

VENTED CLOSURES

This invention relates to a method of and apparatus for providing a vented closure for a
5 container and it particularly relates to venting members for container closures.

An known type of container closure is a cap having a none-gas tight screw thread fitting with
the complimentary thread neck of a container and a seal in the cap to form a gas- and liquid-
tight seal with the container neck. Liquid containers can become over or under pressurised
10 and the container damaged, such as by ballooning or crushing, depending on the liquid to be
contained and the ambient temperatures. One solution is to make the container strong enough
to resist such changes, another solution is to fit the container with a gas vent. The choice of
solution is mainly an economic one, depending upon whether or not it is cheaper to make the
container stronger or to fit a gas vent.

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Known gas vents for container require special closures and/or modified containers.

According to one aspect of the present invention, a method of providing a vented closure for a
container, the closure and container having complimentary none gas-tight features by which
20 the closure may be removeably attached to close the container, comprises fitting a venting
member to form a liquid-tight, gas-venting seal between the closure and the container and
provide a venting gas path from the container through the venting member to atmosphere via
the complimentary closure and container features.

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25 According to another aspect of the present invention, a method of converting a sealed to a
vented closure for a container, the closure and container having complimentary features by
which the closure may be removeably attached to close the container and a sealing member to
form a fluid-tight seal between the closure and the container, comprises replacing or by-
passing the sealing member with a venting member to form a liquid-tight, gas-venting seal
30 between the closure and the container and provide a venting gas path from the container
through the venting member to atmosphere via the complimentary closure and container
features.

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No modification to either the closure or the container is required when using the method of the present invention.

Also according to the present invention, in a venting closure for a container, the closure and container having complimentary, none gas-tight features by which the closure may be removeably attached to the container, a venting member is shaped and dimensioned to fit as a liquid-tight, gas-venting seal between a given closure and container and, in use, provide a venting gas path from the container through the venting member to atmosphere via the complimentary closure and container features.

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The vented member may designed to replace or by-pass a sealing member, forming a fluid-tight seal between the closure and the container, and form a liquid-tight, gas-venting seal between the closure and the container.

Thus, a liquid container can be provided with a gas vent according to the present invention simply and economically; no modification of the container or closure being required, simply the provision of a suitable venting member together with taking advantage of the potential gas flow path already present between the closure and container attachment features.

In a preferred embodiment, the venting member is microporous; for example a microporous membrane.

The advantages of the using microporous membranes for vented closures is that they work at zero differential pressures and are bi-directional; i.e. they vent gases in both directions, in and out of a container. The main disadvantage of such use of microporous membranes is that their operating efficiency is severely reduced when wetted by a liquid, such that the membrane hardly works at all.

According to a further embodiment of the present invention, the complimentary closure and container features form an air-side labyrinth seal that, in use, acts to prevent passage of liquid to the venting member.

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According to another embodiment of the present invention and wherein the closure is a cap and the container has a neck, the cap and neck having the complimentary features, the venting member is an insert for the cap. Gas flow means may be provided between the insert and the cap.

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According to a still further embodiment of the present invention, the insert has a liquid-side capillary port that, in use, acts to permit passage of gas and prevent passage of liquid to the venting member. The capillary port is dimensioned so that the surface tension of a liquid to be contained in the container prevents that liquid from normally contacting the microporous membrane; this both improves membrane efficiency by preventing membrane wetting and protects the membrane from liquid-induced forces and loads that may occur during operational use of the filled container.

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The above and other features of the present invention are illustrated, by way of example, in the Drawings; wherein:-

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- Fig. 1 is a cross-sectional view of a microporous membrane vented closure for a liquid container in accordance with the present invention;
- Fig. 2 is an exploded cross-sectional view of the closure of Fig. 1;
- Fig. 3 is a cross-sectional view of a container neck;
- Fig. 4 is a cross-sectional view of the closure of Fig. 1 screwed onto the neck of Fig. 3;
- Fig. 5 is a side elevation corresponding to Fig. 4; and,
- Fig. 6 is an enlarged detail of part of Fig. 4.

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As shown by the figures, a microporous membrane vented closure 10 consists of a generally circular insert 12 moulded from a suitable rigid plastics material, such as LDPE, to generally conform to the inner shape of a container cap 14. The insert 12 has a central aperture 16 with an air-side, surrounding, axially upwardly extending, cylindrical lip 18 and a radially extending liquid-side rim 20. The rim 20 has a liquid-side, surrounding, axially downwardly extending, cylindrical rib 22. The aperture 16 is closed on the liquid-side by a microporous membrane 24, for example of "GORTEx®", that is bonded, such as by welding, within the rib 22 to the rim 20 to form a liquid seal therewith.

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The membrane 24 is protected on the liquid-side by a moulded plastic cup 26, having cylindrical upper part the external diameter of which is an interference, liquid-tight fit within a liquid-side, axially extending, cylindrical, outer rib 30, that co-axially surrounds rib 22. The cup 26 has an external, radially outwardly extending flange that acts as a stop against the rim of rib 30, to control the depth of insertion of the cup upper part.

The cup 26 has a hemispherically-shaped bottom part that is provided with a central port 28; the port 28 is dimensioned so that it can act as a capillary port, using the surface tension of a liquid to be contained in the container act to prevent that liquid from normally entering the cup.

Outer rib 30 is an integral part of and depends from a dished central portion 32 of the insert 12 that flares upwardly and outwardly from lip 18 to a corrugated rim portion 34. The rim portion 34 has two concentric peripheral grooves 36 and 38 respectively opening upwards, to accommodate an integral sealing flange 40 that depends within the container cap 14, and downwards, to accommodate the rim 42 of a container neck 44.

