

PROTECTING MEANS FOR VENTING SYSTEMS

Field of the invention

The present invention relates to a package or cap for said package suitable for containing gasifying products. Said package or cap comprises a venting means and a protecting means for said venting means. Said protecting means prevents contact of that said gasifying product, through splashing during shipment and transportation, with said venting means.

Background of the invention

The problem of package deformation in response to pressure differences existing between the inside of a closed package and the ambient pressure is well known in the packaging industry. Such package deformation may be non-recoverable for certain package materials, like some plastics or metals. Thin-walled, partially flexible packages, often made of these sensitive materials, are particularly subject to the problem.

There are a number of possible factors which may lead to the existence of the pressure differences between the interior and the exterior of the package mentioned above. The content of the package may, for example, be chemically unstable or may be subject to reaction with gases which may exist in the head space of the package, or alternatively, in certain specific circumstances, may react with the package material itself. Any chemical reactions involving the liquid contents may lead to either production of gases, and hence to over pressure in the package, or to the absorption of any head space gases thereby causing under pressure in the package.

Pressure differences between the pressure inside the container and the ambient atmospheric pressure may also occur when the temperature during the filling and sealing of the container is significantly different from external temperature during shipment, transportation and storage. Another possibility of a pressure difference may be caused by a different ambient pressure at

the filling of the container from another ambient pressure at a different geographical location.

The prior art has proposed several solutions using valve systems which avoid pressure differences between the interior and the exterior of the package. Proposed solutions also relate to various venting caps which allow pressure generated inside the package to be released by escape of gas. For example, FR-A-2 259 026, US-4 136 796 and DE-A-2 509 258 disclose self-venting closures comprising a gas-permeable membrane covering an orifice to the exterior. Said membranes are made of a material which is impermeable to liquids, but permeable to gases. Therefore, packages may comprise apertures to release gas to the exterior without losing their leak-tightness. Another example is EP-A-593 840 which discloses containers for containing liquids which generate pressure, said container being made of a thermoplastic material comprising a network of microchannels. This network of microchannels is permeable to gases, but not to liquids.

We found that should liquid product contact these membranes, said membranes may lose at least part of their gas-permeability. Also, liquid products which are viscous or which have some affinity for these membranes may not drain away from said membrane back into the package. Therefore, should said membranes become contacted by such products, their venting performance is substantially lost for any part of said membrane covered by the product which has not drained away from said membrane. In this manner, it may happen that the package loses venting capacity.

Prior to purchase by the consumer, said product may splash onto said membrane as the filled package is agitated during shipment and transportation of the package. We found that the amount of splashes normally occurring during shipment and transportation are sufficient to completely interrupt the venting capacity of said package. We further found that other venting systems, like valves for example, may also suffer with a similar disadvantage.

It is therefore an object of the present invention to provide a package, or a cap for said package, in which the contained product is impeded from

contacting the venting system, thus prolonging the gas venting efficiency of the package or the cap.

Summary of the Invention

The present invention provides a package (10) for containing liquid products or a cap (10) for said package. Said package, or said cap for said package, comprises a venting means (20), which allows passage of gases between the interior and the exterior of said package when the pressure inside said package is different from the ambient pressure. Said venting means is permeable to gases, but impermeable to said liquid product. Said package or cap for said package further comprises a protecting means (30) which inhibits splashing of said product onto said venting means, and whereby said protecting means allows the passage of gases to said venting means.

Brief description of the figures

Figure 1a is a cross sectional view of the top portion of a package (shown partially) or cap for a package with an embodiment of the protecting means according to the present invention. Figure 1b is a plan, top view of the same package or cap.

Figure 2 illustrates the cross sectional view of a package (shown partially) or cap for a package with another embodiment of the protecting means according to the present invention.

Figure 3a shows cross sectional side view of a package (shown partially) or cap for a package with a further embodiment of the protecting means according to the present invention. Figure 3b is detailed view of Figure 3a.

Figure 4a and 4b show cross sectional side views of a package (shown partially) or cap for a package with another embodiment of the protecting means according to the present invention.

Figure 5a shows a cross sectional side view of a package (shown partially) with a dosing cap with another embodiment of the protecting means according to the present invention. Figure 5b shows a plan, top view of the same package with a dosing cap.

Detailed description of the invention

In the following, the drawings may refer to the upper portion of a package as well as to a cap. A cap of the screw-on/in or snap-on/in type, or a flip-top, push-pull or turret cap closures may be engagement means between said cap and said package.

In the following, Figure 1a will be described first as a package, then as a cap. In case Figure 1a shows a cross sectional view of a package, the package (10) (only partially shown) comprises a hollow body (11). Said hollow body is able to contain any liquid products. Preferably, said hollow body is flexible to an extent that it may deform in response to pressure differences arising between the inside of said package and the ambient pressure. Pouches made of thin plastic material, for example, are also encompassed by the present invention. Otherwise, suitable shapes of said package may include essentially cylindrical, tapered cylindrical, oval, square, rectangular or flat-oval.

Said hollow body should be suitable for leak-tight containment of liquid products. In the following, liquid products encompass also pastes, creams, gels, emulsions and slurries. Said products may include, for example, household products such as detergents for laundry or dish washing, hard-surface and household cleaners, shampoos, bleaches, personal/beauty care products, creams and toothpastes. According to the present invention, said hollow body is able to contain liquid products which generate pressure inside said package. For example, these products may be liquid laundry products comprising a bleach, particularly peroxygen bleach. Preferably said product has a viscosity of between 200 cps and 5000 cps, more preferably of between 800 cps and 1800 cps, most preferably of between 1300 cps and

1600 cps, where this viscosity is measured using a Brookfield viscosity meter, spindle 3, 60 rpm at 20°C.

In case Figure 1a represents a cross sectional view of a cap, the cap (10) comprises a top wall (17) and a side wall (18). Said cap can be engaged in a leak tight manner to the package described before. In another preferred embodiment of the present invention, said package or cap (10) may comprise a spout (as depicted in Figure 2, 12 for example). Preferably, said package or cap is made of plastic, metal, paper, or combinations of these materials as layers, laminates or co-extrudates. The materials may be also recycled. Preferred materials for said hollow body include plastics such as polyethylene (high or low density), polyvinyl chloride, polyester, polyethylene terephthalate (=PET), extrudable PET, polypropylene, polycarbonate and nylon. These plastics may used individually or be combined as co-extrudates, layers or laminates.

Another essential feature of said package or cap (10) comprises a venting means (20). Said venting means is able to equalize the pressure inside said package to the external atmospheric pressure. Consequently, said venting means is able to avoid over pressure as well as under pressure inside said package. Indeed, said venting means allows the escape of gases released from the contained product from the inside to the outside of said package, or vice versa. Said venting means is located in the upper portion of said package above the level of said contained product, when said package is in its upright position. Indeed, the gases causing the over pressure or under pressure accumulate typically in the upper region of the package. Therefore, the passage of gases to the exterior or interior is facilitated.

Said venting means comprises at least an orifice. Preferably, said venting means comprises at least an orifice (21) and a membrane (22). Said membrane increases the leak tightness of the package without substantially decreasing the venting capacity of the package. Said orifice connects the interior of said package with the exterior. Specifically, said orifice (21) allows the passage of gases from the interior to the exterior of said package, or vice versa, such that pressure inside said package is either maintained identical to the external atmospheric pressure or at a pressure at least below the pressure at which significant bottle deformation occurs. The dimension

of said orifice should be suitable for said passage of gases. Preferably, said orifice is circular and has a diameter of at least 0.5 mm, preferably between 1 mm to 3 mm. The number of orifices can be chosen by a person skilled in the art to allow a sufficient amount of flow of the gases.

Said membrane (22) is located between the content of said hollow body (11) and said orifice (21), covering said orifice. Preferably, said membrane is impermeable to liquids, but permeable to gases. Therefore, said membrane is able to provide a liquid impermeable barrier, while allowing gas venting. Preferably, said membrane is made of any material capable of being formed into a thin layer which may be used to cover said orifice (21). Said membrane must be permeable to gas flow, also in response to small pressure differences. Preferably, said membrane should allow gas flow with pressure differences as low as 100 mbar, more preferably as low as 5 mbar. The thickness of said membrane is a matter of choice, but preferably would be in the region of 0.2 mm to 2 mm. Said membrane can comprise essentially any material which may be formed into thin layers such as plastics, paper or metal having micropores. Preferred film materials include microporous plastic films. The size of the micropores of said membrane should be such as to allow passage of gases at low pressure differences and at the same time to provide liquid impermeability. Preferably, the micropores will be in the range of 0.1 mm to 5 mm, more preferably between 0.2 mm to 1 mm.

Preferred microporous plastic films for this application are:

- non-woven plastic films, especially the non-woven spun bounded polyethylene film material sold under the trade name TYVEK by the Du Pont Company, of which TYVEK, Style 10, which is fluorocarbon treated to achieve high fluid impermeability;
- an acrylic copolymer cast on a non-woven support (nylon or PET) with a fluoro-monomer post-treatment hydrophobicity, sold under the trade name, VERSAPOR, by the Gelman Sciences Company, 600, South Wagner Road, Ann Arbor, MI 48106, US, which is the most preferred.

The microporous film material of said membrane (22) may be treated to reduce its surface energy and therefore to improve the leak tightness of said film material. The lowering of the surface energy of said film material is particularly necessary to improve leak tightness when said package (10) contains products comprising surfactant components. Preferably in this case, the specific surface energy of said film material should be lower than that of the surfactant-containing product to achieve a substantially complete impermeability to the product contents.

Fluorocarbon treatment, which involves fixation of a fluorocarbon material, on a micro scale, to the surface of the film material is a specific example of a treatment which provides such reduced surface energy. Indeed, the fluorination treatment reduces the susceptibility of the microporous film material of said membrane to wetting by the liquid product contents. However, when used to treat said microporous film material of said membrane according to the present invention, this fluorocarbon treatment should not compromise the gas permeability of said membrane. For example, a fluorocarbon material for use in the fluorocarbon treatment according to the present invention is sold under the trade name SCOTCHBAN, by the 3M Company.

Said membrane (22) may be applied and located inside said hollow body (11) between the content and said orifice (21) in any way maintaining its liquid-impermeability and gas-permeability according to the present invention. The means of application may therefore include the use of adhesives, or the heat-sealing of said membrane onto the area around said orifice or the use of mechanical means such as clamping or hot-stamping, or the insertion of said membrane during molding of said package. As said before, the application means employed should not significantly compromise the venting ability of the breathable membrane. For this reason, it is preferred that any adhesive used is also permeable to gases, or does not fill up the pores of the membrane.

The membrane may be also fitted in a housing. Housings whose dimensions are particularly compatible for use in a package or a cap according to the present invention are commercially available from GVS, Via Roma 50, 40069, Zola Predosa (BO), Italy. In a highly preferred

embodiment, the manufacture of said housing and the fitting of said membrane (22) in said housing can be achieved by an "insert molding operation", where:

- a sheet of membrane is fed into an apparatus; the sheet of membrane is advantageously fed from a roll of membrane material;
- in said apparatus, at least one membrane is cut from said sheet and is placed into a mold wherein said housing will be formed;
- then, the housing is molded substantially around said membrane in a manner which secures said membrane in said housing. As "substantially around" it is meant herein that once completed, this step should generate a housing with its fitted membrane, where both surfaces of the membrane are accessible to air, but said membrane is tightly maintained in the housing.

Housings may also be manufactured by glueing or heat sealing said membrane (22) onto a supporting material or by mechanically trapping said membrane between two or more plastic pieces.

As another essential feature of the present invention, said package or cap comprises a protecting means (30). Said protecting means protects the venting means (20) from the splashing of contained product onto said venting means. As used herein splashing means a non continuous and brief contact of a liquid substance upon a surface when said liquid is agitated within the package. The splashing of the contained liquid product occurs mainly during shipment and transportation when the risk of agitation is higher. We found that the orifice or the membrane may lose its gas-permeability when the contained liquid product contacts the orifice or the membrane. Indeed, we found that liquid product or part of said product may not sufficiently drain away from around said orifice or from said membrane back into the package. In this manner, said orifice or said membrane may be covered by the product, i.e. its venting performance is reduced for any part of said membrane covered by the product which has not drained back. Consequently, the venting capacity of the package is reduced or effectively lost.

This is particularly the case for liquid products which are viscous, or which have some affinity for the membrane or for the material surrounding the orifice. Examples are liquids exhibiting non-newtonian flow behaviour or liquids having a low surface energy ($< 30 \text{ dyne/cm}^2$). For example, liquids comprising surfactants exhibit typically a non-newtonian flow behaviour. As used herein, a "non-newtonian" product is a product which presents a high viscosity when the shear rate is low, vice versa its viscosity is low when the shear rate is high. Consequently, a non-newtonian product exhibits poor drain back characteristics, since said drain back is characterized by a low shear rate and the product accordingly has a high viscosity.

Prior to purchase by the consumer, especially during shipment and transportation of the package, said liquid product may splash onto said orifice or membrane as the filled package is agitated. We found that the amount of splashes normally occurring during shipment and transportation are sufficient to completely interrupt the venting capacity of said package. We found that other venting systems, like valves for example, may also suffer of a deteriorated venting capacity.

The draining away of the splashed product from the venting means may be helped by a product repellant coating around the venting means. A product repellant coating is any coating reducing the surface energy of the material on which the product repellant coating is applied upon. The product tends to drain away from the regions of lower surface energy. Suitable product repellant coating may be, for example, coating of teflon or silicone. We found that a sufficient venting capacity of the package can be maintained when the product repellant coating is applied on the venting means comprising at least an orifice without any membrane. Consequently, this product repellant coating is a possible protecting means according to the present invention of a venting system. However, we found that the product repellant coating may deteriorate the venting capacity of a membrane when the product repellant coating is applied directly on the membrane of a venting means. Other types of protecting means have to be foreseen for these particular venting means.

The protecting means according to the present invention should reduce or completely impede these splashes of the contained liquid product onto said venting means without disadvantages to the membrane when the venting means further comprises a membrane. Furthermore, the protecting means according to the present invention has to satisfy certain constraints so that it does not interfere with the other functions of a package or a cap for a package. Firstly, said protecting means should not interfere with the air flow from the product through the venting system, i.e. it should not itself interrupt the venting of the package. Secondly, said protecting means should not interfere with the product drainage away from the venting system, if the liquid comes in contact with the venting system. Finally, said protecting means should not interfere with the dispensing of the product from the interior of the package or from a dosing cap, for example, during normal use.

Said protecting means (30) will be further illustrated by the following non-limiting examples with the help of the Figures 1 to 5. Figure 1a illustrates the package (partially shown) or cap (10) with said venting means (20). Said venting means comprises an orifice (21) and a membrane (22). Said orifice (21) is further shown in Figure 1b in a top view of said package or cap (10). Said venting means may only comprise at least an orifice without the membrane. However, we found that the leak tightness of the package is improved having a venting means further comprising a membrane. Said package or cap further comprises the protecting means (30). Said protecting means comprises a side wall (31) and a bottom wall (32) connected to said side wall. Said side wall and/or bottom wall comprises at least a venting aperture (33). Said venting aperture allows the passage of gases towards said venting means (20). Preferably, said bottom wall comprises at least an aperture to allow drain back of product in case liquid product enters within the volume (30a) of said protecting means. Preferably, the venting aperture (33) on the side wall (31) is located in the upper portion of said protecting means when said package is in its upright position. As used herein, "upper portion of said protecting means" is the portion of the protecting means which is located near said top wall (17) of said package or cap (10). Preferably, said apertures (33) on said bottom wall (32) are not in vertical alignment with said venting means. This further prevents the contained liquid from splashing onto said membrane (22) or said venting means

through said venting aperture of said bottom wall of said protecting means (30).

Said protecting means (30) may be an integral part of said package or cap (10). Other possibilities are to have said side wall (31) as an integral part of said package or cap, whereas said bottom wall (32) is a separate part able to be attached to said side wall (31) to form the complete protecting means (as shown in Figure 1a itself). Another possibility is shown in Figure 2, where said side wall (31') and bottom wall (32') are a one piece part which is attached to said package or cap. A further possibility is to have said side wall and said bottom walls as two separate parts. In this case, said side wall can be attached around said venting means and said bottom wall is attachable to said side wall under said venting means. All these possibilities mentioned before are applicable to all the examples as will be described hereinafter, although they will not be explicitly repeated again.

Preferably, said bottom wall (32) should be located at a certain distance from the bottom edge (Fig. 1, 23) of said venting means (20). Indeed, we found that a certain distance has to be kept between said bottom wall and the bottom edge (23) to allow the drainage of the liquid product from said venting means back into the package through said aperture (33) of said bottom wall. This distance is dependent predominantly on the surface tension and viscosity of the liquid. Preferably, said distance is at least 1 mm, more preferably between 2 mm and 5 mm.

Figure 2 illustrates a package or cap (10) with a spout (12) which is located outside the volume defined by said protecting means (30). Any liquid product flowing inside said volume defined by said protecting means is able to drain back into said package through the venting aperture(s) (33). Figure 3a illustrates a package or cap with a spout (12') located within the volume (30a) defined by said protecting means (30). Said bottom wall (32') comprises an oblique slit (34) defining a venting aperture (33). Said oblique slit is formed by two baffles (32'a) and (32'b). Said baffles may overlap and/or stay on parallel planes, but preferably said baffles are not in parallel planes, as shown in Figure 2. Preferably, a baffle (32'b) is longer than the other baffle (32'a) and said longer baffle (32'b) is above the other baffle (32'a). In this manner, said venting means (20) is better protected from the

splashes of the contained liquid product. Preferably, said spout (12') is located substantially in vertical alignment with the shorter baffle (32'a). Therefore, said longer baffle (32'b) protects the major part of said venting means from contact with the contained liquid product even when said contained liquid product has to enter the volume defined by said protecting means to reach the spout (12').

Figure 3b further illustrates the inclination between the two baffles (32'a) and (32'b) of said bottom wall (32'). We found that the inclination angle of the baffles a and the distance between the free ends of the baffles D are critical parameters to ensure protection against splashes of the contained liquid product onto said venting means(20) as well as to allow the flow of said contained liquid product towards said spout (12'). Preferably, said angle a is between 10°deg and 90°deg, more preferably between 20°deg and 60°deg, most preferably between 20°deg and 50°deg. On the other hand, said distance D is preferably between 0.3 cm to 1 cm, more preferably between 0.5 cm to 1 cm.

It is understood that the protecting means described in Figures 3a and 3b can be easily adapted to said package or cap of Figure 1a or Figure 2 by the person skilled in the art. Different shapes of said side wall (31) and/or said bottom wall (32) can be selected to adapt said protecting means in a package or cap and/or to improve the aesthetics of the package or cap. For example, said bottom wall may have a rounded shape.

Figure 4a shows another possibility of a package or cap (10) according to the present invention. Said protecting means comprises a cap (35) which is manufactured as part of a housing (6) containing said membrane (22). Said cap (35) is engaged within said housing over said membrane, e.g. said cap (35) is snapped over said membrane. Said cap (35) comprises at least a venting aperture (33), which allows the passage of gases to and from said venting means.

Figure 5a illustrates the cross sectional side view of a package (10') comprising a container (16) and a cap (15). Said container (16) comprises a discharging opening (14). Said cap comprises said venting means (20) and

said protecting means (30). Said cap comprises a top wall (17) and side wall (18). Said cap may be adapted to be used as a dosing device.

Preferably, the venting means (20) and the protecting means (30) are part or attached to the top wall of said cap (15). The protection of said venting means is best achieved when said protecting means is located between said discharging opening (14) and said venting means. Preferably, said protecting means is a wall substantially perpendicular to said top wall (17) of said cap, as shown in a cross sectional top view of the cap with said discharging opening in Figure 5b. More preferably, said wall (36) has a shape of an arc in a plane parallel to said top wall. Preferably, the concave part of said arc may be directed towards the discharging opening (as shown in Figure 5b) or opposite towards the venting means.

Preferably, the height H and length L of said wall (36) are such that said venting means is completely protected from any possible splashes coming from said discharging opening (14). As herein used, the height H is measured from the top wall (17) of said cap to the lower edge (37) of said wall, and the length L is measured along the shape of said wall in the direction which connects the two distal points of said wall. Preferably, said height H is at least such that said lower edge (37) of said protecting means is below the upper edge of said discharging opening (14) and said length L is at least of the same dimension of said venting means. This arrangement impedes any splashing of contained liquid product onto said venting means. This protecting means (30) does not need any venting and draining aperture, since said protecting does not form a closed volume around said venting means. However, the distance between the venting means (20) and the wall of the protecting means should be maximized to ensure that product is not trapped between said venting means and said wall (36). Preferably, this distance should be greater than 2 mm, more preferably it should be greater than 4 mm.

Preferably, said protecting means is made of plastic, metal, paper, or combinations of these materials as layers, laminates or co-extrudates. The materials may be also recycled. Preferred materials for said protecting means include plastics such as polyethylene (high or low density), polyvinyl chloride, polyester, polyethylene terephthalate (=PET), extrudable PET,

polypropylene, polycarbonate and nylon. These plastics may used individually or be combined as co-extrudates, layers or laminates.

WHAT IS CLAIMED IS:



1. A package (10) containing a liquid product, or a cap (10) of a package containing a liquid product, said package or said cap comprising a venting means (20), said venting means allowing passage of gases between the interior and the exterior of said package when the pressure inside said package differs from the ambient pressure, said venting means being permeable to gases, but impermeable to said product, characterized in that said package or cap for said package further comprises a protecting means (30) which inhibits splashing of said product onto said venting means, and said protecting means allows the passage of gases to said venting means.
2. A package or a cap according to claim 1 characterized in that said protecting means (30) comprises a side wall (31, 31') and a bottom wall (32, 32') connected to said side wall, said side wall being located all around said venting means.
3. A package or a cap according to claim 2 characterized in that said side wall (31, 31') and/or said bottom wall (32, 32') of said protecting means comprises at least one venting aperture (33), said venting aperture being preferably located in the upper portion of said protecting means when said package is in its upright position.
4. A package or a cap according to claim 2 or 3 characterized in that said bottom wall (32, 32') further comprises at least a draining aperture to allow drain back of product in case liquid product enters within the volume (30a) of said protecting means.
5. A package or a cap according to any of claims 2 to 4 characterized in that said bottom wall (32b) comprises an oblique slit, said slit being formed by two baffles (32'a) and (32'b).
6. A package or a cap according to claim 5 characterized in that said baffles (32'a) and (32'b) are not in parallel planes.



7. A cap according to claim 1 for a package characterized in that said protecting means is a wall (36) located between said venting means on said cap and the discharging opening (14) of said package (10').
8. A cap according to claim 7 characterized in that said wall forms an arc in a plane parallel to the top wall (17) of said cap.
9. A cap according to claim 7 or 8 characterized in that the distance between said venting means (20) and said wall (36) is greater than 2 mm.
10. A package or a cap according to any of the preceding claims characterized in that said venting means (20) comprises an orifice (21) connecting the interior with the exterior of said package and a membrane (22) covering said orifice which permits the passage of gases, but prevents the passage of liquid products.
11. A package or a cap according to any of the preceding claims characterized in that said product has viscosity of between 200 cps and 5000 cps, said viscosity measured using a Brookfield viscosity meter, spindle 3, 60 rpm at 20°C.
12. A package or a cap according to any of the preceding claims characterized in that said product generate pressure inside said package.
13. A package or a cap according to any of the preceding claims characterized in that said product comprises a bleach.
14. A package or a cap according to claim 13 characterized in that said product comprises peroxygen bleach.