a liquid) and because of the possibility of the entrance of moisture or external air (if a solid or powder). Moreover, structural changes in the cap itself have been found to be disadvantageous because such caps are not suitable for use with conventional materials, where the venting problem is not present and because it is always more expensive to produce specially constructed caps than conventional caps.

It is an object of the present invention to provide a novel, efficient and expeditious method of manufacturing such disks, and of assembling them with conventional or special receptacle closure caps.

In the accompanying drawing, certain preferred illustrative embodiments of the invention are disclosed, but it must be understood that the invention is not limited to the specific details thereof, or to the features of construction described below, but covers all devices and methods falling within the scope of the appended claims and their equivalents.

In the drawing:
Figure 1 is a sectional view of a receptacle closure in accordance with the present invention, taken on a substantially diametric, vertical plane.
Figure 2 is a similar view taken on a diametric plane at right angles to that of Figure 1.
Figure 3 is a fragmentary view taken on the plane of Figure 1, showing the parts, somewhat exaggerated, in venting position.
Figure 4 is a view similar to Figure 3, taken on the plane of Figure 2.
Figure 5 is a top plan of a cushion disk in accordance with the invention.
Figure 6 is a side elevation of the article of Figure 5.
Figure 7 is a view similar to Figure 5, showing a slight modification.
Figure 8 is a side view, partly in section and partly in elevation, showing a slightly modified form of cap, and
Figure 9 is a diagrammatic view of a preferred method of making the disks and assembling them with caps.

Referring to Figures 1-4, the neck 10 of a conventional receptacle, such as a bottle, is provided with the usual screw-thread 11 and with an upper, annular sealing surface 12 around the mouth thereof. A screw cap 13 having a top 14 and a depending skirt 15, provided with a continuous thread 16, is secured on the neck 10 by cooperative relation between the threads 11 and 16, in such manner that the cap can be drawn downwardly in the usual manner to compress the cushion liner disk 17 between the top and the sealing surface 12, as is well understood in the art. Obviously, instead of using a continuous thread type of cap and a bottle neck or jar having a similar finish, a lug type cap may be employed and the jar provided with the well known "amersel" finish.

The cushion disk 17 preferably comprises a sheet of relatively resilient material such as cardboard, rubber or the like and a facing layer 18.
on its substantially plane bottom sealing surface which is impervious to gases and liquids. The layer 18 may be formed from any of the materials conventionally used in the art, such as varnish, varnish-coated paper, metal foil, synthetic resin materials, or the equivalent. If desired, the facing layer may be omitted as such, provided that the cushion disc liner is otherwise made impervious to gases and liquids.

In accordance with the invention, an area of the circular disk extending entirely across the same between spaced points on the disk margin is rendered of increased compressibility, so that when gas pressure in the receptacle is raised to a predetermined point, by any cause whatever, the cushion disk in that area may be compressed, the pressure flexing the sealing surface of the disk upwardly within the compressible area entirely across the disk, as shown in Figures 3 and 4, and at the margins to permit the gases to vent between the two sealing surfaces at the marginal points where the cushion disk is of increased compressibility. As shown in the accompanying drawings, this transverse compressible area is formed by providing in the upper face of the disk a groove or channel 20 which extends between circumferentially spaced points on the margin of the disk entirely across the disk while leaving a circumferentially continuous margin below the ends of the channel. As shown in Figures 1, 3 and 5, the groove or channel 20 is defined by a bottom substantially parallel in the direction of its length with the surfaces of the disk and by side edges which are preferably straight. Where, in the claims, reference is made to the sides or side edges of the groove, I do not refer to groove side wall surfaces, but to the lines of junction between the groove and the substantially plane upper surface of the disk, since, as pointed out below, the groove may be of any desired cross-sectional shape. The material of the disk, below the groove 20, is of increased compressibility, since it can flex upwardly entirely across the disk to occupy at least a portion of the space provided by the groove. As shown in Figures 3 and 4, this upward flexing or compression of the material below the groove 20 provides a vent opening 21, between the sealing surface 12 and the facing 18, so that gas may escape outwardly into the space between the skirt 16 and the outer periphery of the bottle neck 10. Obviously, this gas may then escape to external atmosphere by following a spiral path downwardly along the threads 11, 16, or, if desired, and as shown in the modification in Figure 6, an aperture 23 may be formed in the base of the cap, or elsewhere to permit the ready escape of the vented gases. If the latter expedient is used, the gases simply flow upwardly, after passing through the vent space 21, and then along the channel 26, until they reach the aperture 23, where they escape to atmosphere.

As shown in Figures 1-5, the groove or channel 26 is preferably considerably wider than deep, although, as suggested in the modification shown in Figure 7, any appropriate shape or proportion of the dimensions of the channel may be employed, such as that shown at 28. As stated above, the channel or groove provides an area of increased compressibility in the disk, to permit the pressure of the gas in the receptacle to lift the sealing surface of the disk out of contact with the sealing surface of the receptacle. From another point of view, it might be considered that the groove 20, or its equivalent, simply provides an area where a decreased sealing pressure is applied to the sealing disk by the top of the receptacle when the cap is screwed down on the bottle neck. In other words, the cushion disk is subjected to a certain substantially uniform compression entirely around the disk, except at the area below the groove, by the pressure applied thereto by the cap top, but, at the areas below the groove, the disk is compressed to a lesser degree, since less pressure is applied. Hence, since the disk at that point is under less pressure and is less compressed, it can flex or lift upwardly to vent the receptacle contents. However, sufficient pressure is applied and the disk is under sufficient compression entirely around the sealing surface 12 to provide a satisfactory seal to prevent the escape of the liquid contents of the receptacle and to prevent the entrance of moisture or external air thereinto.

