

1

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SELF-VENTING CLOSURE

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ABSTRACT OF THE DISCLOSURE

A closure device for sealing an opening in a container includes a screw element normally biased by a flexible disc element to provide a seal. When the internal pressure within the container exceeds a predetermined level, the screw element is forced out of sealing engagement to permit a venting action.

This invention involves a closure device or cap of the self-venting type. Such caps are used in connection with containers which may cause variations in internal gas pressure within the containers during storage. These materials, for example, may include volatile liquids which build up vapor pressures within the containers as a result of being shipped or stored in relatively warm temperatures. Such materials may also include paint or other chemicals which are normally stored in different environmental conditions in different places for periods of time. In many cases if the materials are confined within the container or bottle without using a self-venting cap, the container may be subject to explosion or might cause the cap or container to spring a permanent vent or leak.

Self-venting caps have taken a variety of different forms heretofore. While operating satisfactorily under given sets of conditions, such caps have often been relatively expensive or designed to vent at one predetermined pressure with no means to accurately and simply adjust for venting at different pressures.

It is an object of this invention to provide an improved closure cap.

It is a further object of this invention to provide an improved closure cap that will permit the venting of internal pressures within an associated container.

It is still a further object of this invention to provide an improved closure cap for attachment to a container wherein the pressure at which a venting action takes place may be adjusted.

It is still a further object of this invention to provide an improved closure cap for a container which is relatively inexpensive to manufacture and in which the means for adjusting the venting pressure cannot be accidentally tampered with.

In accordance with the present invention, a closure device for a container includes a main body having a central aperture therethrough. A screw element is passed through the central aperture to threadably engage a flexible disc. The screw element normally provides a seal with the main body of the closure devices. When the pressure within the container exceeds a predetermined level, the screw element moves of contact with the main body to permit venting of pressure from the container. The pressure at which venting takes place is determined by the screw adjustment.

Other objects and advantages of the present invention will be apparent and suggest themselves to those skilled in the art, from a reading of the following specification and claims, in conjunction with the accompanying drawing, in which:

FIGURES 1 and 2 are cross sectional views of a clo-

2

sure device with a container illustrating different operations, in accordance with the present invention.

FIGURE 3 is a view of the main body of a closure device, in accordance with the present invention, and

FIGURE 4 is an exploded view of a closure device assembly, in accordance with the present invention.

Referring to the drawing, a closure device 10 is adapted to close an opening in a container 12. The container 12 may include various types of materials or chemicals which cause the internal gas pressures within the container to vary. Such changes in pressure may be brought about by changes in the ambient temperature or by chemical reactions of the materials of the material within the container, for example. The closure device or cap 10 is designed to maintain a seal between the atmosphere and the interior of the container. At the same time, if the pressure within the container exceeds a predetermined minimum, the closure device 10 is designed to vent the excess pressure from within the container 12.

The closure device 10 includes a main body 11 having a top portion 14 and a bottom portion 16. This body may be polyethylene. A threaded portion 18 is disposed about the circumference of the cap to threadably engage a threaded portion of the container 12.

The top portion 14 includes a rectangular shape recess 20 and the bottom portion 16 includes a bottom cylindrical recess 22. The closure device 10 includes a central aperture 24 extending through the main body from the top recess 20 to the bottom recess 22. The aperture 24 is dimensioned to receive a screw element 26 therethrough.

The screw element 26 includes a threaded shank 28 and an enlarged head 30. The screw element 26 extends through the aperture 24 to threadably engage a disc element 32 which may be a plastic having good flexibility. The disc element 32 includes an internally threaded hub 34. The disc element 32 includes one or more apertures 36 disposed off center from the hub 34.

In assembling the closure device 10, the screw element 26 is inserted through the aperture 24 to engage the disc element 32. When the shank 28 threadably engages the disc element 32, the head 30 is disposed within the recess 20.

The diameter of the shank 28 is slightly smaller than the diameter of the aperture 24. This spaced relationship is provided to permit gas pressures to pass through the space between the shank of the screw and the main body 11 of the closure device 10 as will be described.

When the closure device 10 is assembled, the screw element 26 inserted into the disc element 32 causes the disc element 32 to be pressed against the bottom portion 16 of the main body to form an enclosed chamber with the bottom recess 22. The tension of the screw 26 with respect to the disc element 32 determines the tension exerted by the disc element 32 against the bottom portion 16 of the main body. The bottom portion 16 includes a cut away area 17 dimensioned to receive the disc element 32 therein.

