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3,245,578

TEMPERATURE RESPONSIVE PRESSURE RELIEF FOR CONTAINERS

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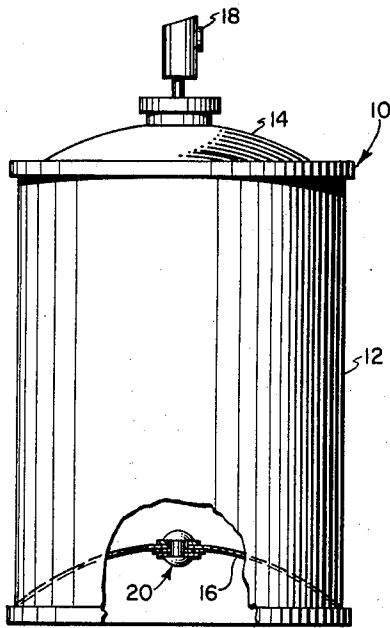


FIG. 1

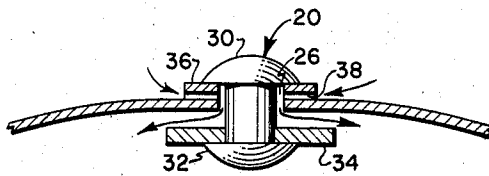


FIG. 4

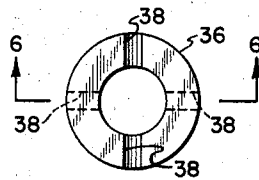


FIG. 5

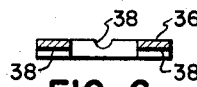


FIG. 6

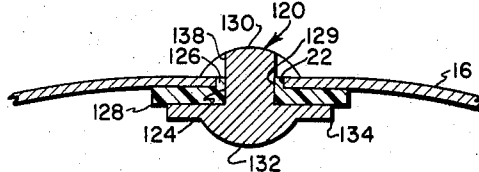


FIG. 7

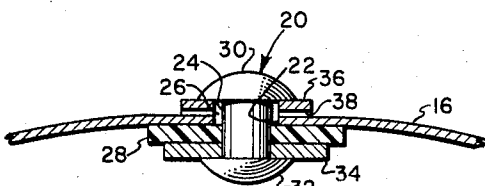


FIG. 2

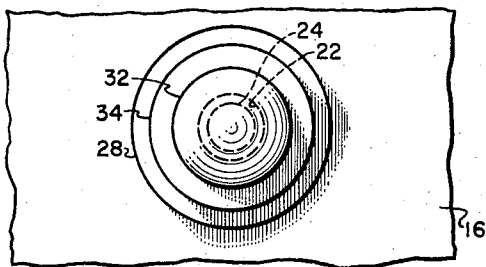


FIG. 3

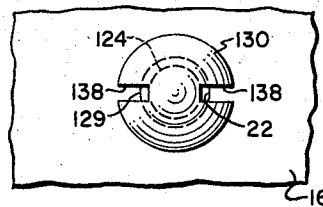


FIG. 8

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1 Claim. (Cl. 220—89)

The present invention relates generally to the relief of excessive pressures generated in containers by abnormal increases in temperature. More specifically, the invention pertains to a safety device which has been devised to relieve or vent excessive pressures arising in sealed containers as a result of improper exposure of such containers to high temperatures and thus prevent explosion of the containers.

With the increased commercial acceptance of pressurized spray containers, commonly known as aerosol cans, the danger of injury caused by the explosive failure of such cans has been increasing. One major cause of such failures is that the cans find their way into incinerators and open fires, either accidentally or intentionally, and the resulting increased temperatures heat the contents of the can, which generally include a gaseous propellant, until the internal pressure exceeds the strength of the can body and an explosion occurs. Such conditions may arise when the container is new and unused or after it is used and discarded.

It is therefore an object of the invention to provide means for relieving excessive internal pressure arising out of the exposure of sealed, pressurized containers to increased temperatures.

