United States Patent

Lee

[15] **3,696,958**

[45] **Oct. 10, 1972**

[54] **GAS VENTING LIQUID RETAINING CLOSURE**

[72] Inventor: **Hong Man Lee**, Danbury, Conn.

[73] Assignee: **U.S. Plywood-Champion Papers Inc.**, Hamilton, Ohio

[22] Filed: **July 22, 1971**

[21] Appl. No.: **165,216**

[52] **U.S. Cl.**.....**215/56**, 138/45, 220/44 A, 220/44 C

[51] **Int. Cl.**.....**B65d 51/16**

[58] **Field of Search**.....215/56, 79; 220/44 R, 44 A, 220/44 C, 490; 138/45

[56] **References Cited**

UNITED STATES PATENTS

1,857,015	5/1932	Gere	215/56
3,337,124	8/1967	De Molin et al.	220/44 R
2,460,647	2/1949	Miller	138/45
3,059,800	10/1962	Mills	215/56
2,436,291	2/1948	Daniel	215/56

FOREIGN PATENTS OR APPLICATIONS

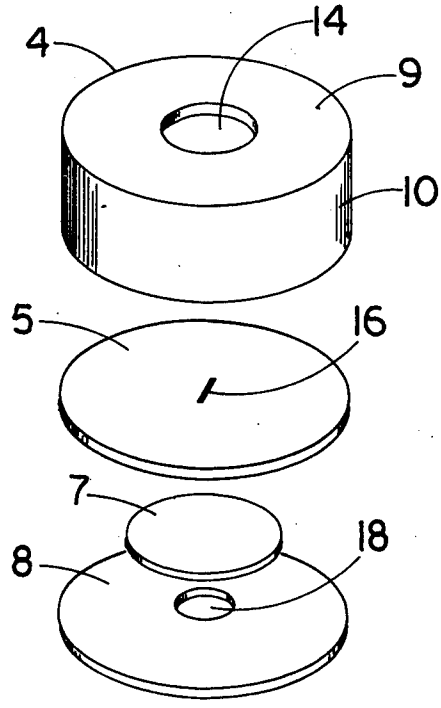
760,890	3/1934	France	215/56
1,047,004	12/1954	France	215/56

Primary Examiner—Joseph R. Leclair
Assistant Examiner—Stephen Marcus
Attorney—Daniel P. Worth

[57] **ABSTRACT**

A container closure, e.g., a bottle cap, vents gases and/or vapors while retaining liquids. The closure has a liquid retaining diaphragm of film sandwiched tightly between a flexible venting disk and a support disk, all of which are held on the container by a cap body which may have threads, bayonet lugs, or the like. The venting disk has a slit which is blocked by the film. Gas to be vented travels past the film in a kind of labyrinth path, traveling radially outwardly to the edge of the film and then back on the other side of the film radially inwardly to where the slit is.

