

[54] SELF-VENTING VESSEL
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[51] Int. Cl. **B65d 51/16**
[58] Field of Search 220/89 A, 44 R, 44 E

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14221; Prepared by H. A. Wasborh, R. E. Reimnagel,
May 1970.

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[57] **ABSTRACT**

A self-venting vessel such as an aerosol container, having at least one wall subject to outward distortion by internal pressure buildup, which wall is modified to provide an annular protuberance having an aperture therein, and a generally cup-shaped closure member which is affixed to cap and seal the aperture in the protuberance under normal internal pressures. When the internal pressure becomes excessive, the closure member is forced by the resulting distortion of the wall to slip from its original position, thus uncapping the aperture and venting the vessel.

7 Claims, 8 Drawing Figures

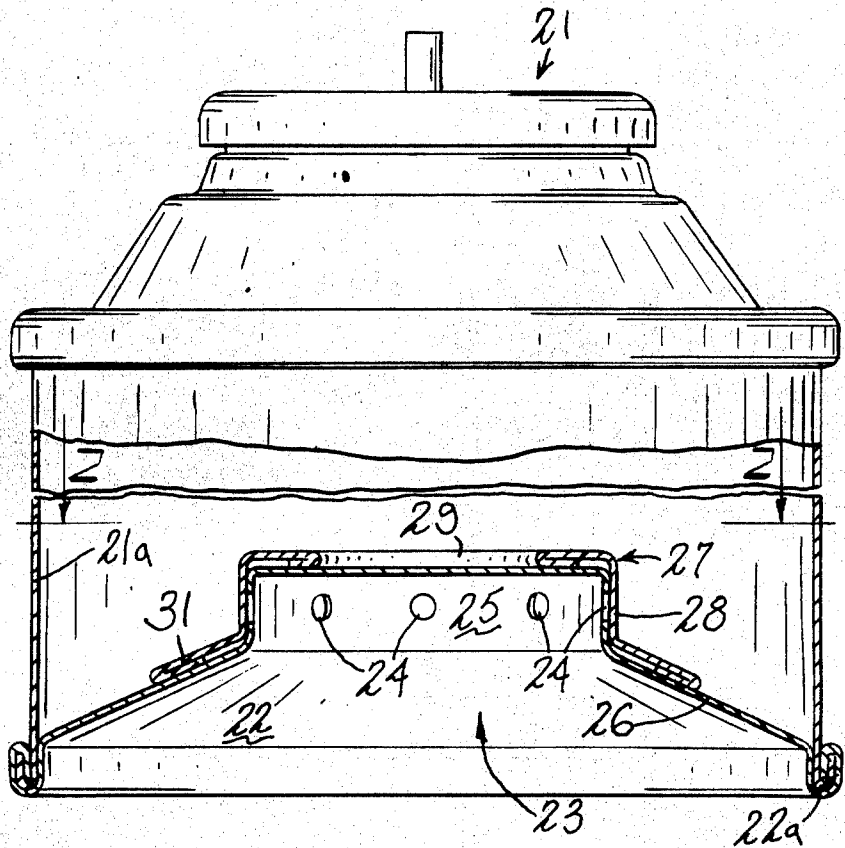


Fig. 1.

