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Zundel

[11] **3,831,822**

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[54] **SAFETY AEROSOL CAN**

[75] Inventor: **Arthur P. Zundel,** Mt. Prospect, Ill.

[73] Assignee: **National Can Corporation,** Chicago, Ill.

[*] Notice: The portion of the term of this patent subsequent to Apr. 3, 1990, has been disclaimed.

[22] Filed: **Mar. 22, 1973**

[21] Appl. No.: **344,057**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 262,050, June 12, 1973, Pat. No. 3,724,727.

[52] **U.S. Cl.** ..... **222/397,** 220/89 A
[51] **Int. Cl.** **B65d 83/14**
[58] **Field of Search** ..... 222/396, 397; 220/44 C, 220/44 D, 44 R, 89 A

[56] **References Cited**

UNITED STATES PATENTS

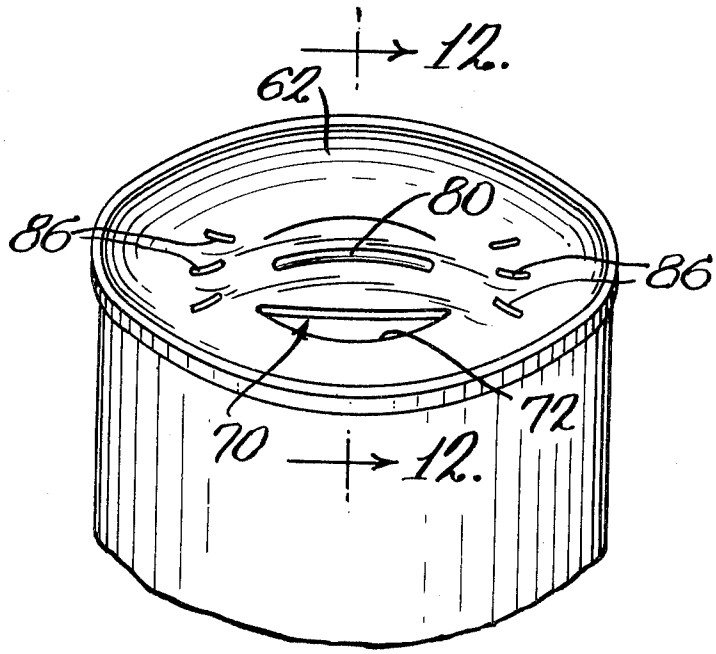
2,795,350	6/1957	Lapin	220/89 A X
3,029,987	4/1962	Gronemeyer	220/89 A
3,074,602	1/1963	Shillady et al.	222/397
3,244,316	4/1966	Atkinson et al.	220/89 A
3,680,743	8/1972	Reinnagel	222/397

Primary Examiner—Stanley H. Tollberg
Attorney, Agent, or Firm—Dressler, Goldsmith, Clement & Gordon, Ltd.

[57] **ABSTRACT**

The invention disclosed here relates to a safety vent for pressurized containers consisting of a relief pressure area in a wall of the container with crowning means within the relief pressure area that produces a crown when the pressure in the container exceeds a predetermined safe limit. The relief pressure area is defined by a pair of spaced, weakened portions that are separated from each other by unweakened portions. In one embodiment the crowning means is a bead that extends generally parallel to the weakened portions and in another embodiment a plurality of weakened lines extending generally normal to the weakened portions define the crowning means.

