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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) **International Patent Classification** 5 : A47G 21/18 — A2

(11) **International Publication Number:** **WO 94/20003**

(43) **International Publication Date:** 15 September 1994 (15.09.94)

(21) **International Application Number:** PCT/GB94/00392

(22) **International Filing Date:** 28 February 1994 (28.02.94)

(30) **Priority Data:**

9304280.2	3 March 1993 (03.03.93)	GB
9317422.5	21 August 1993 (21.08.93)	GB

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(81) **Designated States:** AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

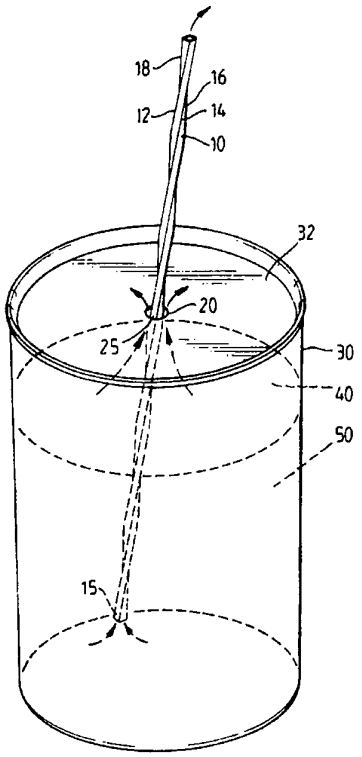
Published

Without international search report and to be republished upon receipt of that report.

(54) **Title:** DRINKING TUBE & CONTAINER END

(57) **Abstract**

A drinking tube having either a polygonal cross section of constant transverse cross-sectional area, or having an enlarged portion which generally has a part of constantly varying transverse cross-sectional area. In this way, when the drinking tube is inserted into a beverage container, a gap is always formed around the outside of the tube which allows the container to vent. A suitable container may typically include a metal container end having a separate panel which is fixed to a central member, the panel being rupturable by a drinking tube. In use, when attached to the container may be consumed in a hygienic manner, without risk of contamination of the beverage by any part of the panel which is pushed into the container on rupturing.



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DRINKING TUBE & CONTAINER END

This invention relates to a drinking tube and container end. In particular, it relates to a drinking tube such as a straw in combination and for use with a container end having a portion through which the straw may be inserted in order to gain access to a beverage within a container to which the end is fixed.

Conventional drinking tubes or straws comprise a cylinder of thin-walled polypropylene or similar non-toxic plastics material. Typical containers with which straws are used are cardboard cartons or plastic cups, having a scored or weakened portion through which the straw is inserted.

With regard to metal beverage containers, container ends of the type known as "easy-open ends" are well-known. Such ends have a tab which is used either to pull off an operable panel, leaving an aperture through which drink can be dispensed (the "pull-off tab" type) or a tab which acts as a lever, pressing on a panel which is thereby partially severed from the rest of the end (the "ecology end"). Generally, ecology ends have replaced pull-off tabs since the tab and operable panel of the ecology end remain attached to the rest of the container and are not simply discarded after opening and are therefore more environmentally friendly.

Such ecology ends, however, suffer from the disadvantage that the panel, once opened, depends from the end into the beverage within the container. There is therefore the risk that contamination of the beverage may arise. Clearly such a problem does not arise with the pull-off tab, but this is regarded as environmentally unfriendly. There is therefore a need for an environmentally friendly container end which does not risk contamination of the beverage within the container with which it is used.

A further problem of lack of hygiene may arise when a user drinks directly from the container aperture, ie. with

his or her mouth in contact with the container end. Whilst the beverage could be poured into a glass, for example, this option is not always available.

Yet another problem which is more apparent with other types of beverage containers, is that it must be possible to tell immediately if the beverage has been tampered with in any way. This problem has been addressed in particular for screw top containers.

According to the present invention, there is provided a drinking tube comprising a non-toxic plastics tube having a constant transverse cross-sectional area comprising a polygon and in which polygons formed by the transverse cross-sections at at least two positions spaced along the tube are rotated relative to each other.