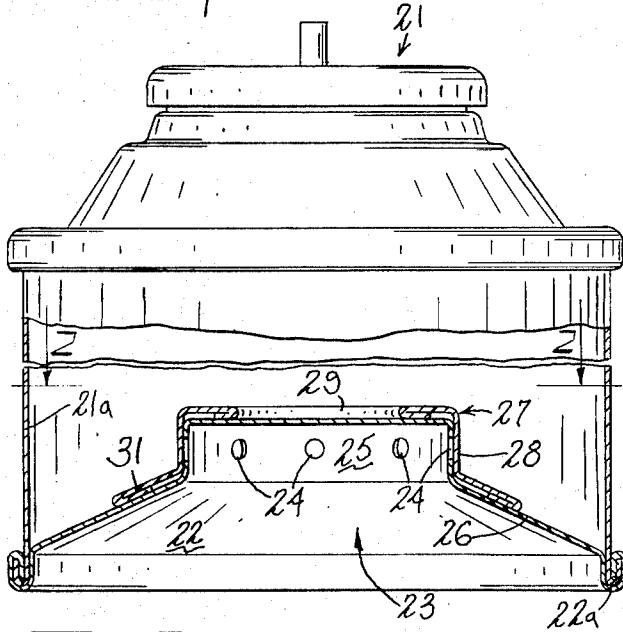


Fig. 2.

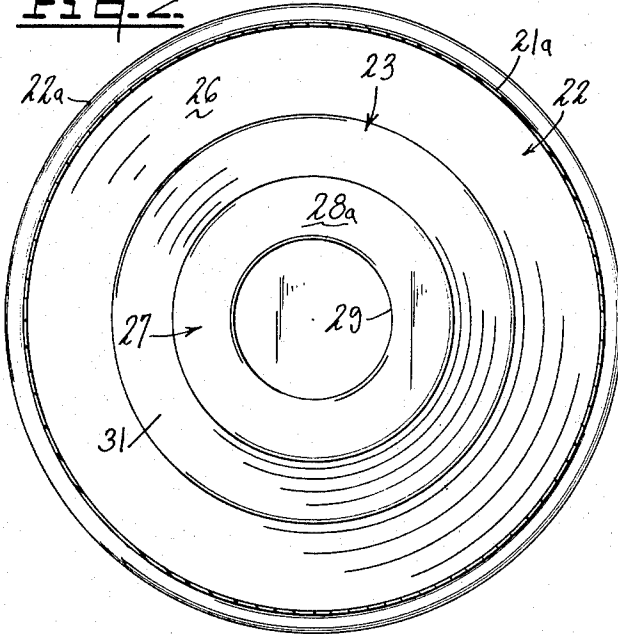


Fig. 3.

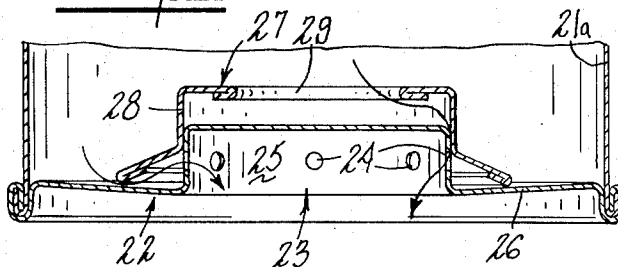


Fig. 4.

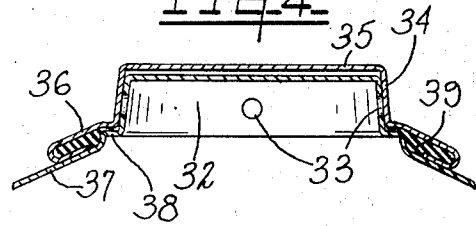


Fig. 5.

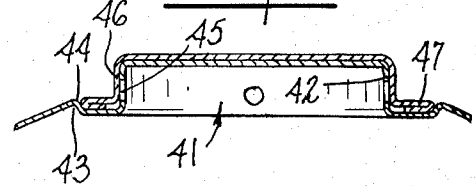


Fig. 6.

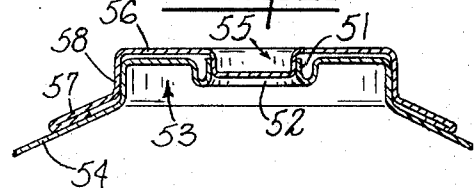


Fig. 7.

