(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 172 711**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 85305641.4

(22) Date of filing: 08.08.85

(51) Int. Cl.⁴: B 65 D 35/50
B 65 D 47/14

(30) Priority: 16.08.84 AU 6615/84

(43) Date of publication of application:
26.02.86 Bulletin 86/9

(84) Designated Contracting States:
BE DE FR GB IT NL

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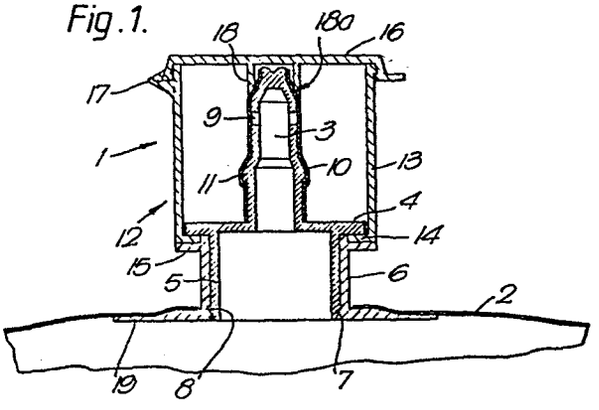
(54) Packaging.

(57) A collapsible container for medicaments or other liquids which must be preserved from contamination has a valve assembly which comprises a hollow projection 3 which is closed at its outer end and which has one or more apertures 9 in the wall through which the contents of the container are dispensed. The projection 3 is surrounded by a resiliently stretchable sleeve 10 which stretches to allow liquid dispensed through the apertures 9 to pass but which after dispensing seals the outlet of the apertures 9 to minimise the ingress of contaminants.

Fig.1.



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Packaging

This invention relates to the packaging of liquids in a way in which the sterility of the liquid in the package can be maintained for an extended period of time. One example of the utility of such packaging is the storage and dispensing of liquid medicaments especially the so-called multidose package in which several doses of medicament are dispensed successively over a period of time. It is essential that the sterility of the liquid medicament is maintained during the dispensing period and, in the past, it has been necessary to incorporate preservatives into the liquid medicament in order to achieve this. The incorporation of preservatives renders the formulation of the liquid medicament more difficult and may lead to unwanted side-effects in the user of the liquid medicament. The present invention aims to provide improved packaging for liquid medicaments and other liquids which are required to be protected from contamination. Further examples of such liquids include the sterile solutions, for example, saline solutions used for the storing and cleaning of contact lenses, and potable liquids such as milk and wine. In the latter case, the contamination to be minimised includes ingress of oxygen into contact with the wine.

The present invention provides a collapsible container for holding a liquid required to be protected from contamination, which container collapses as the liquid contained therein is dispensed, and is provided with a valve assembly which permits the egress of liquid from the container but which substantially prevents the ingress of contaminants into the container, said valve assembly comprising (a) a hollow projection extending outwardly from the container, in which the interior of the projection is in communication with the interior of the container and the outer end of the projection is closed, said projection being provided adjacent its outer end with one or more radially extending apertures which allow liquid to pass from the interior of the projection to the outside and (b) a resiliently stretchable closure element retained on the projection so as to cover the outermost end of said one or more apertures and be in sealing contact with the outer surface of the projection about said one or more apertures, which contact may be at least partly broken by compressing the container to expel liquid between the closure element and the projection.

The resilient closure element is preferably a sleeve, for example of latex or silicone rubber, surrounding the projection, whereby liquid expelled from the container through the one ore more apertures flows between the projection and sleeve to the outer end of the projection. Advantageously the sleeve is fitted onto the projection so that its outer end is flush with the end of the projection. Means are preferably provided at the outer end of the projection to reduce droplet retention. Said means are advantageously provided by a concave surface to the outer end of the projection and a sharp edge formed around the periphery of the outer end of the

projection. The projection may be circular, or may be configured to provide a generally flat or slightly convex face about the outermost end of the or each radially extending aperture.

Preferably the cover is provided with a sealing member which is movable from a first position in which it contacts the closure element to prevent egress of liquid and a second position in which the sealing member is spaced from the closure element. Conveniently, the sealing member is a finger which in the first position applies pressure to that portion of the sleeve overlying the outermost end of the one or more apertures.