6 Claims, 5 Drawing Figures



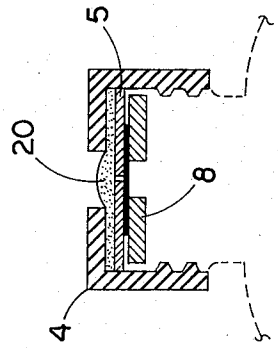


FIG. 5

FIG. 4

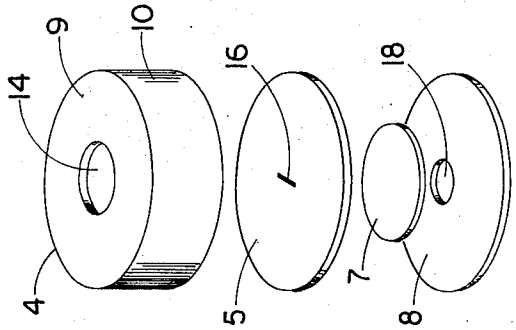


FIG. 2

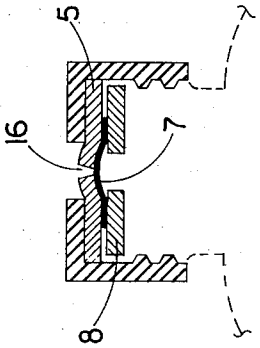


FIG. 3

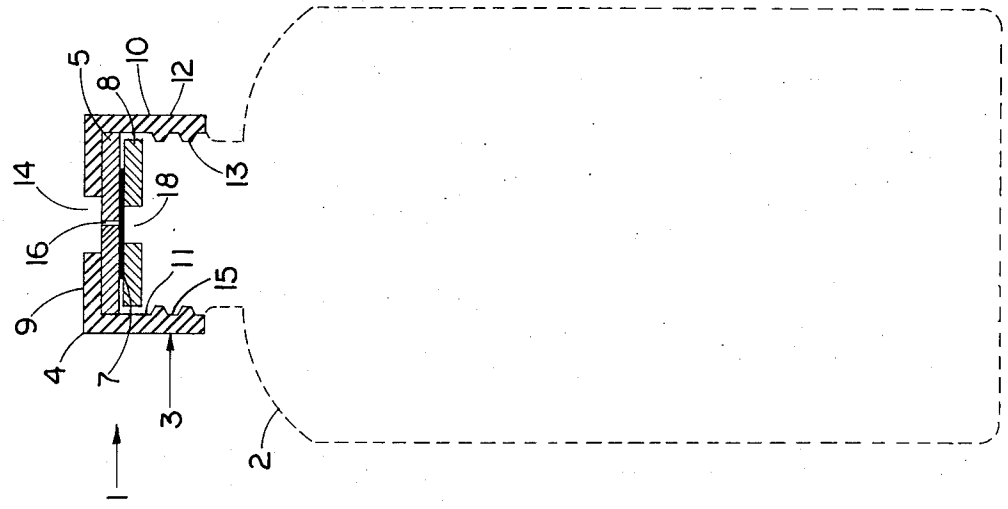


FIG. 1

INVENTOR.
HONG MAN LEE
BY
DANIEL P. WORTH

GAS VENTING LIQUID RETAINING CLOSURE

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a gas venting liquid retaining closure. One aspect of the invention relates to a closure having a sandwich structure for the venting and retaining means. One specific aspect of the invention is a bottle cap suitable for hydrogen peroxide and similar chemical container closures requiring the use of a vent cap in connection with which the invention will be described.

A variety of chemicals and compositions when stored tend to create internal gas or vapor pressure. This is particularly true if elevated temperatures are encountered during transportation and storage, for example during the summer while in a boxcar or in a poorly ventilated warehouse. Hydrogen peroxide is particularly sensitive to such problems because it may decompose and release oxygen, building up excessive pressure inside the container. An explosion thereby could be created in addition to which adjacent containers may be damaged.

A number of different means are known for venting liquid filled containers. They are not very satisfactory so far as liquid retention is concerned, which leads to damaged goods, e.g., labels come off, paper containers soften to the point of tearing or breaking, etc. One such system is a pressure system comprising pieces of rubber, metal springs, and/or soft films (preferably vinyl chloride) being used to lift and open vent holes in a closure when internal pressure reaches a given value. Another technique is to provide elaborate passages in a closure whereby gases may leave the system but liquid losses are minimized. A third system, which may be called the pinhole system, employs one of more tiny holes in rubber, metal or plastic diaphragms which render same permeable to gases but not to liquids.

The present invention involves a system using a slit in a flexible venting disk but does not rely on gas permeability or small hole size in order to achieve liquid retaining properties. Instead the present invention employs a flexible venting disk with a slit which is blocked by a diaphragm of thin flexible film which in turn operates as a liquid retaining feature.

Other objections, advantages, features and the like will become apparent from the following disclosure when read in connection with the annexed drawings wherein:

FIG. 1 illustrates in cross-section the assembly of a closure according to the present invention and a container of hydrogen peroxide;

FIG. 2 is an exploded view of the closure assembly of FIG. 1;

FIG. 3 is a cross-section of the assembly of FIG. 1 illustrating how the cap operates during a gas venting function;

FIG. 4 illustrates a diaphragm in the FIG. 3 position; and

FIG. 5 is a modification of the embodiment of FIGS. 1–3.

Throughout the drawings the same reference numbers refer to the same elements.

Referring to FIGS. 1 and 2, a package 1 comprising a hydrogen peroxide bottle 2 of brown glass (a conventional material therefor) the opening of which is sealed by a closure assembly 3 made in accordance with the present invention. The closure assembly 3 comprises a bottle cap body 4 of rigid plastic or metal, preferably the former. Within the cap body is a sandwich of elements that includes a flexible venting disk 5 outermost, a film diaphragm 7 in the middle and, next to the container, a rigid support disk 8. All are preferably of circular shape.