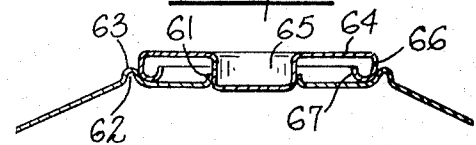
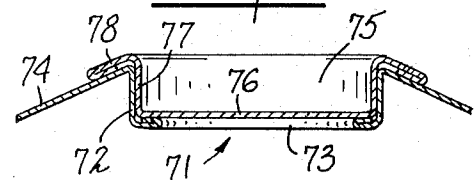


Fig. 8.



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SELF-VENTING VESSEL

BACKGROUND OF THE INVENTION

This invention relates to self-venting vessels, especially self-venting pressure vessels.

A common hazard in the use of vessels, especially pressure vessels, is the explosion of the vessel caused by a buildup of pressure in the vessel in excess of the retention strength of the walls and other structural points in the vessel. Representative of such vessels are the standard aerosol-type containers designed to hold fluids and gases under pressure in one or more compartments within the reservoir of the vessel. When such vessels are exposed to an open flame or other source of excessive heat such as incinerators, hot stoves, and the like, the vessel even when thought to be empty is capable of exploding with such force as often to shoot metal fragments in all directions. The hazard of explosion exists during the filling and quality testing of the vessels, as well as during shipping, storage, use and disposal.

While considerable attention has been given to the standardization of the strengths of vessels relative to pressurization for normal use conditions, such as Interstate Commerce Commission regulations, it is obvious that it is uneconomical to manufacture vessels strong enough to eliminate all possibility of distortion and explosion. Among the modifications which have been attempted are so-called "safety valves", unfolding seams, sealing materials which melt at elevated temperatures, weakened points, and eutetic metal plugs. In addition to the expense entailed by these modifications, each suffers from particular problems. For example, it has been observed that internal pressure buildup can be so fast that a relatively large aperture is required to vent the vessel quickly enough to prevent an explosion. This requirement therefore excludes eutetic metal plugs since in addition to the impracticality of a large plug of this type, the plug cannot be heated up fast enough to cause melting, thereby quickly forming a sufficiently large hole for venting.

OBJECTS OF THE INVENTION

Accordingly, an object of the invention is to provide a new and improved self-venting vessel, that is, a vessel which vents itself when excessive internal pressure is reached, thereby avoiding explosion of the vessel.

Another object of the invention is to provide a new and improved pressure vessel which is self-venting and nonexplosive no matter how quickly the excessive internal pressure is attained.

These and other objects, features and advantages of the invention will in part be obvious and will in part be apparent from the specification which follows.

SUMMARY OF THE INVENTION

The invention is best understood and appreciated by consideration of the events which normally occur during the explosion of a pressure vessel. While the following discussion is in terms of conventional aerosol containers, it will be understood that such containers are but representative of pressure vessels rendered non-explosive in accordance with the invention, the invention being applicable to any pressure vessel having a wall subject to outward distortion caused by internal pressure buildup.

When excessive pressure buildup occurs in an aerosol container, the top wall usually first begins to distort.

Then the bottom wall of the container, which normally is inwardly concave or stacked, begins to bulge outwardly, causing unfolding of the seam uniting the bottom wall to the side wall. As the bottom wall continues to bulge, the valve assembly on the top end of the container begins to lift, causing outward bulging of the valve mounting cup accompanied by unfolding of the top seam of the container. The actual sequence of distortion of the various parts of the container and the rapidity of distortion will depend, of course, on the relative strengths of the various walls and seams, as well as upon the design of the interior compartments of the container. For most of the existing aerosol containers, however, the lifting ("eversion") of the walls will be in the sequence described.

Briefly, the essential features of the invention relate to a vessel having at least one wall subject to outward distortion by internal pressure buildup, which wall is modified to provide an annular protuberance having an aperture therein, and to a closure member for the aperture, which is generally cup-shaped and fits in or on the protuberance so as to seal the aperture under normal internal pressure. When the internal pressure becomes excessive, the closure member is forced by the resulting distortion of the wall to slip from its original position, thus uncapping the aperture and venting the vessel.