Alternatively, the tube may comprise a drinking tube comprising a non-toxic plastics tube having an enlarged portion, the transverse cross-sectional area of which constantly varies along the length of the enlarged portion and a cylindrical portion of constant transverse cross-sectional area, the maximum transverse cross-sectional area of the enlarged portion being greater than the transverse cross-sectional area of the cylindrical portion.

A particular problem with insertion of a drinking tube into a container is the risk of beverage spurting out of the drinking tube as it is inserted into the container. If the container is flexible, for example of the cardboard type, then pressure on the side walls of the container wall exacerbates the problem. Even if the side walls are rigid, the problem manifests itself, particularly if the tube is inserted quickly through the headspace and into the beverage. This is particularly the case if the beverage is carbonated.

Since the aperture formed by the drinking tube or straw is of larger cross-sectional area than that of the proximal portion of the straw once the distal portion has been inserted, gas from the headspace above the beverage is able to escape from the container around the outside of the straw.

Even if the straw has quickly entered the beverage, gas is still free to pass around the outside of the straw. If the container is of flexible material and the container is squeezed, gas in the head space above the beverage will be able to pass out of the container around the side of the drinking tube, whereas beverage will simply rise up within the container, reducing the head space.

Where the drinking tube has a constant transverse cross-sectional area comprising a polygon, the tube is preferably twisted along its length so that the polygon rotates. For example, the tube may have a square cross-section of constant area, but which is rotated so as to give helical edges along the length of the tube. In this way, as the square rotates, a round hole is cut in a container end with a diameter corresponding to the diagonal of the square. Thus there is always an escape route for gas in the container once the tube has entered the container by a distance which gives a quarter turn of the square. All kinds of polygonal shapes which leave a gap once the drinking tube has entered the container by one pitch are possible, including indented shapes such as a star-shape, for example.

Alternatively, where the drinking tube has an enlarged portion, one example of this embodiment may be a "pen nib" end or a tapered part of the distal portion which increases gradually in cross-section and then reduces slightly again to a smaller but constant cross-sectional area for the remaining portion of the

tube. Clearly other embodiments are also possible and the enlarged part need not be at the extremity of the distal portion providing it enters the container prior to consumption of beverage within.

According to another aspect of the present invention, there is provided, in combination, a drinking tube as described above which has a constant cross-section and a metal can end for a metal beverage container, the end having a weakened portion through which the tube is insertable to form a hole, the hole thus formed having a larger cross-sectional area than that of the transverse section of that part of the tube which, when the tube is used to extract beverage from the container, is within the hole, whereby a gap is provided between the tube and the end to allow venting from one side of the end to the other.

Alternatively, the combination may comprise a non-toxic plastics tube having an enlarged portion, and a metal can end for a beverage container, the end having a weakened portion through which the tube is insertable to form a hole, the hole thus formed having a larger cross-sectional areas than that of the transverse section of that part of the tube which, when used to extract beverage from the container, is within the hole, whereby a gap is provided between the tube and the end to allow venting from one side of the end to the other.

Preferably, the end comprises a central member formed with a dispensing aperture and means for attaching the end to the container; and a separate rupturable panel closing the dispensing aperture.

According to yet another aspect of the invention, there is provided a metal can end comprising a central member formed with a dispensing aperture and means for attaching the end to the container, and a separate

rupturable panel closing the dispensing aperture; in which the dispensing aperture has an area no more than 10% of the surface area of the end.

The panel may typically overlie one side of the central member. Preferably, the panel is attached to one side of the central member, which may be, in use, the inside of the container.

The central member may be made of different material from the panel. It is important that the container end and rupturable panel be strong enough to withstand any pressure which may be exerted by the beverage, in particular if the beverage is carbonated. On the other hand, the panel must not be so strong that it is only rupturable with difficulty. It is thus advantageous that the central member be of stronger material than that of the rupturable panel.