21 Claims, 12 Drawing Figures



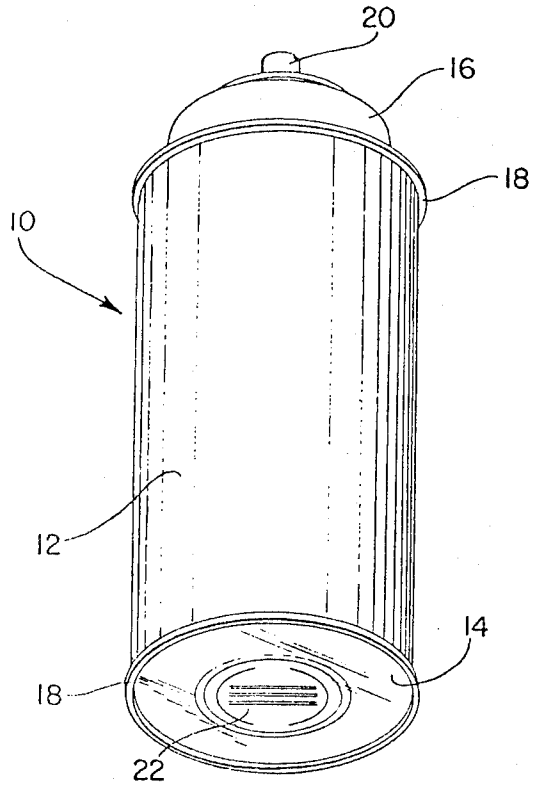


FIG. 1

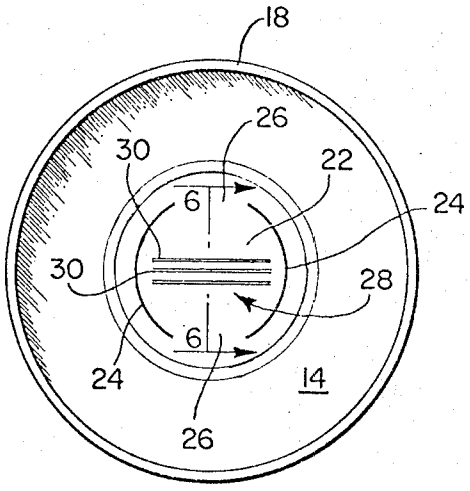


FIG. 2

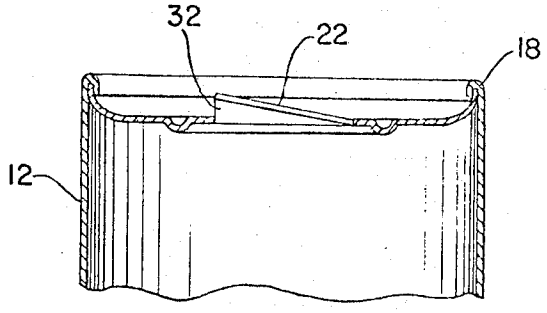


FIG. 4

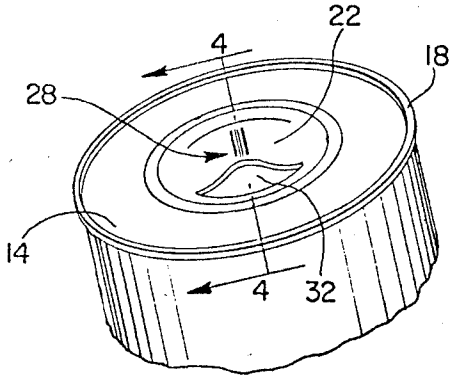


FIG. 3

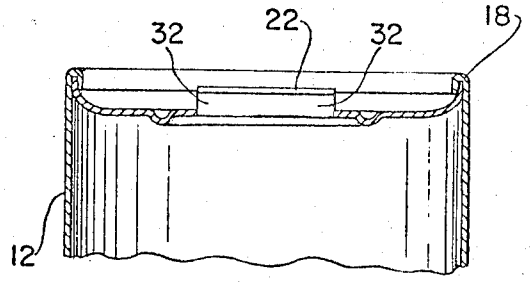


FIG. 5

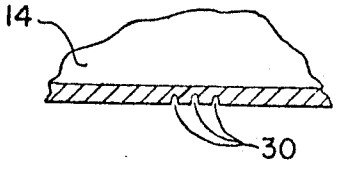


FIG. 6

Fig. 7.

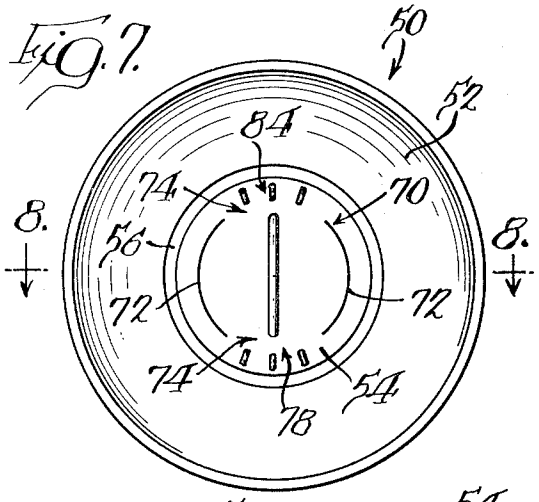


Fig. 9.

