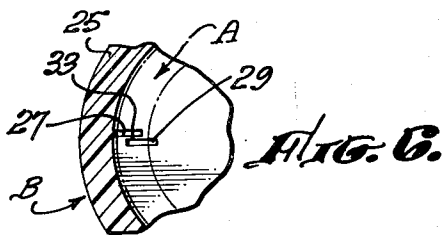
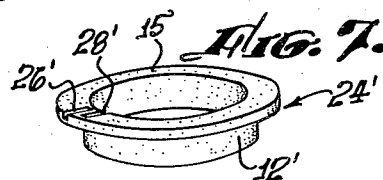
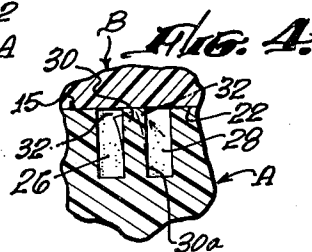
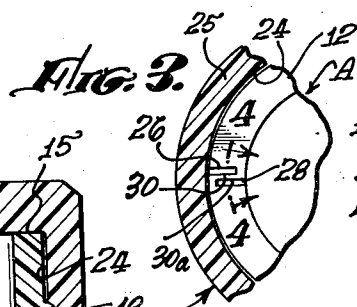
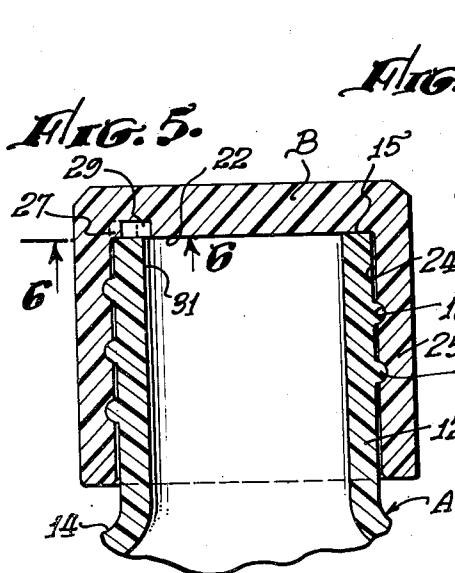
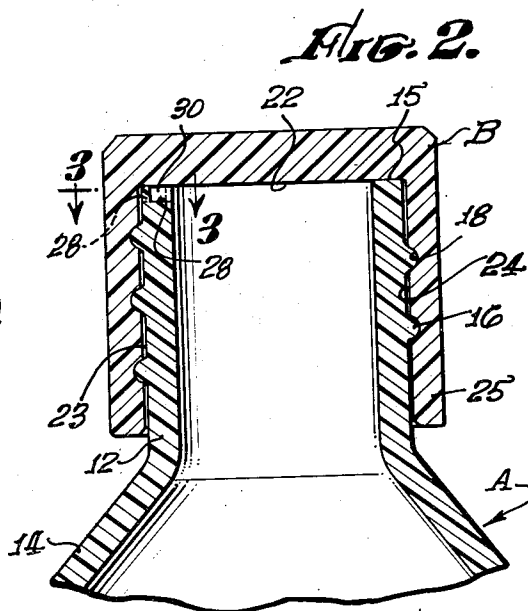
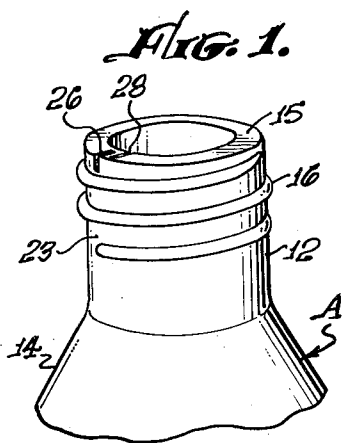


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R. W. BEALL, JR
PRESSURE EQUALIZING CONTAINER
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3,043,463

PRESSURE EQUALIZING CONTAINER
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This invention relates to containers and more particularly to an internal pressure equalizing closed container that prevents the building up of pressure differential there-in above a predetermined maximum limit.