Another object of the invention is to provide a sealed, pressurized container which when exposed to abnormally high temperatures will become vented to relieve the consequent increase in internal pressure without explosive failure.

Still another object of the invention is to provide a simple means which will relieve high pressures at high temperatures in a sealed container, but will effectively maintain the seal at normal temperatures and pressures in such containers.

A further object of the invention is to provide a simple and effective device for relieving high pressures caused by high temperatures in a sealed container, the device having a minimum number of parts of minimum complexity and being easily and economically assembled and installed in a conventional container body.

A still further object of the invention is to provide a simple device having a positive, virtually foolproof operation without a significant increase in container manufacturing costs.

The invention may be described briefly as a safety device for placement within an opening in the wall of a container, the container having contents under a given pressure, the device being capable of normally resisting the release of the contents but releasing the contents when the temperature of the container is raised to a predetermined level where the pressure within the container tends to become excessive so as to preclude explosion of the container. First means are provided which pass through the opening, the means and the opening having such relative dimensions that a passage is established between at least a portion of the means and the perimeter of the opening, the passage having an ingress communicating with the interior of the container and an egress communicating with the exterior of the container. A member of fusible material normally closes the passage, the material being capable of resisting the passing of the contents through the passage at temperatures below the predetermined level, but fusing to permit passing of the contents through the passage when the temperature of the

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container is raised to the predetermined level. Further means are provided which cooperate with each end of the first means adjacent the ingress and the egress to firmly fix the fusible member in the passage against the given pressure of the contents and allow unobstructed ingress and egress to the passage for the contents upon the fusing of the member. Still further means may be included adjacent the egress of the passage for directing the contents which will flow through the egress into a pattern which will prevent the momentum of the flow from establishing a thrust tending to accelerate the container to a dangerous velocity.

The invention will be more fully understood and further objects and advantages thereof will become apparent in the following detailed description of specific embodiments of the invention illustrated in the accompanying drawings in which:

FIGURE 1 is a partially sectioned elevational view of a container constructed in accordance with the invention;

FIGURE 2 is an enlarged cross-sectional view of the pressure relief device illustrated in FIGURE 1;

FIGURE 3 is a bottom plan view of the device of FIGURE 1;

FIGURE 4 is a view similar to FIGURE 2 illustrating the operation of the device;

FIGURE 5 is a plan view of a component part of the device of FIGURE 1;

FIGURE 6 is a cross-sectional view taken along line 6—6 of FIGURE 5;

FIGURE 7 is an alternative pressure relief device; and FIGURE 8 is a top plan view of the device of FIGURE 7.

Referring now to the drawings, and particularly to FIGURE 1, a container is shown having a body 10, with side wall 12, top wall 14 and bottom wall 16. Container 10 is a sealed, pressurized container of the type generally known as an aerosol can and employed for dispensing the contents of a can through a nozzle 18, usually in the form of a spray. Such cans are finding use in a wide variety of applications in spraying, and otherwise dispensing under pressure, paints, coatings, cosmetics, pharmaceuticals and many other products. The contents of the can are usually expelled by the pressure of a gaseous propellant present within the can. While the container body is fabricated with enough strength to withstand the pressure of the propellant under normal conditions, abnormal conditions, such as an increase in the temperature of the container and its contents, can raise the internal pressure and cause such containers to fail with an explosive force capable of harmful results to both persons and property. Even after the contents have been largely exhausted and the container is ready for discard, sufficient propellant or other contents may remain to cause such an explosion. Although warnings are generally issued against exposing these containers to excessive temperatures, invariably a container will inadvertently find its way into an incinerator or may even be intentionally placed in an open fire with adverse results.