Preferably, the rupturable panel is of aluminium and the central member of aluminium alloy. The central member may be coated with a polymer on either or both sides, for example polypropylene and/or polyester. The panel may be heat sealed on one side to the central member, for example by a polypropylene layer.

Still more preferably, the rupturable panel and any part of the central member which, in use, may contact beverage, further comprise an additional outer layer which is compatible with the beverage which may contact it. Such a layer may be of lacquer, or a suitable plastics material.

Alternatively, the rupturable panel may be of another metal, such as steel, or be entirely of plastics material. Likewise, the central member may be of a steel alloy, or of a metal/polymer laminate as noted above, such as Alulite or Ferrolite (trade marks).

When the rupturable panel comprises a metal such as aluminium foil which is used as an oxygen barrier, the panel preferably further includes a polymer film which protects the edges of the metal so that no metal pick-up occurs in the beverage which might affect the taste of the beverage. The metal itself prevents the taste of the beverage from being adversely affected by oxygen passing into the beverage. Furthermore, the polymer can be used for bonding to the central member. Such adhesion need only be sufficient to maintain the rupturable panel in position since, where the internal pressure of the container is greater than atmospheric pressure, the pressure difference will help to force the panel against the central member.

Typical alternative rupturable panels may comprise (i) a polypropylene/aluminium foil/polypropylene laminate with the exposed polypropylene layer covering the edges of the foil; (ii) a polypropylene/aluminium foil/PET laminate with either polypropylene or PET bonded to the central member and the other polymer covering the foil edges or (iii) aluminium foil having contact adhesive on its exposed surface and a polymer such as polypropylene which is placed over the foil and bonded to it by means of the contact adhesive, the polymer being heat sealed to the central member and obscuring the exposed edges of the foil. All of these panels can be used in conjunction with a traditional lacquer-covered container end or with an end of metal/polymer laminate.

The rupturable panel may thus comprise a closure portion, exposed by the aperture, and an adhered portion, which fixes the rupturable panel to the central member. For a typical can end of between 200 and 206mm diameter, the aperture preferably comprises a circular hole of from 4 to 20mm diameter. Still more preferably, the diameter

is from 4 to 10mm. A rupturable panel may be used with any size of can end but the aperture may usually be no more than 10% of the size of the can end and the panel itself is most preferably in the form of a patch adhered to the central member. Smaller apertures are preferred for reasons of strength of the end and also only a small closure portion is then available for rupturing. If only a small area is ruptured there is less material depending from the end into the container.

Generally, the panel is of a material which may be adhered to the central member, which is compatible with the beverage within the container, and which will remain broken once ruptured. It is therefore advantageous to avoid such materials as elastomerics, which are not tamper-proof, in that it would be possible to inject substances through an elastomeric panel into beverage within the container, without such tampering being immediately evident. In particular, elastomeric materials would tend to "reseal" around a puncture hole formed by injecting through the material, making visual inspection for tampering ineffective.

Advantageously, the panel is rupturable by a drinking tube, such as a polypropylene straw. The straw may be packed in sterile condition, so that there is no risk of contamination of the beverage by the straw.

It is also preferred that the aperture be centrally located in the end, so that even a large area of closure portion, when ruptured, will not be able to contact any beverage. This would clearly be possible if the aperture were at the side of the end and the container were then tilted towards the aperture, as is normal in drinking. A centrally located aperture also limits the risk of beverage spurting out when the closure portion is ruptured, since the rupture always occurs into a headspace

above the beverage and depressurisation can occur before the drinking tube is pushed into the beverage itself.

The gauge of the rupturable panel is dependent on the aperture size and material used. The larger the aperture, the greater the thickness of material required to withstand any internal pressure from carbonated beverages within the container. Preferably, gauges will vary from 50um to 100um for an aluminium panel.

The a beverage container may usually comprise a metal body and a metal end, said end comprising a central member formed with a dispensing aperture and means for attaching the end to the container body, and a separate rupturable panel closing the dispensing aperture.

According to a still further aspect of the present invention, there is provided a method of making a drinking tube comprising: extruding a cylindrical tube of non-toxic plastics material, heating at least a central portion of the tube, bending the portion and cutting the portion at an angle along the inside of the bend so as to form a tube having a distal portion of varying transverse cross-sectional area.

Preferred embodiments of drinking tube and container end will now be described, by way of example only, with reference to the drawings, in which:

Figure 1 is perspective cross-section of a metal container and first embodiment of drinking tube;

Figure 2 is a side view of a second embodiment of drinking tube, during manufacture;

Figure 3 is a perspective view of a cardboard beverage carton with the second embodiment of drinking tube;

Figure 4 is an enlarged cross-section of the area IV on Figure 5;

Figure 5 is a cross-section of a container end having a rupturable panel;

Figure 6 is a cross-section of the container end of figure 4, with the panel ruptured by a drinking tube; and

Figure 7 is a vertical section of a container having the end of figures 4 and 6, ruptured by a drinking tube.

Figure 1 shows a metal can of the type described with reference to figures 4 to 7 below having a rupturable panel through which a straw is inserted.

A straw 10 has a square transverse cross-section of constant area which is twisted along its length. As the square rotates, therefore, it describes a circle. When the square straw is inserted into a container, the twist of the straw 10 causes the corners 12, 14, 16, 18 of the square to translate from their original positions to the original position of the adjacent corner 14, 16, 18, 12, ie by a pitch of a quarter turn, so that full circular hole 20 is obtained in the end 32 of the container 30 after an end or distal portion 15 of the straw 10 has been pushed into the container.

The end portion 15 has a pitch or length which corresponds to the quarter turn being made. This length clearly depends on the tightness of the helix formed by the twist in the straw. The constantly varying orientation of the straw results in a hole 20 which has a larger cross-sectional area than that of the straw once the end portion has entered the container.

This form of polygonal straw is readily formed by extrusion through a rotating die or by rotation of the tube as it passes through a square die.

The arrows in Figure 1 indicate the flow of gas 40 above beverage 50 and the flow of the beverage 50 when a user sucks on the straw. The single arrows show that the gas 40 is free to escape from the container around the

outside of the straw, through the gap 25 formed between the edge of hole 20 and the straw 10 within the hole. Beverage, on the other hand, passes into the end portion 15 of the straw and up the straw to the consumer, as indicated by the double arrows. It will be realised that other polygonal straw can be used to describe a circular hole, whilst still leaving a gap between the straw itself and the edge of the hole.

An alternative form of straw is shown in Figures 2 and 3. This straw has a variable cross-sectional area, formed as illustrated in Figure 2. A cylindrical tube 60 is extruded, heated and bent so that it kinks as indicated at 62 by plastic deformation. The bent tube 60 is then cropped along the inside of the bend 62 as indicated by the dotted lines. This form of straw is more difficult to manufacture than a twisted polygonal straw since it involves the use of additional cutters in order to crop the straw at an angle.

Bending of the tube in this manner leads to an enlarged portion at 64 as the tube undergoes plastic deformation. Cutting along the inside of the curve thus produces a tube 70 having an end or distal portion 75 with a variable cross-sectional area along the length of this end portion. The heating step may be omitted if the heat of extrusion is sufficient to allow bending as described.

In a similar manner to the embodiment of Figure 1, the straw 70 is inserted into a container and provides a hole 80 of larger cross-sectional area than the remaining or proximal portion 78 of the tube. Figure 3 shows a straw 70 inserted into a cardboard carton 90 by puncturing a weakened area in the end 92 of the carton. As the distal portion of the straw passes through the weakened area, the hole 80 increases in size until it reaches the size of the enlarged portion. Once this part of the end

has passed through the hole, the area of the tube decreases to the area of the remaining cylindrical portion 78 of the tube 70. Thus a gap is produced between the edge of the hole 80 and the outside of the remaining portion 78, through which gas 94 is free to escape to the atmosphere as indicated by the single arrows. In the same way as noted for the embodiment of Figure 1, beverage 98 can pass up the straw 70 to the drinker as indicated by the double arrows.