The valve assembly may be provided with a cover to enclose it when not in use. The container may comprise a pouch formed from sheet plastics materials or from "lay-flat" tubing and the valve assembly may be affixed at one end or on one face of the pouch. The pouch may be enclosed in an outer container which is also adapted to collapse as the contents of the pouch are expelled or the pouch may be affixed to a foldable support in such a way that as the support is folded the pouch is compressed between the folded parts of the support. The container may be manufactured by blow moulding in any convenient collapsible form for example in a concertina-like form or a bellows-like form.

The invention also provides a collapsible container for holding a liquid medicament or other liquid which is required to be sterile, in which the container collapses as the liquid contained therein is dispensed, and in which is provided with a valve assembly which permits the egress of liquid from the container but which prevents the ingress of air into the container, said valve assembly comprising (a) a

hollow projection extending outwardly from the container, in which the interior of the projection is in communication with the interior of the container and the outer end of the projection is closed, said projection being provided adjacent its outer end with one or more radially extending apertures which allow liquid to pass from the interior of the projection to the outside and (b) a resilient sleeve surrounding the projection and in sealing contact with the outer surface of the projection along at least that part of its length adjacent to the outermost end of the one or more radially-extending apertures.

The invention will now be illustrated by the following description of several embodiments thereof. The description is given by way of example only and has reference to the accompanying drawings in which:-

Figure 1 is a cross-sectional view of a valve assembly,

Figure 2 is a cross-section view of a dispensing container embodying the present invention,

Figure 3 is a perspective view of the container of Figure 2,

Figure 4 is a perspective view of the container of Figure 3 when in use,

Figure 5 is an exploded view of an alternate embodiment of the invention,

Figure 6 is a perspective view of a further embodiment in which the container is of concertina-like form,

Figures 7 and 8 are perspective views of another embodiment in which the container is of bellows-like form, and

Figures 9, 10 and 11 are cross-sectional views of further embodiments of the invention.

In Figure 1 is shown a valve assembly 1 connected to a flexible container 2. The valve assembly 1 comprises a projection 3 extending from an annular flange 4 and an annular wall 5 extending from the face of the flange 4 opposite the projection. The wall 5 is a liquid tight fit in the neck 6 of the container and is retained therein by cooperation between an annular tapered enlargement 7 around the outer surface of the wall 5 and an annular matching rebate 8 around the inside surface of the neck 6. The lower surface of the annular flange 4 abuts the outer end of the neck 6.

Projection 3 is hollow and is closed at its outer end. The interior space of the projection 3 communicates with the interior of the container. Radially extending apertures 9 in the wall of the projection allow liquid to pass through from the interior space. The projection 3 may be of circular cross-section but preferably the apertures 9 open into faces of the projection 3 which are generally flat or are slightly convex. A resilient sleeve 10, for example of latex or a silicone rubber which preferably has a hydrophobic surface, surrounds the projection 3 and extends along its full length. The sleeve 10 is preferably fitted onto the projection 3 so that its outer end is flush with the outer end of the projection 3. The outer end of the projection 3 is advantageously concave and the periphery of the outer end is preferably formed with a sharp edge. The projection 3 is provided with an annular raised portion 11 which

helps to retain the sleeve 10 in place on the projection 3. Advantageously the sleeve may be held in position by an annular retainer, which may be an integrally-formed annular bead (not shown in Figure 1), which is positioned between the raised portion 11 and the flange 4 or the sleeve may be sealed to the projection 3 adjacent the flange 4.

Sleeve 10 is in a stretched condition and is sufficiently stretchable that when pressure is applied to the container the liquid contained therein is forced through the apertures 9 and then between the outer surface of the projection and the sleeve which resiliently stretches to allow passage of the liquid. To cause the liquid dispensed to flow to the dispensing outlet of the valve assembly the projection 3 may be tapered along its length or the sleeve 10 in its unstretched condition may be of larger diameter at the end which, in use, overlies the outer portion of the projection 3. When the pressure on the container is released the flow of liquid stops and the resilient sleeve reverts to its original shape and blocks the apertures 9. As the sleeve 10 is a tight fit on the projection it prevents the ingress of air and potential contaminants from the atmosphere.