The cap body has a flat outer surface or lid 9 from the rim of which depends a wall 10 having an inside diameter surface 11 and outside diameter surface 12. Extending inwardly of the inner surface 11 are threads 13. A round hole 14 is formed at the center of the lid. The preferred diameter of the hole is about one-third to one-half the diameter of the inside surface 11 of the cap. The cap wall may be knurled or serrated on its outside surface for ease of handling, and it is illustrated as having securing means such as threads 13 for securing to matching means—here threads 15—on the bottle.

The venting disk 5 is a piece of thin flexible plastic film such as flexible polyethylene, polypropolene, or similar materials. Its preferred thickness is about one-tenth to about one-fourth of the diameter of the hole 14 in the top of the cap body. A cut 16 of the kind that would be made by a razor blade is made at the center, or substantially at the center of the venting disk 5. The cut 16 is aligned with the hole 14. The preferred length of the cut is substantially the same as the radius of the hole 14, i.e., it is substantially one-half the diameter of said hole.

The liquid sealing diaphragm 7 is made of flexible plastic film such as polyethylene, mylar, polypropolene or the like. The preferred thickness should be in the range from about 3 to about 6 mils. The diaphragm 7 has a diameter greater than hole 14 and less than the diameter of disk 5. Preferably the diameter of the film is about halfway between the diameter of the hole 14 and the inside diameter 11 of the cap body.

The support disk 8 is made of rigid plastic material, preferably the same as the cap body 4: in fact, these two members each may be made of phenol formaldehyde molding or of metal. At the center of the support disk 8 and aligned with the cut 16 and hole 14 is a round hole 18 the diameter of which is approximately equal to the radius of the hole 14. The support disk outer diameter is slightly less than that of threads 13 so the same can be easily assembled.

The venting disk is flexible enough it can be forced in over the threads 13 or alternatively, the threads are cut into the cap wall 10 so that their inside diameter is not less than diameter 11.

Thus it will be seen that the cap in its operating parts has a liquid retaining film 7 sandwiched between a flexible venting disk 5 and a rigid support disk 8.

In operation, as shown in FIG. 3, the pressure within the container increases pushing the flexible venting disk 5 and the diaphragm 7 outwardly. The cut 16 on the venting disk is thereby opened and the tendency of the circular film to wrinkle as it bulges in conformity to movement of disk 5 provides small labyrinthine passages (gaps) through which gases vent but which are highly resistant to the flow of any liquids. The inside pressure is thus released through the gaps formed by the wrinkles in the diaphragm 7 and the cut 16. Once the pressure is sufficiently reduced, the flexible disk 5 will restore to its original position.

In the preferred embodiment all elements of the cap have a circular cross-section. The flexible liquid sealing film may be provided with a serrated edge to enhance the formation of gaps for gas passages.

As shown in FIG. 5 a piece of flexible foam **20** may be placed so that it covers the cut **16**. Thus should any liquid manage to escape through the cut it would be immediately absorbed by the flexible foam. The preferred density of such foam is from 2 to 8 pounds per cubic foot, and it may have a preferred thickness from about one-eighth to one-fourth inch.

A further modification could be applied to the structures of either FIGS. **1** or **4** by laminating together at the rims only the rigid plastic member **8** and the flexible plastic member **5** with the film **7** therebetween. When the lamination is done to the embodiment of FIG. **5**, flexible foam member **20** may also be laminated to the venting and support disks, again around the rim.

This invention is intended to include all lawful equivalents to the various portions of the structures and to embrace all equivalent applications, not just those given by way of example or to facilitate explanation.

I claim:

1. A gas venting liquid retaining closure comprising

a rigid body member having a first hole in the top thereof;

a venting disk of flexible material having a venting cut in approximately the center thereof;

a support disk of rigid material with a second hole therein underlying said venting disk; and

a liquid seal diaphragm of flexible film material disposed between the said two disks, the diaphragm having a diameter less than the outer diameter of either disk but greater than the diameter of the hole in the body member and located to cover the venting cut in said venting disk,

the holes and the cut being aligned.

2. The closure of claim **1** wherein said body member has a flat lid surface in which is said first hole, with depending walls and is generally cup-shaped.

3. A closure according to claim **1** wherein said support disk hole is approximately half the diameter of the hole in said body member.

4. A closure according to claim **1** further including a piece of absorbent material held in position over said venting cut.

5. A package comprising the closure of claim **1** secured to an opening in a container.

6. An assembly of a cap and bottle comprising a bottle to which is secured a closure comprising a bottle cap made according to claim **1**.

* * * * *