This application is a continuation-in-part of copending United States application Serial No. 648,473 filed March 22, 1957, by Richard W. Beall, Jr., titled "Fitment for Container," now Patent No. 2,915,223.

A major object of the present invention is to provide a fluid container that is adapted to be closed and sealed by a closure cap whereby air or other gas is permitted to flow into or from the confines of the container when the pressure differential between the interior of the container and the ambient exceeds a predetermined value.

Another object of the present invention is to supply a closed container in which internal pressure of the container is equalized by means of a closure cap cooperatively associated with the fluid discharge member of the container.

It is another object of the present invention to provide a container having a closure associated therewith whereby the container is vented when the pressure within the container exceeds a predetermined limit.

Still another object of the present invention is to provide an internal pressure equalizing closed container which can be efficiently and economically manufactured and which is simple and efficient in operation.

It is another object of the present invention to provide a container having a novel fluid discharge neck and a closure cap associated therewith whereby the container is sealed by the closure cap but vented to the ambient atmosphere upon the creation of an excessive differential pressure between the internal volume of the container and the ambient.

It is a further object of the present invention to provide a novel closure cap for a container whereby the container is sealed by the closure cap but vented to the ambient atmosphere upon the creation of an excessive pressure differential between the interior of the container and the ambient.

These and other objects and advantages of the invention will become apparent from the following description of the preferred and certain alternate forms thereof and from the accompanying drawing illustrating such forms, in which:

FIGURE 1 is a view in perspective of the upper portion of a container in accordance with the presently preferred embodiment of this invention;

FIGURE 2 is a sectional view in elevation of the container corresponding to FIGURE 1 with the closure cap in sealing engagement therewith;

FIGURE 3 is a partial view in section taken along line 3—3 of FIGURE 2;

FIGURE 4 is a partial view in section taken along line 4—4 of FIGURE 3;

FIGURE 5 is a view corresponding to FIGURE 2 of an alternative embodiment of the present invention;

FIGURE 6 is a partial view in section taken along line 6—6 of FIGURE 5; and

FIGURE 7 is a perspective view of a second alternate form of the present invention.

Although the present invention is adapted to containers for containing all fluids including liquids and gases, it is particularly adapted to the storage and dispensing of

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liquids and will accordingly be described throughout the following description in connection with a container for liquid.

When a closed container is utilized to confine liquids or gases which are susceptible to increasing or decreasing vapor pressures due to temperature changes, the problem of confinement becomes acute in that with some fluids the increase or decrease in vapor pressure fluctuates sufficiently to reach a dangerous level in the container. That is, certain bottled liquids such as bleach and carbonated beverages, as well as other liquid products, emit gases when confined in a fluid-tight container and such gases create dangerously high pressures within the container, particularly when the temperature of the container rises. To avoid possible breakage or rupture of the container due to such increase in internal pressure, it is highly desirable that gas dispelled from the confined liquid be bled off from the confines of the container to reduce the internal pressure thereof to a safe level. Conversely, certain other fluids when confined in a closed container will cause the internal pressure within the container to drop off sharply under certain storage conditions. In such cases, for example, when the temperature of the container drops appreciably, it is highly desirable to again vent the bottle to allow entrance into the bottle of air at atmospheric pressure in order to equalize pressure existing between the interior and exterior of the container.

Referring now to the drawing and particularly to FIGURES 1 through 4, the present invention includes in general a container A having a fluid opening therein defined by a neck of the container, and a closure cap B adapted to sealingly engage the neck of the container. Throughout the following description the container in the open condition will be referred to as the container A, and the combination of the container A and closure B with the closure B in sealing engagement will be termed the closed container or container assembly. Although it will be apparent from the following description that other materials may be utilized, in its presently preferred form a polymerized resin material such as polyethylene or other resilient materials of a similar type presently available for molding is used to form both the container A and the closure B.