The air-side, cap facing surface of insert 12 is roughened and the dished central portion is provided with integral ribs 46 extending radially to the rim portion 34.

In use, and especially as shown by Figs 1, 4 and 6, the vented closure 10, comprising insert 12 with membrane 24 and cup 26 is fitted within a conventional container cap 14 and the whole assembly is screwed onto the neck 44 of a container 48.

Gases within the container 48 can vent:-

through the microporous membrane 24,

within the insert cylindrical lip 18,

though notches 50 in the rim of lip 18,

between the under-surface of cap 14 and the ribs 46 on the facing surface of insert 12,

around and between cap sealing flange 40 and the roughened, cap-facing surface of insert groove 36,

around and between the roughened, cap-facing surface of insert groove 38 and the cap 14;

down through the cap and neck threads 52, 54; and,
past the cap anti-tamper ring 56 to atmosphere;
and as shown by the arrows in Fig. 6.

- 5 A sealing ring 58 is located between the neck rim 42 and the insert groove 38 to seal the insert with the container; as the insert, perforce, by-passes the cap's integral sealing flange 40..

10 This complex gas passage effectively forms a labyrinth seal on the air-side of the microporous diaphragm; thus;-

- the cap protects the membrane from any contamination coming from outside during storage or transport of the container;
- the same cap can be used for vented and non-vented applications, simply by insertion of a vented closure into the cap;
- 15 the membrane is welded to the insert to ensure that it remains liquid tight; and,
- the cap has no gas ports or perforations.

By this means, a non-vented cap-closure can readily and simply be converted to a vented closure by either replacing or by-passing the existing sealing member within a conventional
20 container cap 14 with insert 12, including membrane 24 and cup 26; provided that there is a sufficient gas leakage path between the cap and neck threads.

CLAIMS:-

1. A method of providing a vented closure for a container, the closure and container having complimentary none gas-tight features by which the closure may be removeaby attached to close the container, **characterised by fitting a venting member to form a liquid-tight, gas-venting seal between the closure and the container and provide a venting gas path from the container through the venting member to atmosphere via the complimentary closure and container features.**
2. A method of converting a sealed to a vented closure for a container, the closure and container having complimentary features by which the closure may be removeaby attached to close the container and a sealing member to form a fluid-tight seal between the closure and the container; **characterised by replacing or by-passing the sealing member with a venting member to form a liquid-tight, gas-venting seal between the closure and the container and provide a venting gas path from the container through the venting member to atmosphere via the complimentary closure and container features.**
3. A method as claimed in claim 1 or claim 2, **characterised in that the venting member is microporous.**
4. A venting closure for a container, the closure (10) and container (48) having complimentary, none gas-tight features (52, 54) by which the closure may be removeaby attached to the container, **characterised in that a venting member (12) is shaped and dimensioned to fit as a liquid-tight, gas-venting seal between a given closure (10) and container (48) and, in use, provide a venting gas path from the container through the venting member to atmosphere via the complimentary closure and container features (52, 54).**
5. A closure as claimed in claim 4, **characterised in that the venting member (12) is a microporous member (24).**

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6. A closure as claimed in claim 4 or claim 5, characterised in that the complimentary closure and container features (52, 54) form an air-side labyrinth seal that, in use, acts to prevent passage of liquid to the venting member (12).
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7. A closure as claimed in any of claims 4 to 6 and wherein the closure is a cap (14) and the container (48) has a neck (44), the cap and neck having the complimentary features (52, 54), characterised in that the venting member is an insert (12) for the cap (14).
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8. A closure as claimed in claim 7, characterised in that gas flow means (46) are provided between the insert (12) and the cap (48).
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9. A closure as claimed in claim 8, characterised in that the gas flow means is formed by projections (46) on a cap-facing surface of the insert (12).
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10. A closure as claimed in claim 8 or claim 9, characterised in that the insert (12) is moulded from rigid plastics material to generally conform to the inner shape of the closure cap (14) and has a central aperture (16) closed on the liquid-side by a microporous membrane (24).
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11. A closure as claimed in claim 10, wherein the closure cap (14) has a depending sealing flange (40), characterised in that the insert (12) has a corrugated rim portion (34) with two concentric peripheral grooves (36, 38) respectively opening upwards, to accommodate and by-pass the cap sealing flange (40), and downwards, to accommodate the rim of the container neck (44).
12. A closure as claimed in claim 9 and claim 10, characterised in that the insert projections are formed by integral ribs (46) extending radially from the central aperture (16) to the rim portion (34).

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13. A closure as claimed in claim 11, characterised in that the cap-facing surfaces of said two concentric peripheral grooves (36, 38) are roughened to form venting gas flow means between the insert (12) and the cap (14).
- 5 14. A closure as claimed in any of claims 4 to 13, further characterised in that the insert (12) has a liquid-side capillary port (28) that, in use, acts to permit passage of gas and prevent passage of liquid to the venting member (24).
- 10 15. A closure as claimed in claim 14 as dependent on claim 10, characterised in that a cup-shaped member (26) is mounted liquid-tight to the liquid side of the insert (12) with the microporous membrane (24) closing the mouth of the cup-shaped member; the capillary port (28) being formed in a wall of the cup-shaped member.
- 15 16. A closure as claimed in any of claims 4 to 15, characterised in that the venting member (12) is designed to replace or by-pass a sealing member, forming a fluid-tight seal between the closure (10) and the container (48), and form a liquid-tight, gas-venting seal between the closure and the container.
- 20 17. A venting member for a venting closure as claimed in any of claims 4 to 16.

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