If the carton is simply squeezed, beverage will simply rise up within the container, reducing the head space, whereas gas in the headspace above the beverage will pass through the gap 85.

In figure 5, there is shown generally a container end 10 comprising an outer wall 120 and a central member 130. A central aperture 140 is closed by a panel 150 attached to the underside of central member 130 around the aperture 140 and forming a closure portion 60 which is exposed by the aperture 140.

An enlarged section of the aperture and panel is shown in figure 4. Central member 130 can be seen to comprise two layers 132, 134. Layer 132 comprises an aluminium alloy and layer 134 is a polypropylene layer. Optionally, the layer 132 may be coated on its upper side by a further layer, of polyester. The panel 150 is made of aluminium and is coated on its upper side by a bond layer 152 of polypropylene and heat sealed to the polypropylene layer of the central member. On the underside of end 110, the central member 130 and panel 150 may be lacquered, or coated with another material which is compatible with beverage which may contact them.

Aperture 140 exposes part of the panel 150, this part being closure portion 160 which is rupturable for access to the beverage beneath. Ideally, the aperture is a hole

of 7mm diameter, but may range from 4 to 20mm. The lower end of this range is determined by the need to be able to obtain sufficient quantity of beverage through the aperture when closure portion 160 is ruptured and the upper end of the range must be below that at which the closure portion may be ruptured and pushed outwards by the pressure exerted by carbonated beverage within the container.

Figure 6 shows the container end 110 with a polypropylene drinking tube or straw 170 (typically as described with reference to figures 1 to 3 above) inserted through the closure portion 160. Once ruptured, the closure portion 160 is pushed into the container and ruptured edges 165 depend from the end into the container. It can thus be seen that, if the aperture is kept as small as possible so that only a small diameter drinking tube may be used, then the edges 165 will only be located in the head space above the beverage.

This can be better seen from figure 7, which shows the container end 110 attached to a container 180, with beverage 190 within the container. From figure 7, it is apparent that the edges 165 only depend a very short way into the container thus avoiding contamination of the beverage.

In use, the straw 170 pierces the rupturable closure portion 160 and enters the headspace 195 above the beverage 190. This allows gas from carbonated beverage to escape through the straw 170 into the atmosphere outside the container 180. The straw is then pushed further into the container and beverage for drinking. It can be seen that, if the container is tilted for drinking when full, the edges 165 will usually not contact the beverage unless there is very little headspace, or the container is inverted.

The container end of the present invention thus provides an environmentally friendly closure, which avoids contamination or lack of hygiene in use.

It will be appreciated that different embodiments of straw and container end are possible within the scope of the invention and that the invention has been described above by way of example only.

CLAIMS

1. A drinking tube comprising a non-toxic plastics tube having a constant transverse cross-sectional area comprising a polygon and in which polygons formed by the transverse cross-sections at at least two positions spaced along the tube are rotated relative to each other.

2. A drinking tube comprising a non-toxic plastics tube having an enlarged portion, the transverse cross-sectional area of which constantly varies along the length of the enlarged portion and a cylindrical portion of constant transverse cross-sectional area, the maximum transverse cross-sectional area of the enlarged portion being greater than the transverse cross-sectional area of the cylindrical portion.

3. In combination, the drinking tube of claim 1 and a metal can end for a metal beverage container, the end having a weakened portion through which the tube is insertable to form a hole, the hole thus formed having a larger cross-sectional area than that of the transverse section of that part of the tube which, when the tube is used to extract beverage from the container, is within the hole, whereby a gap is provided between the tube and the end to allow venting from one side of the end to the other.

4. In combination a drinking tube comprising a non-toxic plastics tube having an enlarged portion and a metal can end for a beverage container, the end having a weakened portion through which the tube is insertable to form a hole, the hole thus formed having a larger cross-sectional areas than that of the transverse section of that part of the tube which, when used to extract beverage from the container, is within the hole, whereby a gap is provided between the tube and the end to allow venting from one side of the end to the other.