In order to protect against such explosive failures, container body 10 is provided with a safety device 20, best seen in FIGURES 2 through 4. An opening 22 is provided in bottom wall 16 and a member shown in the form of a cylindrical rod 24 passes through the opening 22. The diameter of rod 24 is smaller than the diameter of opening 22 such that the relative dimensions of the rod and the opening establish a passage 26 between the surface of the rod and the perimeter of the opening. Passage 26 is sealed against the normal internal pressure of the container by annular member 28 which surrounds rod 24 and intercepts passage 26.

In order to hold member 28 firmly fixed in place in passage 26, rod 24 is provided with a head fixed at each end, first head 30 being shown integral with the rod adjacent the ingress to passage 26 and second head 32 being integral with the rod adjacent the egress to the passage. Part of the simplicity of the illustrated embodiment of FIGURES 1 through 6 is that the rod 24, complete with head 30 and 32, may be in the form of a standard rivet and can be installed very simply using well known riveting techniques. In such an instance, a relatively larger diameter, washer-like annular plate 34 is employed between head 32 and annular member 28 to provide an adequate surface for bearing against the annular member 28 as well as to provide a deflecting surface at the egress of passage 26 as will be explained hereinafter. Another washer-like ring 36 is placed between head 30 and bottom wall 16 and is provided with radial grooves 38 which establish an unobstructed ingress to passage 26 for purposes which will now be explained.

Annular member 28 is fabricated of a material which will soften and yield to the internal pressure of the container so as to be blown clear and allow unobstructed egress from passage 26 when the temperature of the container and its contents is raised to a predetermined level where the internal pressure tends to become excessive. Such yielding will open the egress of passage 26 between annular plate 34 and bottom wall 16 and allow the contents, generally the gaseous propellant, to be vented through the passage to relieve the excessive internal pressure as indicated by the arrows in FIGURE 4, which arrows depict the flow of the gaseous propellant after the annular member 28 has been blown clear.

It is noted that the gaseous propellant will usually tend to escape at a relatively high velocity. In order to defeat the tendency of the high velocity flow to establish a thrust which could accelerate the container to a dangerously high velocity, annular plate 34 diverts the egress to direct the flow into a generally radial pattern along the bottom wall 16, rather than perpendicular to the bottom wall, so that no dangerous thrust is generated.

As the propellant is vented, as seen in FIGURE 4, a downward thrust is imparted to rod 24 tending to drive head 30 downwardly toward the ingress of passage 26. In order to prevent head 30 from obstructing the ingress despite the downward thrust, ring 36 is placed beneath the head and is provided with grooves 38 through which the gas can flow. It is noted that several grooves 38 are provided and that the grooves 38 are circumferentially spaced from one another so that alternative paths for the gaseous flow are provided in the event that ring 36 or rod 24 should shift laterally and one of the grooves should become closed by contact of the ring 36 with rod 24. The location of grooves 38 on opposite faces of ring 36 assures that maximum flow area is attained without a drastic decrease in the cross-sectional strength of the ring. In addition, the location of grooves 38 on both faces of ring 36 enables assembly of device 20 to be accomplished without concern over which face of the ring will lie contiguous with bottom wall 16. Thus, should head 30 be deformed during installation of the device 20 in such a manner that the head will clog the grooves 38 in the face contiguous with the head, the grooves 38 in the opposite face of ring 36 will still remain open.

A variety of materials are available for the fabrication of annular member 28, the choice being dictated by the temperatures and pressures at which the annular member 28 must operate. An example of typical temperatures and pressures may be found by examining a conventional aerosol can which employs Freon-12 as a gaseous propellant. At a temperature of 80° F., such a can will have an internal pressure of about 100 p.s.i., well within the limits of the strength of the container body. Upon heating to 120° F. the internal pressure will rise to about 170 p.s.i., and at 160° F. the internal pressure will be as much as 280 p.s.i.