Referring now particularly to FIGURE 1, the container A comprises a fluid-confining portion 14, which may take any desired form defining an interior volume, and a fluid discharge member or neck 12 coextensive with the internal volume of the fluid-confining portion 14 of the container. The outer extremity or end surface of the neck 12 terminates in a ring-shaped sealing surface 15. Male threads 16 are formed on the exterior surface of the member 12 and are adapted to be threadably engaged by female threads 18 defined by the interior wall of the closure cap B as described hereinafter.

Referring now to FIGURES 1 through 4, the closure cap B is, in general, cylindrical in configuration with a closed upper end. The inside diameter of the closure cap B is substantially equal to but greater than the outside diameter of the container neck 12. Female threads 18 are formed in the interior wall of the closure cap B and are threadably mateable with male threads 16 formed on the exterior wall of the neck member 12. The interior end wall 22 of the closure cap B is so formed that when the closure cap B is threadably mated with the neck member 12 of the container A the end surface 22 is in sealing engagement with the outer ring-shaped sealing surface 15 of the neck member 12 of the container A. Thus, as shown in FIGURE 2, the closure cap B when threaded onto the neck member 12 of the container A moves downward toward the fluid-confining portion 14 until the interior end wall 22 of the closure cap B moves into sealing en-

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gement with the ring-shaped sealing surface 15 of the neck member 12. A fluid-tight seal then exists between the closure cap and the neck member to prevent the escape of fluid from the container A. It should be noted, however, that the fluid seal exists between the ring-shaped sealing surface 15 and the end surface 22. The threaded engagement between the closure cap B and neck member 12 will not create a fluid seal along the threads due to distortion along the threads or tolerances between the male and female threads. Thus any fluid passing between the sealing surface 15 and the end wall 22 would escape to the ambient by passing between the outer surface 23 of the neck member and the inner surface 24 of the side wall 25 of the closure cap B.

In accordance with the present invention as shown in FIGURES 1 through 4, the upper portion of the neck member 12 is provided with a first slot 26 which extends downwardly from the ring-shaped sealing surface 15 and inwardly from the external circumferential edge thereof, and a second slot 28, circumferentially spaced from the first slot 26, which extends downwardly from the sealing surface 15 and outwardly from the inner circumferential edge of the sealing ring. Neither of these slots extends completely across the width of the sealing ring, but do overlap one another to define a deformable wall section 30 therebetween, as can best be seen in FIGURE 3. The thickness of the wall section 30 is dependent upon the resiliency of the material from which the neck member 12 is fabricated. That is, the thickness of the wall section 30 must be such that it will deform in a clockwise direction as shown in phantom in FIGURE 4 to define an escape passage 32 when the gas or air pressure within the confines of the container A rises above a predetermined value in contact with the side 30a of the wall section 30. The free edge of the wall section 30 and the interior end surface 22 of the closure cap B cooperatively define the vent passage 32 therebetween. Excess gasses formed within the container A flow through the second slot 28, the passage 32 defined by distortion of the wall member 30, the first slot 26 and then pass between the interior surface 24 of the closure of the side wall 25 and the external surface 23 of the neck member 12 to the ambient atmosphere. When the pressure in the container A is reduced by this flow of excess air or gas to the ambient atmosphere the pressure exerted against the side 30a of the wall section 30 is insufficient to maintain the wall section 30 in the deformed position shown in FIGURE 4, and due to the resiliency thereof the wall section 30 returns to its normal sealing position shown in FIGURES 1 through 3.

It will be understood that when the wall section 30 is in the sealing position any foreign material that may have passed upwardly between the tubular discharge member or neck 12 and the side wall 25 of the cap A from the atmosphere cannot pass between the wall section 30 to enter the confines of the container and contaminate the liquid contents thereof.

Although both the container A and closure cap B in the presently preferred embodiment as described above are formed of resilient material such as polyethylene, it may be seen by one skilled in the art, in view of the foregoing, that resiliency is required primarily in that portion of the container assembly which defines the deformable wall section 30. Accordingly, it can be seen that the closure cap B can be formed of relatively rigid material so long as a fluid-tight seal is obtained between the interior end wall surface 22 of the closure cap and the ring-shaped sealing surface 15 of the container A.