As indicated in Figure 9, the cushion disks are preferably made and assembled with caps by feeding an elongated relatively narrow strip 30 of cushion material, such as cardboard or the like, along a predetermined path by appropriate feed rolls (not shown) under a hold-down plate 31 and over a relatively narrow, rapidly rotating cutter, abrasive wheel, grinder or the like, device 33, the latter being positioned to cut in one face of the strip, a longitudinally extending groove 34 which subsequently becomes a groove 26, or the like. Preferably, the groove is cut centrally of the strip, so that it will be disposed diametrically of the disks subsequently made therefrom. The strip is fed from the grooving mechanism 33 to a punch represented diagrammatically at 35, which cuts out disks from the strip and simultaneously deposits them on the caps, which are fed below the punch in timed relation to its movements, one of the caps being represented in the disk-receiving position at 36. Preferably, the strip material 30 has its upper surface coated or otherwise provided with a gas and liquid impervious material 38, before it is fed to the grooving and punching mechanisms 33, 35.

The cutter or abrasive wheel shown diagrammatically at 33 may be mounted for rotate vertical adjustment with respect to the strip 30, so as to cut grooves of different depths therein. Moreover, cutters or wheels of different widths or peripheral contour may be interchangeably used, to form grooves of various widths, depths or cross-sectional shapes. The width, depth and shape of the groove or recess in the upper surface of the gas and liquid impervious liner disks determine the pressure at which the sealing surface will be forced upwardly from sealing contact with the receptacle, thereby controlling the pressure at which venting will occur, as well as controlling the amount of gas that will escape and the pressure at which the receptacle will be re-sealed.

As stated above, many modifications of the specific constructions and method described above may be resorted to without departing from the present invention, and all such modifications as come within the scope of the appended claims or their equivalents are comprehended within the invention.

1. In combination, a cap comprising a top and a depending skirt provided with means for engaging the neck of a receptacle to draw the cap downwardly thereon, and a self-ventilating cushion
liner disk having a circumferentially continuous, circular margin and a continuous circular gas impervious lower surface positioned to engage the sealing surface of the receptacle, said disk having in its upper surface adjacent the top of the cap, an upwardly facing channel of substantial width forming an area in the disk of reducing thickness, said channel being defined by a bottom substantially parallel in the direction of its length with the surfaces of the disk and by straight side edges, said channel extending in the direction of its length continuously across the disk and intersecting the margins of the disc at circumferentially spaced points, whereby excessive internal pressures applied to the lower surface of the disk below the channel may force the same upwardly entirely across the disc and thereby assist in lifting said lower surface from the sealing surface of the receptacle to vent the receptacle.

2. A self-venting liner for use with a receptacle closure, comprising a cushion disk having a circular, circumferentially continuous margin and a circular, normally plane, gas impervious lower surface, said disk having in its upper surface an upwardly facing channel defined by a bottom substantially parallel in the direction of its length with said surfaces and by straight side edges, said channel extending in the direction of its length continuously across the disk and intersecting the circular margins of the disk at circumferentially spaced points, whereby excessive internal pressures applied to the lower surface of the disk below the channel may force the same upwardly entirely across the disk inwardly of the sealing surface and thereby facilitate lifting the said lower surface below the ends of the channel from the sealing surface of the receptacle to vent the receptacle.

3. The method of manufacturing self-venting liners for use with receptacle closures, which comprises feeding an elongated strip of flexible sheet material along a predetermined path, forming in one surface of said material a continuous channel extending longitudinally of the strip while leaving the other surface substantially plane, and cutting from said strip liners having continuous circular margins with the channel portion of the strip extending across the liners and intersecting the circular margin at circumferentially spaced points.

4. The method of manufacturing self-venting liners for use with receptacle closures, which comprises feeding an elongated strip of flexible sheet material along a predetermined path, forming in one surface of said material, a continuous channel extending longitudinally of the strip while leaving the other surface substantially plane, and continuously cutting from said strip as it is channeled liners having continuous circular margins with the channeled portion of the strip extending across the liners and intersecting the circular margin at circumferentially spaced points.

5. In combination, a cap comprising a top and a depending skirt provided with means for engaging the neck of a receptacle to draw the cap downwardly thereon, and a self-venting cushion liner disk having a circumferentially continuous, circular margin and a continuous circular gas impervious lower surface positioned to engage the sealing surface of the receptacle, said disk having in its upper surface adjacent the top of the cap, an upwardly facing channel of substantial width forming an area in the disk of reduced thickness, said channel being defined by a bottom substantially parallel in the direction of its length with the surfaces of the disk and by sides which are continuous from end to end of the channel, said channel extending in the direction of its length continuously across the disk and intersecting the margins of the disk at circumferentially spaced points, whereby excessive internal pressures applied to the lower surface of the disk below the channel may force the same upwardly entirely across the disk and thereby assist in lifting said lower surface from the sealing surface of the receptacle to vent the receptacle.

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