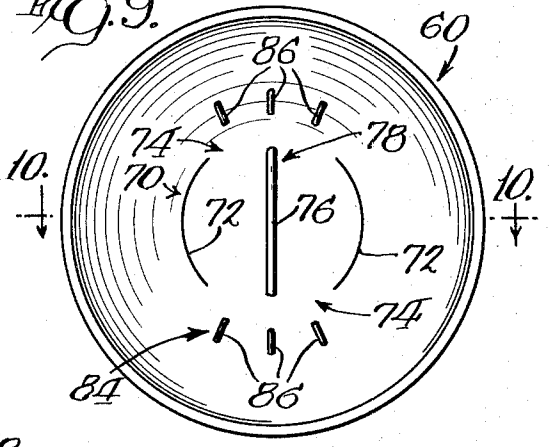


Fig. 8.

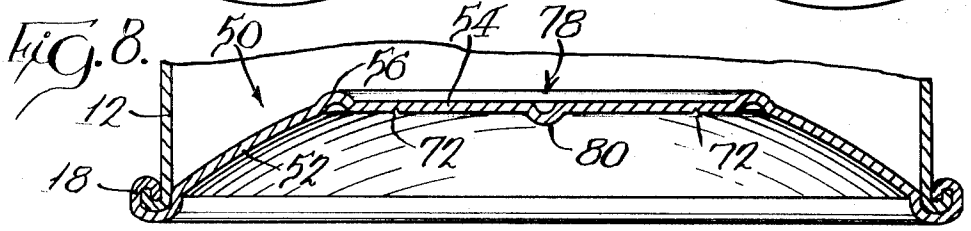


Fig. 10.

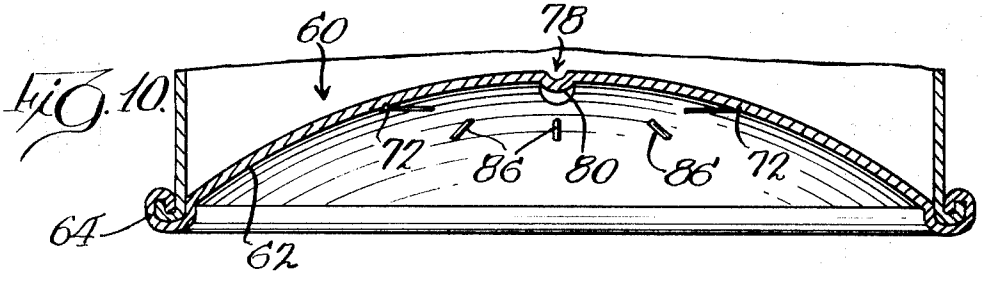


Fig. 11.

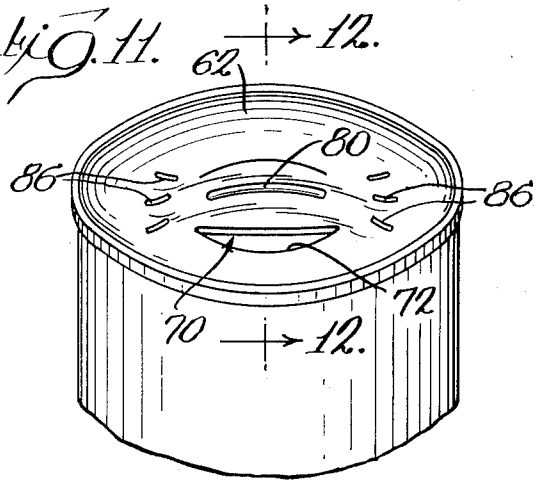
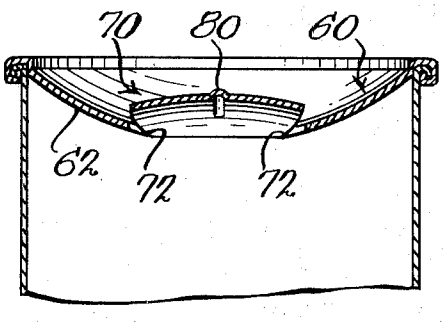


Fig. 12.