The invention accordingly comprises a self-venting vessel possessing the features, properties, and the relation of elements which will be exemplified in the vessel hereinafter described, and the scope of the invention will be indicated in the claims.

DETAILED DESCRIPTION

For a fuller understanding of the nature and objects of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is an enlarged elevation of portions of a self-venting vessel of the invention before excessive internal pressure buildup, with the bottom portion of the vessel shown in section;

FIG. 2 is a top view along the line 2-2 of FIG. 1;

FIG. 3 is a portion of the sectional view of FIG. 1 showing relative positions of parts during excessive internal pressure buildup; and

FIGS. 4-8 are fragmentary vertical sections, similar to the sectional portion of FIG. 1, illustrating other embodiments of the invention.

With reference to FIGS. 1-3, a self-venting vessel of the invention, such as an aerosol container 21, includes a cylindrical side wall 21a, a bottom wall 22 and a circumferential bottom seam 22a normally formed by curling the overlapping edges of the side wall and bottom wall. Bottom wall 22 is formed with an a generally cylindrical inwardly extending protuberance 23, preferably centrally positioned in bottom wall 22. Apertures 24 are positioned in the side walls of the protuberance. The side walls forming the periphery of the apertures define a generally cylindrical wall 25. The portion of wall 22 which is shown as a skirt immediately adjacent wall 25 defines a shoulder 26. An inverted generally cup-shaped closure member 27 is press-fitted as a cap over protuberance 23, as shown in FIG. 1, when the internal pressure of the container is normal. Closure member 27 includes a side wall portion defining a generally cylindrical wall 28 which sealingly engages generally cylindrical wall 25 under normal internal

pressures, thereby closing apertures 24. The bottom wall 28a of the inverted cup-shaped closure member is provided with an aperture 29. Positioned outwardly and on the edge of generally cylindrical wall 28 is a projection, preferably formed as an annular skirt, defining a lever member 31, which sealingly engages shoulder 26.

Under normal internal pressures, the closure member 27 caps protuberance 23, thereby closing apertures 24. Upon excessive internal pressure buildup, wall 22 begins to distort and to bulge outwardly (in a downward direction in FIG. 3). It will be evident that as wall 22 is distorted in this fashion, the skirt portion forming lever member 31 is biased by shoulder portion 26, causing disengagement of wall 28 from the wall 25, thereby lifting closure member 27 and opening apertures 24. In consequence, the interior of container 21 is quickly vented in the direction of the arrows shown in FIG. 3 and explosion of the container is prevented.

In the embodiment of FIG. 4, a side wall of the protuberance again defines a generally cylindrical wall 32 similar to wall 25 of the embodiment of FIG. 1. Positioned in wall 32 are apertures 33. In the closure member of FIG. 4, there is a side wall 34 but, in contrast to the embodiment of FIG. 1, the bottom wall 35 is closed. Immediately adjacent and outwardly of wall 34 is a projection, preferably in the form of an annular skirt, forming lever member 36. A portion of the bottom wall of the container adjacent lever arm 36 forms a shoulder 37, and is connected to wall 32 by a crimped annular edge 38. The crimped edge 38 in conjunction with a sealing material 39, for example in the form of a conventional rubber-like can seaming compound or gasket, within the curled outer edge of lever member 36, serves to maintain a good seal between the elements of the structure. Preferably, as shown, the side walls of the protuberance and closure members, defining walls 32 and 34 respectively, are slightly tapered to facilitate initial press-fitting and relative dislocation under excessive internal pressures, in a manner now to be described.

In operation under excessive internal pressures, the outward distortion of the bottom wall of the container, including shoulder 37, biases lever member 36 to cause the closure member to lift and to move wall 34 away from aperture 33, thereby opening the aperture and venting the vessel. The relative taper of the walls defining walls 32 and 24 promotes the rapid venting of the vessel since the space between the walls increases as the closure member lifts off the protuberance and seal 39 is broken.