To minimise the risk of contamination further, the projection is surrounded by a cover 12 which comprises an annular side wall 13 and an inwardly directed annular flange 14 around the base of the annular side wall. The inwardly directed annular flange 14 is located in place between the lower face of the annular flange 4 and an outwardly directed annular flange 15 around neck 6 adjacent the outer end of the neck. The outer end of the cover 12 is closed by a closure 16 which is hingedly connected to the side wall 13 by an integrally moulded hinge 17. The inner surface of the

closure 16 has a central annular sealing member 18 which contacts the outer end of the projection 3 when in its closed position as shown in Figure 1. The outer end of the projection includes a frustoconical surface 18a underlying the sleeve 10. When the cover is in place on the container as shown in Figure 1, the sealing member 18 engages the sleeve at this point to provide a secondary seal.

The inner surface of the closure 16 within sealing member 18 may be provided with means such as an absorbent pad perhaps impregnated with preservative to reduce droplet formation and local contamination between dispensings.

The projection 3, flange 4 and wall 5 may be integrally moulded, for example, by injection moulding, from any suitable synthetic plastics material. The neck 6 may be formed integrally with the container 2 where the container is formed for example by blow moulding or the neck 6 may be formed separately from the container and affixed to the container for example by means of a flange 19 which may be sealed to the container by, for example, welding or adhesive. The cover 12 may also be formed from a moulded synthetic plastics material. The sleeve 10 may be formed from a natural or synthetic rubber e.g. latex or silicone rubber or from a suitably resilient synthetic plastics material. The container and its contents may be sterilised for example by gamma radiation after filling.

The container 2 may take any convenient form provided that it can be compressed to expel the contents. Preferably, the container should be totally collapsible so that all of the contents can be expelled. In its simplest form the container

may comprise a flexible pouch formed from two sheets of synthetic plastics material sealed together for example by welding around their edges or from the so-called "lay-flat" tubing. The valve assembly may be affixed to one end of such a pouch or the valve assembly may be affixed to one face of the pouch. The pouch may be contained in an outer container. An example of a container of this type is shown diagrammatically in Figures 2 to 4. In these Figures a flexible pouch 20 formed from two sheets of plastics material 21, 22 sealed together by a weld 23 is enclosed in an outer container 24 which may conveniently be manufactured from cardboard. The valve assembly 25 which is affixed to one face of the pouch 20 extends outwardly through an aperture in the wall of the outer container. The end walls of the outer container are fluted and cut as shown in Figure 3 to allow the outer container to collapse to compress the pouch to expel the liquid contained therein when the outer container is folded as shown in Figure 4.

In Figure 5 there is illustrated an alternative dispensing container in which a pouch 30 containing the liquid to be dispensed is affixed to a foldable support 31 having an aperture 32 through which the valve assembly 33 extends. The pouch 30 may be affixed to the support 31 by for example adhesive or double side adhesive tape. The support may be formed from cardboard having a central crease 34 or from moulded synthetic plastics material with a central hinge section 34 of reduced thickness. One end of the support 31 is provided with an apertured flange 35 by means of which the support 31 may be suspended. Prior to use the support 31 with its affixed pouch may be suspended by the flange 35 in its unfolded state as shown in Figure 5. This provides a convenient display feature for the package in the retail outlets where it

is to be sold. In use the liquid in the pouch 30 is expelled by folding the two parts of the support together to compress the pouch between them. The folded package may be suspended from the flange 35 or may be used on a table by placing the folded package on the table with half of the support which contains the aperture 34 on the table top and the valve assembly 33 extending downwards adjacent the edge of the table. Downwards pressure on the other part of the support will cause the liquid to be expelled.

The container may be initially of a more rigid form and so not require the outer container or support described hereinbefore. Such containers must still be capable of collapsing in use to expel their liquid contents. However the actual shape of these rigid but collapsible containers may be of any shape which suits the use to which the liquid is to be put or which provides an attractive package to attract potential customers to the package. Suitable containers may be manufactured by known techniques for example by blow moulding in a variety of shapes. Figure 6 shows a concertina-like arrangement in which a valve assembly 40 as hereinbefore described is affixed to an extension 41 of the base of a concertina-like container 42. Figures 7 and 8 show a bellows-like container 43 having a valve assembly 44 affixed to the neck. The container comprises two generally flat substantially triangular faces 45a and 45b. The sides of the container have fold lines 46, 47 and 48 as shown in Figure 8 to allow the sides to fold inward as the two faces 45a and 45b are moved together. The base of the container is also provided with a central fold line (not shown) to facilitate the collapse of the container. The liquid contents are expelled by pushing the two flat faces 45a and 45b towards one another to compress the container.

In alternative embodiments shown in Figures 9 to 11 the projection 3 has a single aperture 9 and the closure 16 is adapted, in its closed position, to apply lateral pressure to the sleeve at the point where it overlies the aperture 9 to form an effective seal before the first use and between subsequent uses. In Figure 9 the sleeve 10 is located in place by an annular retainer 50 which may be integrally formed with the sleeve 10. A cover 12 having an annular wall 13 which surrounds the projection 3 also has a closure 16 hingedly connected to the annular wall by an integrally moulded hinge 17 which includes an integrally moulded spring portion 51 of a type which is well known in the art to urge the cover into either the closed position shown in solid lines or the open position shown by the chain dotted lines. The underside of the closure 16 is provided with a downwardly depending finger member 52 which in the closed position is urged into contact with that portion of the sleeve 10 overlying the outlet of the aperture 9. The contacting surface of the finger 52 and the surface for the projection 3 containing the outlet of the aperture 9 are formed with complementary profiles so that in the closed position the finger applies lateral pressure to the sleeve to seal the outlet of the aperture 9 to prevent egress of liquid before first use and between subsequent uses. In Figure 10 a cover 12 is shown which is similar to that shown in Figure 9 except that the hinged cover 16 only extends over a part of the outer end wall 53 of the cover 12. Other components shown in Figure 10 have the reference numerals which are used for the corresponding components in Figure 9. In Figure 11 a cover 12 is shown in which the end wall 53 of the cover carries a slidable closure 54 which is movable from a sealing position (shown in solid lines) in which a downwardly depending finger 52 is in contact with the portion of

the sleeve 10 overlying the outlet of the aperture 9 and a dispensing position (shown in chain dotted lines) in which the finger 52 is located adjacent the annular wall 13 of the cover 12.

Claims

1) A collapsible container for holding a liquid required to be protected from contamination, which container collapses as the liquid contained therein is dispensed, and is provided with a valve assembly which permits the egress of liquid from the container but which substantially prevents the ingress of contaminants into the container, said valve assembly comprising (a) a hollow projection extending outwardly from the container, in which the interior of the projection is in communication with the interior of the container and the outer end of the projection is closed, said projection being provided adjacent its outer end with one or more radially extending apertures which allow liquid to pass from the interior of the projection to the outside and (b) a resiliently stretchable closure element retained on the projection so as to cover the outermost end of said one or more apertures and be in sealing contact with the outer surface of the projection about said one or more apertures, which contact may be at least partly broken by compressing the container to expel liquid between the closure element and the projection.

2) A collapsible container as claimed in claim 1 in which the resilient closure element is a sleeve, surrounding the projection, whereby liquid expelled from the container through the one ore more apertures flows between the projection and sleeve to the outer end of the projection.

3) A collapsible container as claimed in claim 2 in which the sleeve is formed from latex or silicone rubber.

4) A collapsible container as claimed in claim 2 or claim 3 in which the sleeve is fitted onto the projection so that its outer end is flush with the end of the projection.

5) A collapsible container as claimed in any one of the preceding claims in which means to reduce droplet retention are provided at the outer end of the projection.

6) A collapsible container as claimed in claim 3 in which the means to reduce droplet retention are provided by a concave surface to the outer end of the projection and a sharp edge formed around the periphery of the outer end.

7) A collapsible container as claimed in any one of the preceding claims in which the cross-section of the projection is such that a generally flat or slightly convex surface is provided about the outer end of the or each radially extending aperture.

8) A collapsible container as claimed in any one of the preceding claims in which the valve assembly is provided with a cover to enclose it when not in use.

9) A collapsible container as claimed in claim 8 in which the cover is provided with a sealing member which is movable from a first position in which it contacts the closure element to prevent egress of liquid and a second position in which the sealing member is spaced from the closure element.

10) A collapsible container as claimed in claim 8 in which the sealing member is a finger which in the first position applies pressure to that portion of the sleeve

overlying the outermost end of the one or more apertures.

11) A collapsible container for holding a liquid medicament or other liquid which is required to be sterile, in which the container collapses as the liquid contained therein is dispensed, and in which is provided with a valve assembly which permits the egress of liquid from the container but which prevents the ingress of air into the container, said valve assembly comprising (a) a hollow projection extending outwardly from the container, in which the interior of the projection is in communication with the interior of the container and the outer end of the projection is closed, said projection being provided adjacent its outer end with one or more radially extending apertures which allow liquid to pass from the interior of the projection to the outside and (b) a resilient sleeve surrounding the projection and in sealing contact with the outer surface of the projection along at least that part of its length adjacent to the outermost end of the one or more radially-extending apertures.

Fig.1.

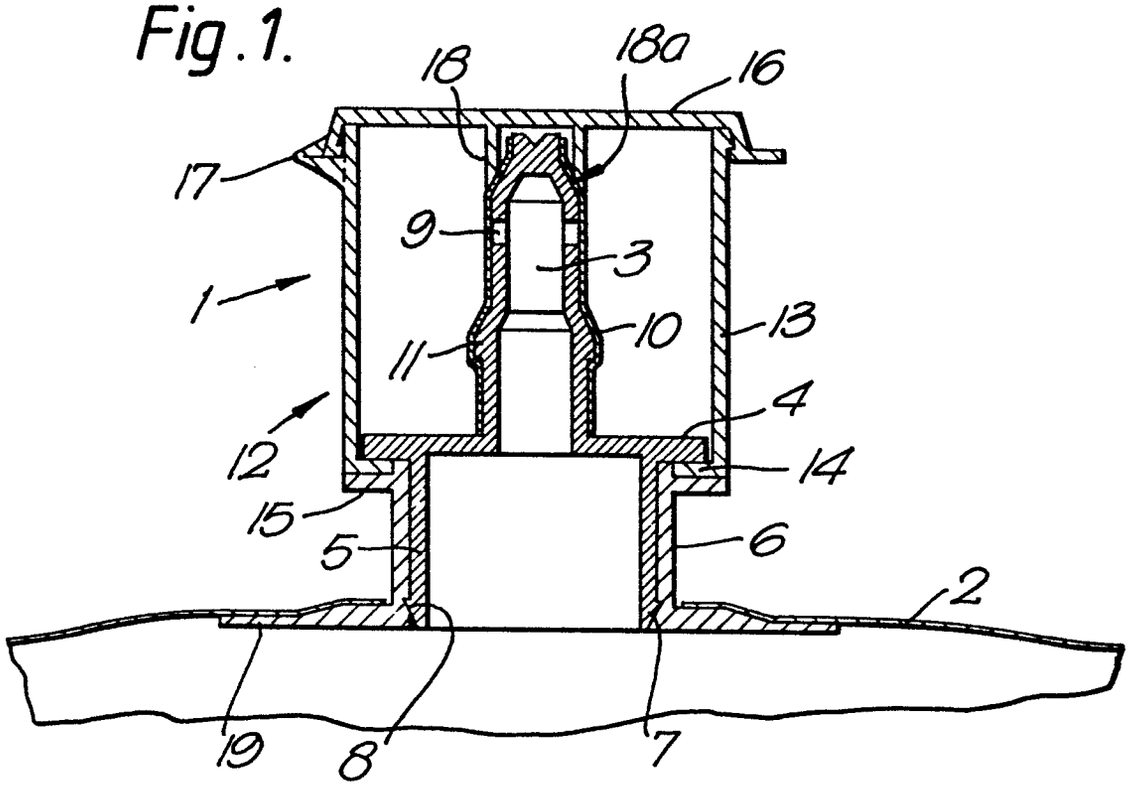

Fig.2.

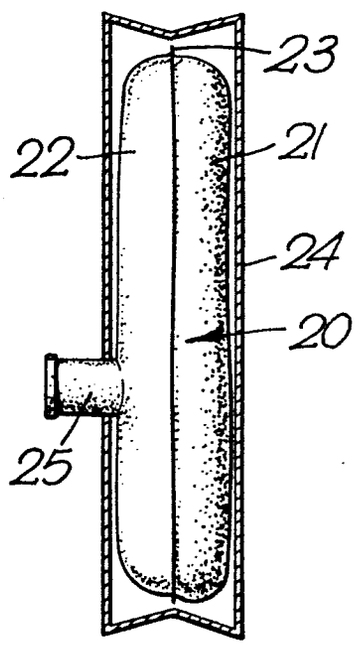

Fig.3.

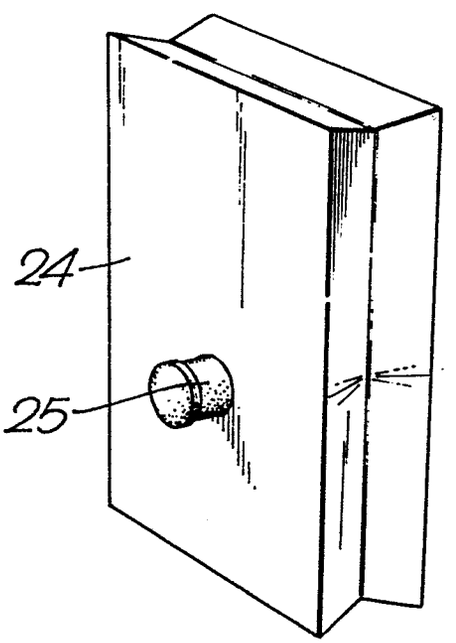

Fig.4.

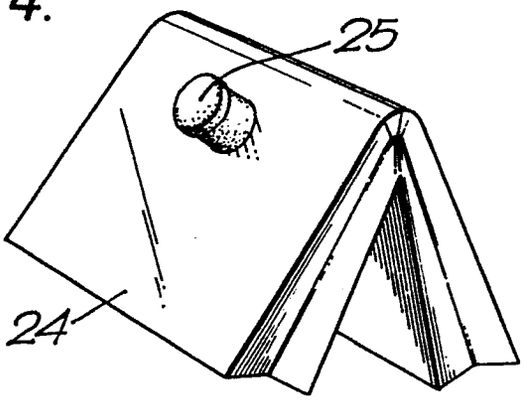

Fig.5.

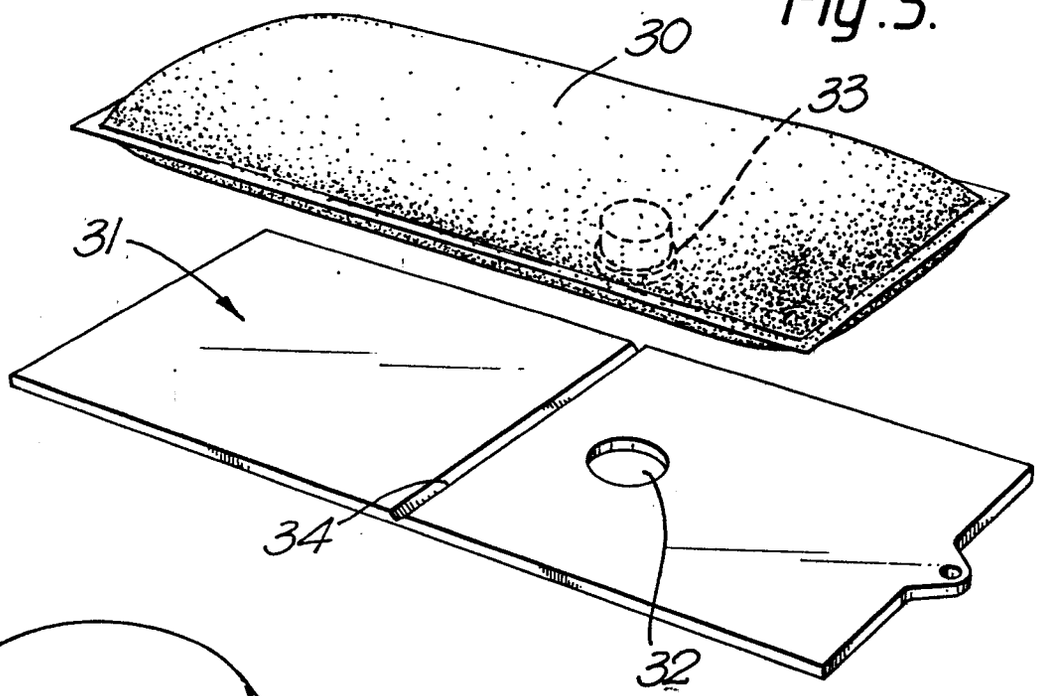

Fig.6.