SAFETY AEROSOL CAN

REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 262,050 filed June 12, 1972, which matured into U.S. Pat. No. 3,724,727 on Apr. 3, 1973.

BACKGROUND OF THE INVENTION

Pressurized dispensing containers and the like are now well known and are widely used for packaging and dispensing such products as hair spray, shaving lather, and food products. Most often such products are mixed with a FDA approved propellant which is gaseous at room temperature and pressure. Most often such dispensing containers are referred to as aerosol containers. It is necessary that such aerosol containers be safely suited for utilization including their transportation from point to point and their ultimate disposal as through home or commercial incineration and/or compaction.

Several mechanisms for accomplishing the above objectives have been proposed by the container industry including a mechanism called "rim vent release" wherein slight notches or cuts are formed in the can stock which ultimately makes up that portion of the can known as the double seam so that upon inversion of the notched end of the container upon a pressure increase above a predetermined safe level, the movement of this end uncovers and splits such weakened areas to produce venting. Such a container is described in U.S. Pat. No. 2,795,350 to Lapin. To date such construction has not been fully commercialized.

Other mechanisms and constructions representing further approaches to provide a safety pressurized container of the type described have been suggested and proposed. One such approach includes the use of a weakened line or lines defining an area within the container wall which is subject to tearing or opening upon increased pressure beyond a certain predetermined safe pressure limit. It has been found, however, that in many cases these weakened areas are subject to complete and sudden removal from the container wall and thus although in part providing a vent means also present a related safety hazard of their own in the form of a projectile.

It has also been suggested to utilize heat fusible plugs tightly fitted into openings provided in the container walls. Such have proven satisfactory in those instances wherein the increased pressure above a predetermined safe level within the container is caused by an even application of heat. Obviously such ideal conditions are not always present nor has such proposed solution any application when increased pressures are caused by crushing forces such as would be brought about through the use of compaction devices such as those now finding increase use in household kitchens.

SUMMARY OF THE INVENTION

The present invention provides a safety vent for pressurized containers which obviates the above difficulties of prior art devices and which is extremely simple in design and structure, inconspicuous in application and inexpensive to incorporate into the normal pressurized aerosol container constructions.

The safety vent means consists of a relief pressure area that is located in one wall of a container, preferably the lower end wall. The relief pressure area is defined by a pair of opposed arcuate weakened portions that are separated from each other by spaced unweakened portions with crowing means located between the pair of weakened portions. The crowing means will produce a bulge or outward crown in the relief pressure area when the pressure in the container exceeds a predetermined level which will cause a stretching of the metal and ultimate severing or rupture of the weakened portions to allow a pressure equalization between the inside and outside of the container.

In one embodiment, the crowning means consists of a plurality of parallel weakened lines defined in the metal of the container and extending generally normal to the arcuate weakened portions defining the pressure relief area. These weakened lines are located within the confines of the pressure relief area and the residual metal in the parallel weakened lines is greater than the residual metal in the weakened portions.

In another embodiment, the crowning means consists of an outwardly directed bead that extends generally parallel between the two opposed weakened portions and the opposite ends of the bead terminate adjacent but inside the area defining the pressure relief area in the wall of the container. In this embodiment, the container wall also has rigidifying means in the form of spaced inwardly directed beads that are located adjacent the unweakened portions and outside of the area that defines the pressure relief area in the wall of the container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a pressurized dispensing container incorporating the safety vent means of my present invention;

FIG. **2** is a bottom plan view of the container shown in FIG. **1** showing one version of safety vent means provided in the container lower end wall, the vent means being depicted in a closed unvented state prior to subjection to forces above a predetermined safety level;