In the embodiment of FIG. 5, the bottom wall of the container is formed as an inwardly extending protuberance 41 with the side wall 42. Outwardly surrounding the protuberance 41 is a second protuberance 43, an inside wall of which defines a wall 44. As in the previous embodiments, the side wall 42 has located therein apertures 45 and the side wall of the closure member defines a generally cylindrical wall 46. Likewise, a projection immediately adjacent and outwardly of wall 46, preferably in the form of an annular skirt, defines a lever member 47 which sealingly engages wall 44 when internal pressure in the container is normal. Upon distortion of the bottom wall of the container including the portion forming protuberance 43 and wall 44, the wall 44 biases lever member 47 to cause lifting of clo-

sure member wall 46 and opening of apertures 45, for venting of the container.

In the embodiment of FIG. 6, the upturned peripheral edges on the bottom wall of the container define a first protuberance 51 in which is centrally positioned an aperture 52. Outwardly surrounding the protuberance 51 is a second protuberance 53 of annular shape and having an annular skirt on its outer edge defining a shoulder 54. A depending embossment 55 centrally positioned in the closure member abutts the peripheral edges of first protuberance 51 to close aperture 52. The embossment is centrally positioned in bottom wall 56 of the closure member. Projections, preferably in the form of an annular skirt defining a lever member 57, are positioned on the outer edge of side wall 58 of the closure member. The operation is similar to that described in the previous embodiments. Distortion of the bottom wall of the container including shoulder 54 causes biasing of lever member 57 and lifting of embossment 55 from aperture 52, thereby venting the container.

The embodiment illustrated in FIG. 7 is similarly structured in that upturned edges in the bottom wall of the container define a first protuberance 61. Outwardly positioned and surrounding first protuberance 61 is a second protuberance 62, the inner walls of which define a wall 63. On the bottom wall 64 of the closure member is centrally positioned a depending embossment 65 adapted to extend into the aperture in the protuberance 61 and thereby to plug the aperture under normal internal pressures. On the side wall 66 of the closure member are inwardly directed projections, preferably in the form of curled lip, defining lever member 67. It will be noted that in contrast to the previous embodiments, the side wall 66 of the closure member fits within protuberance 62 and it is only the centrally positioned sleeve defining embossment 65 which is press-fitted into the bottom wall of the container. However, operation under excessive internal pressures is similar. Upon distortion of the bottom wall of the container, including wall 63 on protuberance 62, wall 63 biases lever member 67 upwardly, thereby lifting embossment 65 from the aperture in the wall of the container, to cause venting of the container.

The embodiment of FIG. 8 is similar in most respects to that of FIGS. 1-3 except that the generally cylindrical protuberance 71, having the side wall 72 on the periphery of aperture 73, is directed outwardly (downwardly in FIG. 8) of the bottom wall of the container. However, a portion of the bottom wall defines a shoulder 74 as in the prior embodiments. The closure member includes a closed sleeve 75 having a bottom wall 76 and a side wall 77, for interiorly engaging the protuberance 71, thereby closing aperture 73 under normal internal pressures. The lever member 78 of this embodiment is similarly formed as projections, preferably as an annular skirt on sleeve 75. Upon eversion of the bottom wall of the container, including shoulder portion 74, shoulder 74 biases lever member 78 to cause elevation of sleeve 75 out of protuberance 71, thereby opening aperture 73 and venting the vessel.

It will be evident that the material from which the closure member is manufactured may be any material which is compatible with the contents of the vessel and which has sufficient strength to be press-fitted onto the protuberance in the bottom wall, or other wall, of the

vessel. While steel is perhaps the most desirable construction material, it is evident that a heavy-duty plastic might also be suitable. The thickness and relative proportions of the modified wall of the container subject to outward distortion may vary widely depending on the strength and dimensions of the vessel which is thus modified. Accordingly, the invention is applicable to vessels of different sizes, such as the aerosol container sizes described in the trade as 202, 211 and 300, and the invention is applicable to pressure vessels meeting distortion pressure specifications of Government agencies such as the Interstate Commerce Commission, including the specifications known in the trade as "non-specification", "2P" specifications and "2Q" specifications. It will be apparent that a substantial advantage of the invention is that standard vessels such as aerosol containers can be easily modified in accordance with the invention and can be made explosion proof and used, stored, and disposed of without hazard.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above vessel without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. In a self-venting vessel:

a first wall subject to outward distortion by internal pressure buildup, a protuberance on said wall having an aperture therein, a portion of said protuberance which forms the periphery of said aperture defining a generally cylindrical wall, a portion of said first wall outwardly adjacent said generally cylindrical wall defining a shoulder;

a generally cup-shaped closure member for said aperture having a bottom wall and peripheral side wall, said peripheral side wall including a wall portion of generally cylindrical shape adapted for sealing engagement with said generally cylindrical wall of said protuberance to close said aperture, said member further including a lever member positioned outwardly of said closure member peripheral side wall such that, in response to distortion of said first wall, said shoulder biases said lever member to disengage said generally cylindrical wall portion of said closure member from said generally cylindrical wall of said protuberance and thereby to vent said vessel;

wherein said aperture is positioned in said generally cylindrical wall portion of said protuberance, said shoulder is joined at an angle to said generally cylindrical wall portion of said protuberance, and wherein said closure member generally cylindrical

cally shaped wall portion is formed as a sleeve for exteriorly engaging said protuberance, said lever member being defined by at least one projection from an edge of said sleeve remote from the top of said protuberance; and

wherein said sleeve is closed at the portion adjacent the top of said protuberance.

2. A vessel according to claim 1 including a plurality of said apertures in the generally cylindrical wall portion of said protuberance.

3. A vessel according to claim 1 wherein said projection defines an annular skirt on said sleeve.

4. A vessel according to claim 1 wherein said sleeve and the side wall of said first protuberance are tapered in a direction axially outwardly from the attached end of said protuberance.

5. A vessel according to claim 1 wherein said generally cylindrical wall of said protuberance and said first wall shoulder are connected by a crimped annular edge, and the outer edge of said lever member is curled and contains in the resulting curled portion a sealing material.

6. In a self-venting vessel:

a first wall subject to outward distortion by internal pressure buildup, a first annular protuberance on said wall having an aperture therein, a portion of said protuberance which forms the periphery of said aperture defining a generally cylindrical wall a portion of said first wall outwardly adjacent said shoulder generally cylindrical wall defining a;

a generally cup-shaped closure member for said aperture having a bottom wall and peripheral side wall, said peripheral side wall including a wall portion of generally cylindrical shape adapted for sealing engagement with said generally cylindrical wall of said protuberance to close said aperture, said member further including a lever member positioned outwardly of said closure member peripheral side wall such that, in response to distortion of said first wall, said shoulder biases said lever member to disengage said generally cylindrical wall portion of said closure member from said generally cylindrical wall of said protuberance and thereby to vent said vessel;

wherein said generally cylindrical wall of said protuberance is defined by a side wall of said first protuberance and said aperture is positioned in said side wall, said vessel further including a second annular protuberance on said first wall surrounding said first protuberance, wherein the inside wall of said second protuberance defines said shoulder, said lever member being defined by an annular skirt projecting from that end of said closure member generally cylindrical wall remote from the top of the second protuberance adjacent said third shoulder.

7. A vessel according to claim 6 including a plurality of apertures in the side wall of said first protuberance.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,759,414 Dated Sept. 18, 1973

Inventor(s) Walter C. Beard

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 30, "eutetic" should read "eutectic"; column 1, line 36, "eutetic" should read "eutectic". Column 4, line 9, "embasement" should read "embossment"; column 4, line 10, "abutts" should read "abuts"; column 4, line 12, "embassment" should read "embossment". Column 6, line 30, delete "shoulder"; column 6, line 30, after "a" insert --shoulder--; column 6, line 46, "sise" should read "side".

Signed and sealed this 25th day of December 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents