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CONTAINER CLOSURE

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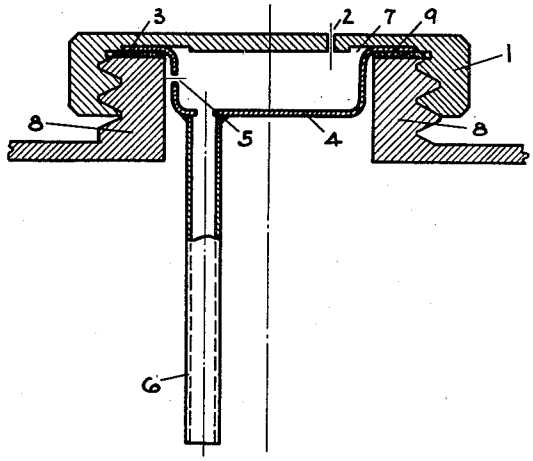


FIG. 1

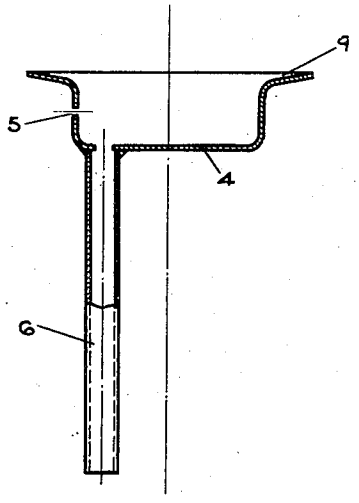


FIG. 2

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CONTAINER CLOSURE

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8 Claims. (Cl. 220—44)

This invention relates to a cap and venting means for containers, and especially to a cap for containers used for shipping or storing volatile liquids or other liquids from which volatile components or gaseous decomposition products may be given off. This invention is especially applicable to containers for hydrogen peroxide solutions which give off oxygen during shipping or storing.

It is well known, for example, in gasoline tanks, to provide a small perforation in the top of the tank or in the filling cap to allow for the entrance of air or the exit of vapors. However, such a perforation in a drum for shipping liquids is unsatisfactory since the liquids may be easily lost and foreign matter may easily get into the drum.

It has also been proposed to provide a gasoline tank cap with a small perforation and to place an insert on the underside of the cap to form a vent chamber, the perforation in the insert being staggered in relation to the perforation in the cap proper. Such a closure has been found to be entirely unsuited for a container in which poisonous or corrosive liquids are shipped because the liquid tends to spray through or flows out the cap perforation when liquid in the container splashes against the closure. It has been found that the flow of liquid out of the cap perforation when the container is being moved or shaken is due to the flooding of the vent chamber formed by the insert and cap. This flooding occurs when the perforation in the base of the insert is so small that the return of liquid into the container is less than the flow of liquid into the vent chamber due to pounding of the waves in the container against the insert perforation. Attempts to overcome this trouble by making the perforation in the insert sufficiently large to effectively drain the vent chamber are not successful, apparently because some liquid splashing against the lower opening flows into the vent chamber at such angle that it strikes the lower opening of the cap perforation causing a spray of liquid to be forced out through the cap perforation.

It has also been proposed for hydrogen peroxide containers to provide a glass capillary tube held in place in a recessed member by means of a cork stopper. This device is ineffective in draining back into the container any liquid which is forced through the capillary tube. Various spring valve vent devices also have been proposed, but these are usually so complicated as to easily get out of order.

The object of this invention is to provide a container or a container closure with a venting means so constructed that no liquid will spray through or will flow out of the external vent, and to provide a venting means in which there are no movable parts.

Another object is to provide a cap with a venting means which is simple and sturdy, will not easily clog, and which can be easily detached from or attached to a container or can be a permanent or integral part of the container.

These and other objects are accomplished by constructing a cap with a vent chamber or a vent chamber alone, having vent holes in the inner and outer walls in staggered relationship and providing a drain tube extending downward from the lower horizontal base of the vent chamber into the interior of the receptacle to which the cap or venting means is applied. Our invention will be further described in connection with the attached drawing which shows one form of the invention. Figure I is a vertical sectional view of a cap and sput assembly and Figure II is a vertical sectional view of the insert or inner wall of the cap shown in Figure I.

In Figure I, part 1 is a threaded metal cap having an exterior vent opening 2. The inside top portion of the cap is machined to form the circular keyway 7 into which the insert 4 is fixed. Part 4 is a cup-shaped insert element which substantially fills the opening in the container formed by the threaded structure 8. The insert 4 is provided with a vent hole 5 in its vertical side wall to allow the escape of gas from the drum when the vertical drain tube 6 is immersed in the liquid in the container. Part 6 is a vertical drain tube attached to the bottom of the insert and which opens into the space between the insert 4 and the cap 1. The insert tube 6 and vent 5 are in staggered relationship to vent 2 and preferably are located as far away from vent 2 as possible. Part 3 is a gasket.

Figure II shows a complete insert element. This element is assembled with the cap 1 as shown in Figure I by applying force in such manner that the flange 9 is forced into the keyway 7. The insert element when thus attached to the cap forms a chamber which we call the vent chamber.

Example

A cap assembly like that shown in Figure I having an outside diameter of 3½ inches and provided with a drain tube 2½ inches long by $\frac{3}{16}$ inch inside diameter was attached to a container which was filled with liquid to such a

point that the tube 6 extended about 1½ inches below the surface of the liquid. The drum then was violently shaken on a barrel shaking machine. No spray or liquid came out of the exterior vent during an extended period of shaking, showing that the assembled cap was satisfactory in preventing spraying and that the insert chamber does not become flooded with liquid but drains freely.

The cup-shaped insert preferably has a substantial liquid capacity in order that the liquid entering the vent chamber due to a single surge, produced by a wave in the container striking the lower end of the drain tube and/or the internal vent 5, will not fill the chamber. If it were possible for a single surge to completely fill the chamber, it is evident that the liquid itself might be forced through the outer vent hole. The drain tube allows only a vertical straight line flow of liquid into the vent chamber; hence any liquid forced into the vent chamber accordingly strikes the cap directly above the tube. The top of the cap directly above the drain tube therefore functions as a baffle plate, which directs splashed liquid downward and away from the exterior vent opening 2.

Although we prefer that the tube should extend below the surface of the liquid in the container, this is not necessary since the cap also functions satisfactorily when the liquid level in the container is below the bottom end of the tube. In this case a wave developing in the container and striking the end of the tube causes splashing inside the tube but by the time the spray enters the insert chamber the direction of flow is changed, thereby causing it to strike the inside of the cap substantially vertically above the drain tube. The inside diameter of the drain tube should be large enough to allow the draining of the liquid from the insert chamber between successive surges, and yet should not be so large as to allow excessive wave motion to occur in the liquid within the partially submerged tube. For most purposes a tube ⅛ inch to ½ inch in diameter is satisfactory. The opening from the vent chamber at the top end of the drain tube may be of the same diameter as the tube or smaller, provided that it is sufficiently large to effect rapid drainage of the vent chamber. The tube should be substantially longer than its diameter. When the liquid level in the container is below the end of the drain tube, the internal walls of the tube act as an anti-splash baffle and the tube itself usually will be of sufficient length so that the friction due to the turbulent flow of the liquid in the tube prevents the liquid from rising into the vent chamber, except when unusually heavy wave motion occurs in the container.

The gas vent in the side wall of the vent chamber should have sufficient capacity to allow any vapors or gases formed by the decomposition of the material in the container to escape without building up any substantial pressure in the container. This vent is preferably placed near the top of the vertical sides of the insert and as far away from the exterior vent as possible. It is possible, however, to place the internal vent in the base of the vent chamber instead of in the side wall provided the vent is in staggered relationship to the external vent and provided the diameter of the vent is sufficiently small to prevent a direct flow of liquid through the internal vent to the external vent. The internal vent should not be confused with the drain tube opening. The latter is sufficiently large to rapidly drain the vent chamber, while the former, when not located above the drain tube opening, is not large enough to act as an effective drain. However, if located above the drain tube opening, the internal vent opening may be relatively large (e. g. as large as the drain tube opening) if desired, provided that the internal vent is so located that liquid flow therefrom towards the external vent will be at such angle to substantially prevent liquid from being forced out through the external vent.

Obviously, our venting means need not be a portion of a stopper or bung but may be permanently fastened in position in any suitable location on the container. If such a venting device is used an ordinary solid bung or stopper can be used for closing the container opening.

It is also preferable to have the cup-shaped insert substantially fill the recess in the cap so as to form a narrow annular space between the outside wall of the insert and the inside wall of the sput member or the inside wall of the cap, depending upon whether the cap fits inside or outside the sput. If desired, a sleeve surrounding the vent chamber may be arranged to form the narrow annular space.

Our invention is not limited to the specific structure shown; if desired, the drain tube may be attached to the vent chamber at an angle to the perpendicular, provided that it is directed away from the upper vent hole. Also, the lower portion of the tube may be bent or coiled, although we prefer a simple straight tube. The drain tube may be attached to the base of the vent chamber by any suitable means. When the tube is attached by soldering or welding, it has been found that the tube can be more easily attached if the diameter of the hole in the base of the vent chamber is somewhat smaller than the inside diameter of the drain tube.

We claim:

1. A container venting means provided with a vent chamber having an external vent, an internal vent and a drain opening and a downwardly extending drain tube communicating with the container, said drain tube and internal vent being in staggered relationship to said external vent and said internal vent being of such diameter and in such location as to substantially prevent a flow of liquid from the internal vent through the external vent.

2. A container venting means provided with a vent chamber having an external vent, an internal vent and a drain opening and a downwardly extending drain tube communicating with the container, said drain tube being in staggered relationship to said external vent and said internal vent being located above said drain tube.

3. A container venting means provided with a vent chamber, the upper wall of said chamber being provided with an external vent and the side wall of said chamber being provided with an internal vent and a drain opening, a drain tube element extending downward from the base of said vent chamber such that a flow of liquid through the drain tube into said vent chamber is directed towards a point on the upper wall of the vent chamber not coincident with said external vent.

4. A container venting means provided with a vent chamber, the upper horizontal wall of said chamber being provided with an external vent and the vertical side wall of said chamber being

provided with an internal vent and a drain opening, a drain tube element extending vertically downward from the horizontal base of said vent chamber such that a flow of liquid through the drain tube into said vent chamber is directed towards a point on the upper horizontal wall of the vent chamber distant from the external vent.

5. A container venting means provided with a vent chamber, the upper horizontal wall of said chamber being provided with an external vent and the vertical side wall of said chamber being provided with an internal vent and a drain opening, a drain tube element extending vertically downward from the horizontal base of said vent chamber such that a flow of liquid through the drain tube into said vent chamber is directed towards a point on the upper horizontal wall of the vent chamber distant from the external vent, said vent chamber being surrounded by a wall forming a narrow annular space therewith.

6. A container sput and closure combination comprising a threaded sput and a threaded recessed closure adapted to be threaded on said sput and a cup-shaped element attached to said closure forming a vent chamber in the recess of said closure, the upper wall of said chamber being provided with an external vent and the side wall of said chamber being provided with an internal vent, a drain tube element extending downward from the base of the cup-shaped element in such direction that a flow of liquid from the tube into the vent chamber is directed towards a point on the upper horizontal wall of the said vent chamber not coincident with said external vent.

7. A container sput and cap combination comprising an externally threaded sput and an internally threaded recessed cap adapted to be threaded on said sput and a cup-shaped element attached to said cap forming a vent chamber in the recess of said cap, the upper wall of said chamber being provided with an external vent and the side wall of said chamber being provided with an internal vent, a vertical drain tube element adapted to extend downward from the base of the cup-shaped element and into the liquid in the container in such direction that a flow of liquid from the tube into the vent chamber is directed towards a point on the upper horizontal wall of the chamber distant from said external vent.

8. A container sput and cap combination comprising an externally threaded sput and an internally threaded recessed cap adapted to be threaded on said sput and a cup-shaped element attached to the cap forming a vent chamber in the recess of said cap, the outside vertical wall of the vent chamber and inside vertical wall of the sput forming a narrow annular space, the upper wall of said chamber being provided with an external vent and the side wall of said chamber being provided with an internal vent, a vertical drain tube element adapted to extend downward from the base of the cup-shaped element and into liquid in the container in such direction that a flow of liquid from the tube into the vent chamber is directed towards a point on the upper horizontal wall of the chamber distant from said external vent.

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