FIG. **3** is a perspective view of a base portion of the container shown in FIG. **1** on a slightly enlarged scale and showing the safety vent means provided therein in an open vented position;

FIG. **4** is a cross-sectional view taken on the line **4—4** of FIG. **3** showing one manner in which the vent means of the present invention operates;

FIG. **5** is a cross-sectional view similar to FIG. **4** showing another manner in which the vent means of the present invention operates;

FIG. **6** is a partial cross-sectional view taken on the line **6—6** of FIG. **2**;

FIG. **7** is a bottom plan view of the container similar to the view shown in FIG. **2** and showing a modified type of safety vent means provided in the lower end wall;

FIG. **8** is a transverse-sectional view as viewed along line **8—8** of FIG. **7**;

FIG. **9** is a bottom plan view similar to FIG. **7** showing the modified safety vent means in the container lower end wall that is concave in cross-section:

FIG. **10** is a transverse-sectional view as viewed along line **10—10** of FIG. **9**;

FIG. **11** is a perspective view of the bottom portion of the container shown in FIG. **9** showing the safety vent means in a vented position; and

FIG. 12 is a sectional view as viewed generally along line 12—12 of FIG. 11.

DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail several specific embodiments, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated.

Referring now to the drawings wherein like reference characters designate the same or corresponding parts throughout the several views and more particularly to FIG. 1 and FIG. 2 thereof, the safety vent of the present invention is shown. An aerosol dispensing container **10** is depicted as formed from a cylindrical side wall portion **12** provided with base and top wall closures **14** and **16** at opposite ends. Such end walls **14** and **16** may be attached to the side wall portion **12** of the container **10** by means of conventional double seams **18.** Alternately the container may be formed of two piece construction wherein the bottom wall **14** is integral with the side wall **12.** It should also be understood that the safety means of the present invention may be incorporated to other areas of the container other than the lower end wall or base **14.** Also, while the present container will be referred to as an aerosol dispensing container, such terms should be recognized as a term of art and inclusive of other pressurized containers. The container **10** is further provided with a dispensing means **20** of conventional construction.

The pressure relief area **22** is depicted of circular configuration but may take on other shapes and configurations within the following general constructional framework, wherein such pressure relief area **22** is comprised of a first set or pair of weakened line portions **24** generally opposed to each other and separated by spaced unweakened wall portions **26.** The relief pressure area, defined by weakened portions **24** and unweakened portions **26,** has crowning means between the weakened portions that produce a crown, as will be described later. In the embodiment illustrated in FIGS. **1–6,** the crowning means consists of a second weakened line portion **28** that is positioned within the pressure relief area **22** and preferably incudes an odd number of weakened lines **30**; 3 being depicted in the drawings. Other odd numbered, e.g. 1,5, etc. lines **30** might be utilized for a purpose which will be hereinafter made apparent.

The weakened lines **24,** as are the weakened lines **30,** are formed in a conventional manner such as scored lines formed in the end wall **14** of the can 10. Such scoring can be formed on the ends while in a flat blank form and prior to being double seamed onto the container body **12.** The scoring to form the weakened lines **24** is deeper than that forming the weakened lines **30,** and accordingly pressure within the container **10** above a predetermined level will initiate rupture along either or both lines **24** while simultaneously permitting bending or crowning of the relief pressure area along the second weakened line portion **28** as best depicted in the cross-sectional views showing rupture pressure relief area configurations in FIGS. **4** and **5.**

An inspection of FIG. **2,** reveals that the relief pressure defined by weakened and unweakened portions **24** and **26** is circular in plan and that the diameter of relief pressure area **22** is approximately one-half and preferably slightly less than one-half the diameter of the circular lower end **14.** Also, the arcuate weakened portions **24** each have a circumferential dimension substantially greater than 90° but less than 180° and the center weakened line **30** passes through the center of the circular relief pressure area.