An alternative form of the present invention is shown in FIGURE 7. This embodiment includes a separate sealing ring member 24' that is provided with slots 26' and 28' to define a ring-shaped sealing surface 15' identical to the ring-shaped sealing surface 15 and slots 26 and 28 shown and described in conjunction with the presently preferred form of the invention illustrated in FIGURES 1 through 4.

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Thus, the ring member 24' serves as an adapter for converting a container having a tubular discharge member or neck 12 into a vented discharge member as described above. The ring 24' accordingly has a cylindrical section 12' extending downwardly from the ring-shaped sealing surface 15' with an outside diameter substantially equal to the inside diameter of the neck member of a container to which it is adapted. The outside diameter of the ring-shaped sealing surface 15' would correspond to the outside diameter of the neck member 12 of the container such that the sealing ring 24' is slidably disposable within the upper confines of the tubular discharge member or neck 12 of a container or bottle. When this alternative form of the present invention is positioned in a container or bottle it serves to relieve the internal pressure thereof in the same manner as described in detail hereinabove.

Referring now to FIGURES 5 and 6, a second alternative embodiment of the present invention is shown in which the venting passage in accordance with the present invention is formed as an integral part of the closure cap B. Thus, in this embodiment the container A can be formed of any material and may, for example, be a standard container or bottle of the type well known to the art which is formed of rigid material having a male threaded neck member 12. The closure cap B in this embodiment is again cylindrical in configuration with female threads 16 formed in the interior wall 24 of the side wall 25 of the container, the threads being mateable with the male threads 16 of the neck member 12. In this embodiment the closure cap B is formed of a resilient material such as polyethylene and the venting slots are provided in the closure cap rather than in the neck member of the container. That is, as shown in FIGURES 5 and 6, a first slot 27 is formed which extends from the interior end wall surface 22 of the closure cap B upward while extending inwardly from the inside diameter of the closure cap to a point which is radially outside of the inside wall 31 of the neck member 12. The second slot 29 is circumferentially spaced from the first slot 27 and again extends upward from the interior surface 22 of the closure cap and outward from a radius less than the radius of the inside wall 31 of the neck member 12 to a radius which is less than the outside radius of the neck member 12. That is, neither of the slots 27 nor 29 extends completely across the sealing area existing between the sealing surface 15 at the upper surface of the neck member 12 and the interior end wall 22 of the closure cap B. The slots 27 and 29 again define a deformable wall section 33 therebetween.

Thus, the second slot 29 is open to the passage of gas and fluid within the confines of the container while the first slot 27 is open to the ambient. If the pressure in the interior of the container exceeds a predetermined limit the wall section 33 is again deformed clockwise in FIGURE 6 to create a passage between the first and second slots to allow gas to pass between the upper surface of the neck member 12 and interior end wall 22 of the closure cap. That is, gas of excessive pressure will enter the second slot 29, deform the wall section 33, pass into the first slot 27 and downward between the closure cap B and neck member 12 of the container to the ambient. Again the circumferential space between the first and second slots which defines the thickness of the wall section 33 will be dependent upon the resiliency of the material from which the closure cap B is formed and the pressure differential at which it is desirable to vent the container.

From the foregoing description of the various embodiments of the present invention it will be seen that air or gas will also follow a reverse path from that described if the pressure differential which exists is due to a lesser pressure within the container.

Thus, in operation in all forms of the invention described above a closure cap B is threadably mateable with the neck member 12 of a container whereby a fluid-tight

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sealing engagement is created between the interior end wall surface 22 of the closure cap and ring-shaped sealing surface 15 at the upper extremity of the neck member 12. First and second slots are provided with a deformable wall section therebetween such that a first slot is open to the ambient while the second slot is open to the pressure existing within the confines of the container. The wall section defined between the slots is deformable but in the non-deformed condition is in sealing engagement with the sealing surface opposed thereto such that no gas can pass between the first and second slots. If, however, the pressure of the gas or fluid in either slot is greater than the pressure within the other slot by a predetermined amount, the wall section will deform to open a passage and allow the pressures to equalize.