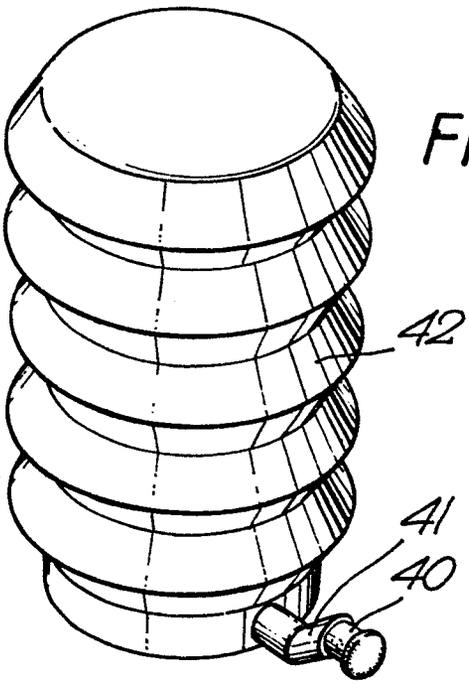

Fig.7.

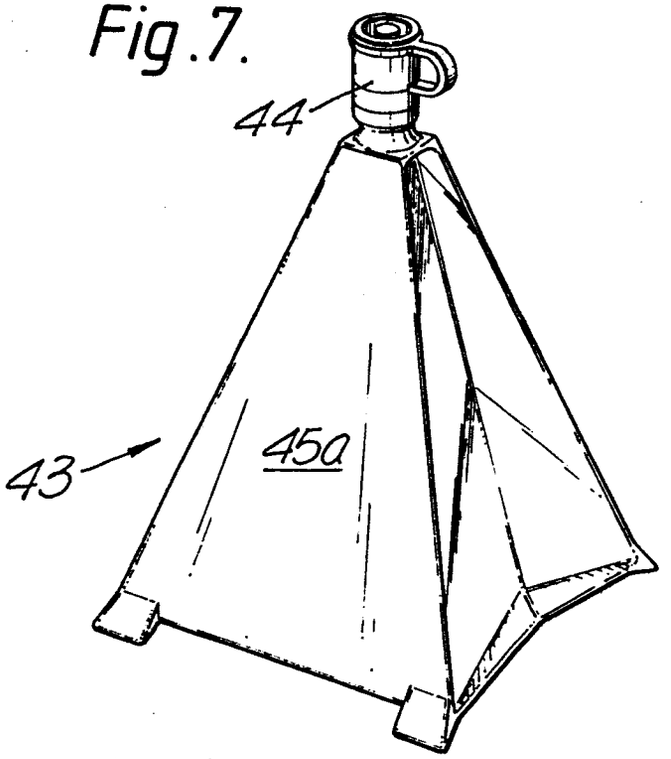

Fig.8.