FIG. 4 shows the ruptured or open vented condition of the pressure relief area **22** wherein tearing or rupture was initiated along the left hand weakened portion **24** and FIG. 5 depicts that condition wherein tearing was initiated along both weakened portions **24** simultaneously. The characteristic tentlike construction shown in both FIG. 4 and **5** is brought about by the co-action of the end openings **32** formed by the tearing of one or more of the weakened line portions **24** and the second weakened line portion **28** permitting the upward travel of the pressure relief area **22** about the unweakened wall portions **26.** Bending occurs along the central portion of the weakened line portion **28** which in turn contributes to the formation of a stiffening tent-like structure thus reducing the chance of continued tearing along the weakened lines **24** into the unweakened wall portions **26** which could cause undesirable complete or partial tear-out of the entire pressure relief area **22.** The use of an odd number of weakened lines **30** contributes in the formation of a central bend line which in turn forms the central ridge of the pressure resisting tent-like configurations shown in FIG. **4** and **5** of the drawings. During the formation of the tent-like configuration, metal flows from the periphery of the lower end wall through the unweakened portions **26** into the relief pressure area.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. By way of example more than two weakened line portions **24** may be provided. For example, should three such areas be provided and each spaced from each other the second weakened line portions **28** would be more radially disposed within the pressure relief area **22** and directed towards the mid-point of one or more of such weakened lines. Also, depending on the differential pressure contemplated, several parameters such as container material and thickness, as well as scoring depths to form weakened line portions **24** and **28** may be provided. Thus, the individual lines **30** making up the second weakened line portion **28** may vary in scored depth, such variation decreasing outwardly so as to emphasize the tent effect described above.

A slightly modified form of relief pressure are defining a safety vent means is shown in FIGS. **7–12.** In FIG. **7,** the modified relief pressure area is illustrated in a container similar to that shown in FIGS. **1–2** which is commonly referred to as a "stacker" container while FIGS. **9–12** show the modified relief pressure area in a container that has a concave lower end wall. Since the two pressure relief areas shown in the respective types of containers are substantially identical in the construction, like reference numerals will be utilized for both versions of the container.

In FIGS. **7** and **8,** the lower end wall **50** is configured to allow containers to be stacked end-on-end before the dispensing means **20** is located in the top wall closure of the container. For this purpose, the container lower end wall or closure has an arcuate annular portion **52** that is connected to the lower end of cylindrical side wall **12** of the container through the conventional

double seam **18.** Lower end wall **50** also has a planar flat portion **54** located inside the annular portion **52** and separated therefrom by an inwardly directed circular bead **56.**

The container end wall **60** shown in FIGS. **9–12** is generally referred to as a "concave" or "regular" container end in which the lower end wall is arcuate in cross-section to define a concave outer surface **62** and the periphery of the concave end wall **60** is connected to container side wall **12** through double seam **64.** The outer concave surface **62** has a constant radius. In another version (not shown) the lower end wall is also concave in cross-section, but the concave surface has a first radius of curvature adjacent the periphery and a second radius of curvature adjacent the center of the end wall which is greater than the first radius of the area adjacent the periphery of the circular end wall.

As indicated above, pressure relief areas **70** for the two container end walls shown, respectively in FIGS. **7** and **9,** are identical in construction so that only one will be described in detail. Referring to FIG. **9,** pressure relief area **70** that defines the safety vent means for the pressurized container consists of a pair of spaced weakened portions **72** that are separated from each other by spaced unweakened portions **74.** As most clearly shown in FIG. **9,** the weakened portions are arcuate and have a common radius that is located at a common center **76** between the two weakened portions so that the pressure relief area that defines the safety vent is circular in plan view. The pressure relief means also includes crowning means **78** between the two weakened portions **72** and the crowning means will produce a crown or tent-like construction substantially between the weakened portions **72** when the pressure within the container exceeds a certain level, as will be explained in more detail later. In the embodiment illustrated in FIGS. **7–12,** the crowning means consists of an elongated bead **80** that is deformed outwardly in the body of the circular end wall **50** or **60.** The elongated bead has opposite ends terminating inside the circular relief area as is most clearly shown in FIGS. **7** and **9.**

The lower end wall of th container also has rigidifying means **84** adjacent each of the unweakened portions **74** to maintain the area of the container adjacent the weakened portions **74** in substantially the original condition. In the illustrated embodiment, the rigidifying means consists of a plurality of equally spaced beads **86** that are deformed inwardly in the container end wall and are equally spaced from each other. The respective beads **86** extend radially from the center **76** of the pressure relief area and are located adjacent each of the unweakened portions **74** outside of the circular pressure relief area **70.** It has been found that the number and specific location of the inwardly directed beads **86** is important, as will be explained later.