Thus, the present invention provides an improved fluid container or container assembly which permits the equalizing of pressures existing between the interior of the container and the ambient. A container in accordance with the present invention is simple and efficient in operation and can be efficiently and economically manufactured.

Although the preferred and alternate forms of the present invention are fully capable of achieving the results and providing the advantages hereinbefore mentioned, it is to be understood that they are merely illustrative of the presently preferred embodiments thereof and that the invention is not to be limited to the details of description above described other than as defined in the appended claims.

What is claimed is:

1. A container comprising: a fluid-holding hollow body having a neck projecting outwardly therefrom, with at least the outer portion of said neck being formed of a resilient material, which outer portion terminates in a flat ring-shaped surface; a closure removably mounted on said neck, said closure including a surface which when said closure is mounted on said neck contacts said ring-shaped surface to effect a fluid seal therewith; and pressure relief means in the form of a wall that is formed as an integral part of the upper portion of said resilient material on said neck, the upper surface of which wall is in sealing contact with said surface of said closure when said closure is mounted on said neck, a first surface of said wall also partially defining a first slot that extends downwardly in said resilient material from said ring-shaped surface thereof, said first slot being in communication with the ambient atmosphere, with a second surface of said wall partially defining a second slot in said resilient material that extends downwardly in said resilient material from said ring-shaped surface thereof, said second slot being in communication with the interior of said body, which wall when the pressure in said container exceeds a predetermined amount is deformed to move said upper surface of said wall out of sealing contact with said surface of said closure.

2. A container as defined in claim 1 wherein said neck has threads formed on the exterior surface thereof and said closure is provided with a ring-shaped side wall that has threads formed on the interior surface thereof that threadedly engage said threads formed on said exterior surface, with the transverse interior cross section of said ring-shaped side wall being greater than the exterior transverse cross section of said neck portion over which it extends as to provide a passage therebetween that is at all times in communication with the ambient atmosphere and said first slot.

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3. A container comprising: a fluid-holding hollow body having a neck projecting outwardly therefrom, with at least the outer portion of said neck being formed of a resilient material, which outer portion terminates in a flat ring-shaped surface; a closure removably mounted on said neck, said closure including a surface which when said closure is mounted on said neck contacts said ring-shaped surface to effect a fluid seal therewith; pressure relief means that is a deformable wall formed as an integral part of the upper portion of said resilient material on said neck, the upper surface of said wall normally being in fluid-sealing contact with said surface of said closure, with a first surface of said wall being at all times in communication with the exterior of said neck, and a second surface of said wall at all times communicating with the interior of said body, which wall when a predetermined pressure in said body is exceeded is deformed to move said upper surface of said wall out of said sealing contact with said surface of said closure; threads formed on the exterior surface of said neck; and threads formed on the interior of said closure that threadedly engage said exterior threads, with the transverse interior cross-section of said closure being greater than the exterior transverse cross section of said neck over which it extends to provide a passage therebetween that at all times is in communication with the ambient atmosphere and with the interior of said body when said upper surface is out of fluid-sealing contact with said surface of said closure.

4. A container comprising:

- (a) a fluid-holding hollow body having a neck projecting outwardly therefrom, with at least the outer portion of said neck being formed of a resilient material, which outer portion terminates in a flat ring-shaped surface;
- (b) a closure removably mounted on said neck, said closure including a surface which when said closure is mounted on said neck contacts said ring-shaped surface to effect a fluid seal therewith; and
- (c) pressure relief means which is a deformable wall formed as an integral part of the upper portion of said neck, with the upper portion of said wall normally being in fluid sealing contact with said surface of said closure, a first surface of said wall being at all times in communication with the ambient atmosphere, with a second surface of said wall at all times communicating with the interior of said body, which pressure relief means when a differential in pressure exists between the ambient atmosphere and that in the interior of said body exceeding a predetermined value is deformed as a result thereof out of said fluid sealing contact with said surface of said closure, to permit flow of fluid between the interior of said body and the ambient atmosphere until said differential has fallen below said predetermined value, said flow of fluid taking place while said closure remains at a fixed position on said neck.

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