A generally accepted safe maximum for temperature in conventional containers is about 120° F. and exposure to higher temperatures could result in an explosive failure of the container body. Thus, thermoplastic synthetic resins which will begin to soften and flow above the safe temperature have been found to be suitable. A typical material is polyvinyl butyral which will act as a gasket providing a good seal against the internal pressure of the container at a normal temperature below 120° F., but will yield under a stress of about 260 p.s.i. at temperatures in the range of 115° F. to 140° F. Annular member 28 may also be fabricated of a low melting point metal alloy such as Lipowitz alloy (melting point 140° F.) or Wood's metal (melting point 154° F.). Other suitable materials will become apparent to those skilled in the art of materials and it is not intended to restrict the invention to the examples set forth above.

The term "fusible" is employed herein to denote the requisite ability of the material chosen for annular member 28 to yield and flow under the predetermined conditions of elevated temperature and pressure encountered in the sealed containers to which the invention is directed.

Turning now to the embodiment of the invention illustrated in FIGURES 7 and 8, the bottom wall 16 of the container is again provided with an opening 22 in which a device 120 is installed. As in the device of FIGURES 1 through 6, a rod 124 passes through opening 22 and has a relatively smaller diameter so as to establish a passage 126 which is sealed by an annular member 128 of fusible material. Note that annular member 128 is especially constructed with a sleeve portion 129 rising up to fill the entire passage and attain an even more efficient seal than corresponding annular member 28 of the earlier described embodiment. A first head 130 is integral with one end of the rod 124 and a second head 132 is integral with the other end of the rod to hold annular member 128 in place. However, in the instant embodiment, second head 132 is especially fabricated with an enlarged flanged portion 134 to provide an adequate surface for bearing against the annular member 28 and establish the flow deflecting surface as explained hereinbefore. First head 130 is also especially constructed with radial notches 138 which establish an unobstructed ingress to passage 126 even when head 130 is thrust against bottom wall 16 by the venting contents. Thus it is seen that the number of component parts can be reduced to only two; however, the complexity of the parts is increased somewhat over those of device 20.

It is to be understood that the above detailed description of embodiments of the invention is provided by way of example only and is not intended to restrict the invention. Modifications of various details of design and construction may be made without departing from the true spirit and scope of the invention as defined in the appended claim.

I claim:

In a container for maintaining contents under a given pressure, a safety device within a opening of fixed diameter in the wall of the container body, the opening communicating with the interior and the exterior of the body, the device being capable of normally resisting the release of the contents, but releasing the contents when the temperature of the container is raised to a predetermined level where the pressure within the container tends to become excessive so as to preclude explosion of the container, said device comprising:

a rod passing through the opening and having a diameter less than the diameter of the opening to establish an annular passage between the rod and the perimeter of the opening, the passage having an ingress communicating with the interior of the container adjacent a first end of the rod and an egress communicating with the exterior of the container adjacent a second end of the rod;

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- a first head integral with the first end of the rod and having a diameter greater than the diameter of the opening;
- a second head integral with the second end of the rod and having a diameter greater than the diameter of the opening; 5
- a ring surrounding the rod and positioned between the first head and the container wall, the ring having a diameter greater than the diameter of the opening and including opposite faces and at least two circumferentially spaced radial grooves in each of said opposite faces such that at least one of the radial grooves communicates with the passage for assuring unobstructed ingress to the passage; 10
- an annular member of fusible material surrounding the rod and positioned between the second head and the container wall to normally close the passage, the first and second heads being displaced from one another a distance great enough to allow the annular member and the ring to be positioned therebetween and cooperating with the rod and the wall so as to fix the annular member and the ring in their respective positions to maintain the passage closed against the given 15 20

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- pressure at temperatures below the predetermined level, the material being capable of fusing to open the passage and relieve the excessive pressure by releasing said contents through the unobstructed ingress and the unobstructed egress when the container temperature is raised to the predetermined level; and
- a deflector plate between the second head and the annular member, the plate having a diameter greater than that of the second head and so much greater than that of the opening as to assure that the released contents are directed into a generally radial direction, with respect to the rod, along the container wall.

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