When an excess pressure above a predetermined level is developed within the container, the pressure relief area **70** will act in a manner similar to that described in connection with the relief area shown in FIGS. **1–6.** A predetermined pressure will cause an initial outward bulging or tenting of the circular pressure relief area **70** generally longitudinally between the two spaced weakened portions **72.**

The longitudinal bead **80,** more particularly the location, direction and configuration will insure that the pressure relief area will tent or bulge outwardly and that the center of the bulging portion is located substantially equally between the two weakened portions **72.** This necessarily results since the outwardly deformed bead will weaken the container end along the center of the bead which will therefore be the first area that will be distorted when the pressure reaches the predetermined level.

During the bulging or crowning of the area of the end between the weakened portions or lines **72,** the additional metal that is required to produce the crowning or tenting will produce a stretching of the metal inside the weakened portions **72** to result in the severance of the weakened portions **72.** During this outward bulging or tenting, there will be some metal flow from the periphery of the wall between the rigidifying beads which will allow sufficient bulging or crowning to cause severance of the weakened portions. However, the rigidifying means **84** will constrain the crowning substantially within the confines of the pressure relief area and will maintain the area outside of the pressure relief area in its original condition.

As was indicated above, the specific number and location of the inwardly directly equally spaced, radially extending beads has been found to be critical. It has been found that if there are too many beads that are located in close proximity to each other, there will not be sufficient metal flow from the periphery of the container end wall into the circular relief pressure area to allow the crowning effect to sever the weakened portions **72** and if there are an insufficient number of beads there will be too much metal flow and insufficient rigidity so that the entire end will bulge. It has been found that three equally spaced radially extending beads adjacent each of the unweakened portions will produce a sufficient rigidity to prevent a crowning of the area outside of the beads **86** while still allowing sufficient metal flow between the adjacent beads through the unweakened portions **74** into the circular pressure relief area to allow adequate crowning of the area between the weakened lines and sever the weakened portions **72.**

The final configuration of the end wall of the container after the pressure relief area **70** has been ruptured is depicted in FIGS. **11** and **12.** It will be noted that the bending of the pressure relief area will be along a line that extends generally through the base of the longitudinally extending bead **80.** It has also been found that the depth of the deformation and the length of bead **80** will determine the pressure at which the pressure relief area will begin to crown or "tent." Thus, the depth of the bead can be utilized to vary the pressure at which the safety vent means will become operative.

It has also been found that the rigidifying means or beads **86** will prevent severing of the end wall of the container beyond opposite ends of the weakened portions **72.** This is important since a severing beyond the desired location may result in a complete removal of the weakened section which could then act as shrapnel that could seriously injure a person in close proximity to the container.

It has also been found desirable to maintain the pressure relief area within the confines of the lower rim or end of the container even after the pressure relief area has been ruptured. This has been accomplished by the particular relative dimensions of the circular pressure area in relation to the diameter of the circular end wall **60** or **70.** For example, it has been found that if the cir-

cular pressure relief area **70** is made with a diameter that is approximately one-half and preferably less than one-half of the diameter of the lower end wall **60** or **70**, the bulging of the wall within the confines of the weakened portions **72** will be limited so that the pressure relief area is maintained above the peripheral edge of the concave wall at all times.

While the rigidifying means has been shown only in the embodiment of the invention shown in FIGS. **7–12**, it will be appreciated that such a feature could be incorporated into the embodiment shown in FIGS. **1–6**. Also, in some applications of the container end wall shown in FIG. **7**, it may be necessary or desirable to have the weakened portions located outside bead **56**.