The closure device 10 is generally assembled at the factory with the adjustment of the screw 26 with respect to the disc 32 being predetermined by the pressure to be vented from the container 12 with which the closure device 10 is to be used.

The head 30 of the screw element 26 is adjusted or turned by a special tool at the factory. The head 30 is disposed within the upper recess 20 so that it normally cannot be tampered with by a person in the field. The head 30 is preferably made blank so that it cannot be moved with a conventional screwdriver in the field.

The closure device 10 is assembled at the factory and adjusted to provide a good seal for the contents of the

container 12. However, if the pressure within the container exceeds a predetermined level, the excess pressure will be vented into the atmosphere. This operation is illustrated in FIGURES 1 and 2.

Referring to FIGURE 1, the normal operation of the closure device 10 is illustrated. The head 30 including a tapered portion 31 is disposed to form a seal with a corresponding tapered portion 33 surrounding the central aperture 24 of the main body of the cap. The machined surface finish of the tapered portion 31 of the screw head with the flexibility of the tapered portion 33 assures a good sealing action. The screw head 30 exerts a downward sealing pressure as a result of its threaded engagement with the bottom disc element 32.

It may be said that the screw element 26 is biased downwardly by the disc 32 to provide a seal between the head 30 and the main body 11. If this sealing action is to be overcome, the pressure within the container 12 must rise causing the screw 30 to move away from the main body 11 and the disc element 32 to flex. This operation is illustrated in FIGURE 2.

When a pressure within the container 12 rises to a predetermined level, the screw head 30 moves away from the main body 11 of the cap 12 and the disc element 32 flexes upwardly. The pressure from the container 12 will then pass through the apertures 36 of the disc 32 into the bottom recess 22. From the bottom recess 22, the pressure passes through the space between the inner walls 35 forming the central aperture 24 and the shank portion 28 of the screw, below the screw head 30 and into the atmosphere.

The closure device assembly is therefore capable of providing a good seal for a container during normal operation and, at the same time, provide means for venting internal gas pressures from within the container when such pressures exceed predetermined safe operating levels. A relatively simple and inexpensive means is provided for adjusting closure device to permit them to vent at different pressures dependent upon the contents of the container, temperature and other conditions.

A variety of different types of material may be used for the parts of the closure device illustrated. These may include various metals or plastics. The main body and cap material in a preferred embodiment should have some resilience so that they may conform to irregularities in the parts with which they are associated so as to assure good sealing. The preferred material for the main body of the cap is polyethylene, due to the wide range of its imperviousness. However, metal or other materials may also be used.

It is noted that the cap illustrated is self-gasketing thus diminishing the need for a separate gasket when plastic material is used. This is due to the design of the top portion of the cap and the use of a material such as polyethylene.

A cap made of polyethylene or comparable material has sufficient surface unctiousness and structural yieldability that it can generally be engaged with and disengaged from the threads of the container without disturbing the threads. Polyethylene material is non-sparking

making it useful for plugs for closing of drums containing inflammables.

The disc may be a suitable plastic or thin metal and the screw made of plastic, hard rubber or metal, depending upon the application.

What is claimed:

1. A cap for closing an opening in a container comprising a main body having a top portion, a bottom portion and a threaded cylindrical side portion to threadedly engage said container, the top and bottom portions of said main body having top and bottom recesses, respectively, therein, said main body having a centrally disposed aperture extending therethrough from said top recess to said bottom recess, a flexible disc element having a threaded central aperture portion disposed to be aligned with the central aperture of said main body and a second aperture spaced from said threaded aperture, a screw element having a shank and an enlarged head, said shank having a threaded portion inserted through said central aperture of said main body to threadedly engage said disc element to cause said disc element to engage the bottom portion of said main body to form a chamber with said bottom recess, and the head of said screw element being disposed within said top recess.

2. The invention as set forth in claim 1 wherein the degree of tension between said disc and the bottom portion of said main body is adjustable by varying the degree of insertion of the threaded portion of said screw element into said disc element.

3. The invention as set forth in claim 2 wherein the shank of said screw element is spaced from the inner wall of the central aperture of said main body and said head is larger than said central aperture whereby a force exceeding a predetermined level causes said head of said screw element to move away from said body to relieve excess pressure from within said container.

4. The invention as set forth in claim 3 wherein the head of said screw element is disposed within said top recess below the top recess below the top portion of said main body to prevent a person from manually tampering with the adjustment of said screw element.

5. The invention as set forth in claim 4 wherein said head includes a bottom beveled portion adapted to engage a beveled portion surrounding the centrally disposed aperture in said main body.

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