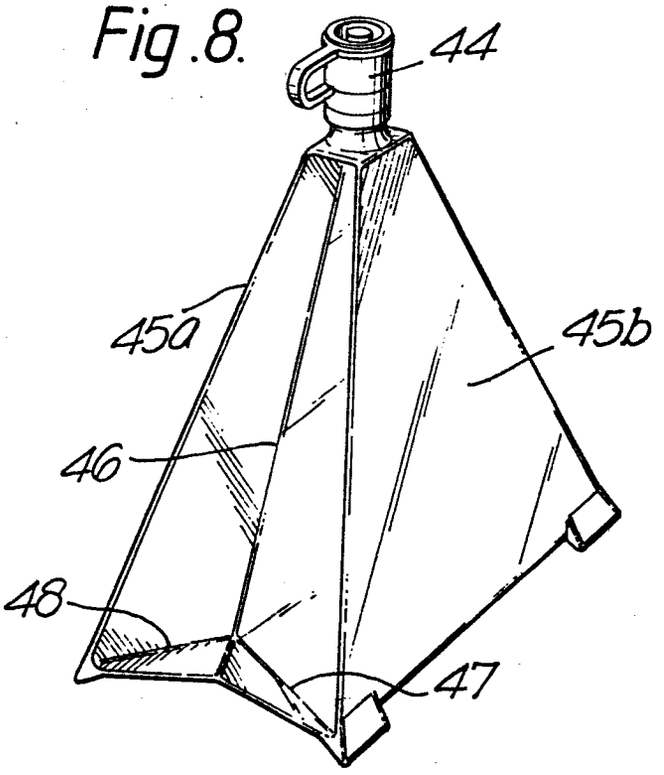

Fig.9.

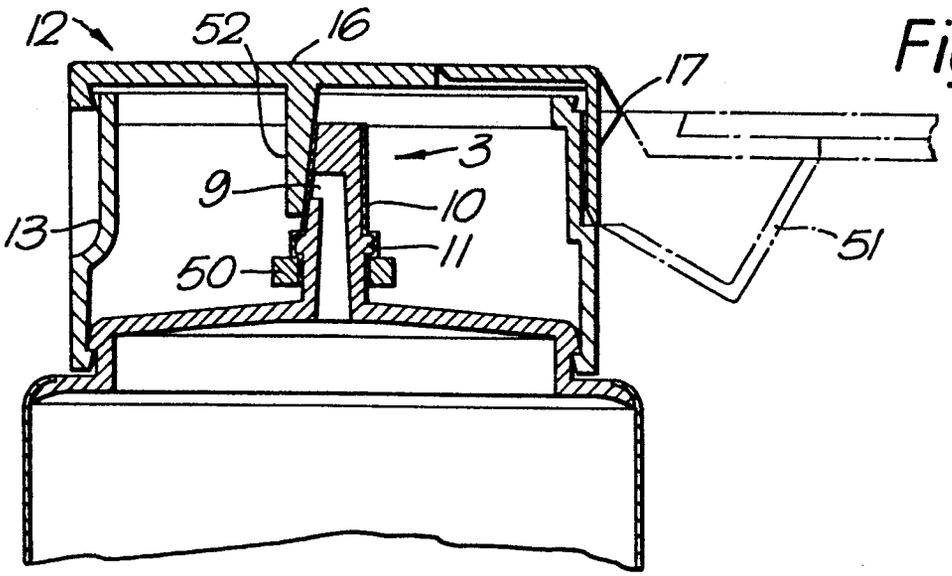

Fig.10.

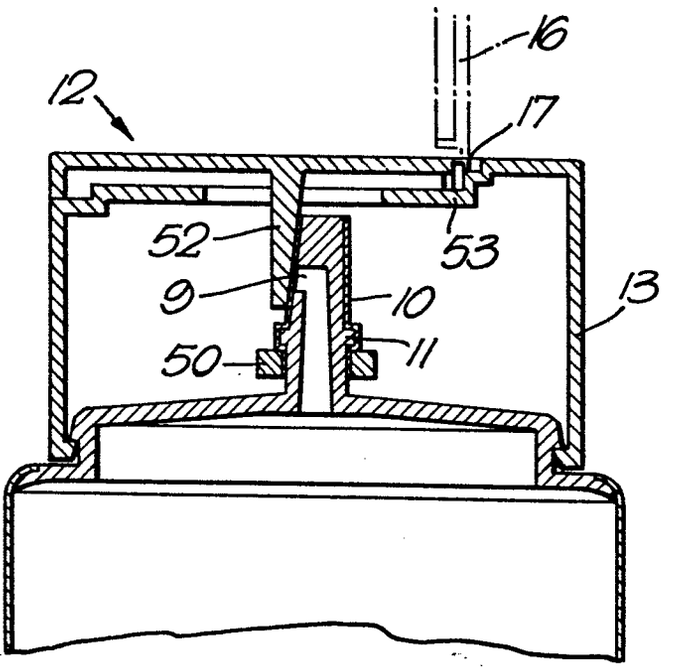

Fig.11.