I claim:

1. A safety vent for pressurized containers such as aerosol containers and the like comprising a pair of spaced opposed arcuate weakened lines defined in said wall with said weakened lines having opposite ends, the adjacent ends of adjacent weakened lines being separated from each other by unweakened portions and cooperating therewith to define a pressure relief section, rigidifying means in said wall, said rigidifying means being located adjacent each unweakened portion outside planes extending through said adjacent ends of adjacent weakened lines, and crowning means between said pair of weakened lines, said crowning means producing a bulge between said weakened lines when the pressure within the container exceeds a certain level to sever said weakened lines, said rigidifying means maintaining said wall adjacent each weakened portion in substantially the original condition.

2. A safety vent as defined in claim **1**, in which said wall is an end of the container.

3. A safety vent as defined in claim **2**, in which said end wall is arcuate in cross-section to define a concave outer surface.

4. A safety vent as defined in claim **1**, in which said crowning means is an elongated bead deformed outwardly of said wall, said bead extending generally parallel between said weakened lines.

5. A safety vent as defined in claim **4**, in which said rigidifying means each includes a plurality of inwardly directed beads.

6. A safety vent as defined in claim **5**, in which each rigidifying means includes three equally spaced beads.

7. A safety vent as defined in claim **1**, in which said pair of weakened lines have a common radius located at a common center between said weakened portions to define a circular relief pressure section and in which said crowning means extends through said common center.

8. A safety vent as defined in claim **7**, in which said crowning means includes an outwardly directed elongated bead having opposite ends terminating inwardly and in close proximity to the periphery of the circular relief pressure section.

9. A safety vent as defined in claim **8**, further including a plurality of radially extending inwardly directed beads located adjacent each of said unweakened portions outside of said circular relief pressure section.

10. A safety vent as defined in claim **9**, in which said relief pressure section is defined in a circular end wall of the container and the diameter of the relief pressure section is approximately one-half the diameter of the circular end wall.

11. A safety vent as defined in claim **9**, in which there are three radially extending beads adjacent each unweakened portion and the radially extending beads adjacent each unweakened portion are equally spaced from each other.

12. In an aerosol container having a cylindrical side wall and upper and lower end walls, a plurality of circumferentially spaced arcuate weakened lines having opposite ends with adjacent ends spaced from each other to define a plurality of unweakened portions between adjacent ends of the adjacent weakened lines, said weakened lines defining a circular pressure relief section; and elongated crowning means having opposite ends terminating inside said circular pressure relief section, said weakened lines being severed when the pressure in said container exceeds a predetermined level and said crowning means causing an outward bulge between the weakened lines with the center of the bulge located generally along said crowning means.

13. An aerosol container as defined in claim **12**, in which said elongated crowning means is an outwardly directed bead having opposite ends located adjacent opposed unweakened portions.

14. An aerosol container as defined in claim **12**, in which said relief section has a diameter of approximately one-half the diameter of said lower end wall.

15. An aerosol container as defined in claim **12**, in which said lower end wall has a concave outer surface in cross-section, the periphery of which is joined to said side wall, and in which said relief section is dimensioned to be maintained above the periphery of said lower end wall after said weakened lines have been severed.

16. An aerosol container as defined in claim **13**, further including a plurality of equally spaced, radially extending, inwardly directed beads located adjacent each unweakened portion outside said circular pressure relief section to ridigify the end wall adjacent each unweakened portion.

17. An aerosol container as defined in claim **12**, in which said lower end wall is arcuate in cross-section to define a concave outer surface having a common radius and in which the center of circular pressure relief section is located at the center of said lower end wall.

18. An aerosol container as defined in claim **12**, in which said lower end wall is arcuate and defines an outer concave surface that has a first radius adjacent the periphery of the lower end wall and a second radius greater than the first radius at the center of said lower end wall.

19. An aerosol container defined in claim **12**, in which said lower end wall has an arcuate concave annular portion adjacent the periphery thereof and a flat portion inside said annular portion and in which said relief pressure area is defined in said flat portion.

20. An aerosol container as defined in claim **12**, in which said crowning means includes a plurality of weakened lines extending generally normal to said weakened portions and terminating in spaced relation at opposite ends thereof.

21. An aerosol container as defined in claim **12**, in which each of said circular weakened portions has a circumferential dimension substantially greater than 90° and less than 180°.

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