5. The combination of claim 3 or claim 4, in which the end comprises a central member formed with a dispensing aperture and means for attaching the end to the container; and a separate rupturable panel closing the dispensing aperture.

6. A metal can end for a metal beverage container comprising a central member formed with a dispensing aperture and means for attaching the end of the container; and a separate rupturable panel closing the dispensing aperture; in which the dispensing aperture has an area no more than 10% of the surface area of the end.

7. A can end as claimed in claim 5 or claim 6, in which the panel is heat sealed on one side to the central member.

8. A can end as claimed in any one of claims 5 to 7, in which the aperture is centrally located in the end.

9. A can end as claimed in any one of claims 5 to 8, in which the rupturable panel includes a metal foil layer.

10. A can end as claimed in claim 8, in which the rupturable panel further comprises a polymeric layer for covering at least that side of the foil which, in use, would be adjacent to the beverage within the container.

11. A method of making a drinking tube comprising extruding a cylindrical tube of non-toxic plastics material;

bending a central portion of the tube; and

cutting the portion at an angle along the inside of the bend so as to form a tube having a distal portion of varying transverse cross-sectional area.

12. A method according to claim 11, further comprising, prior to the bending step, heating at least a central portion of the tube.

Fig.1

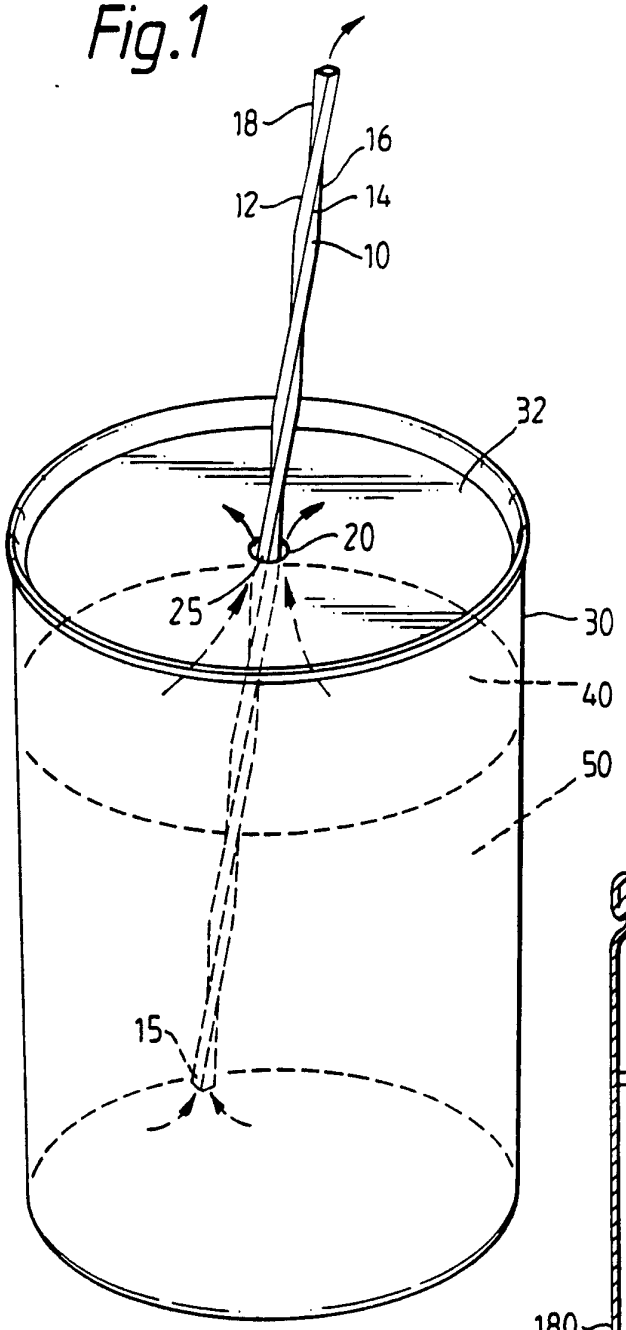


Fig.7

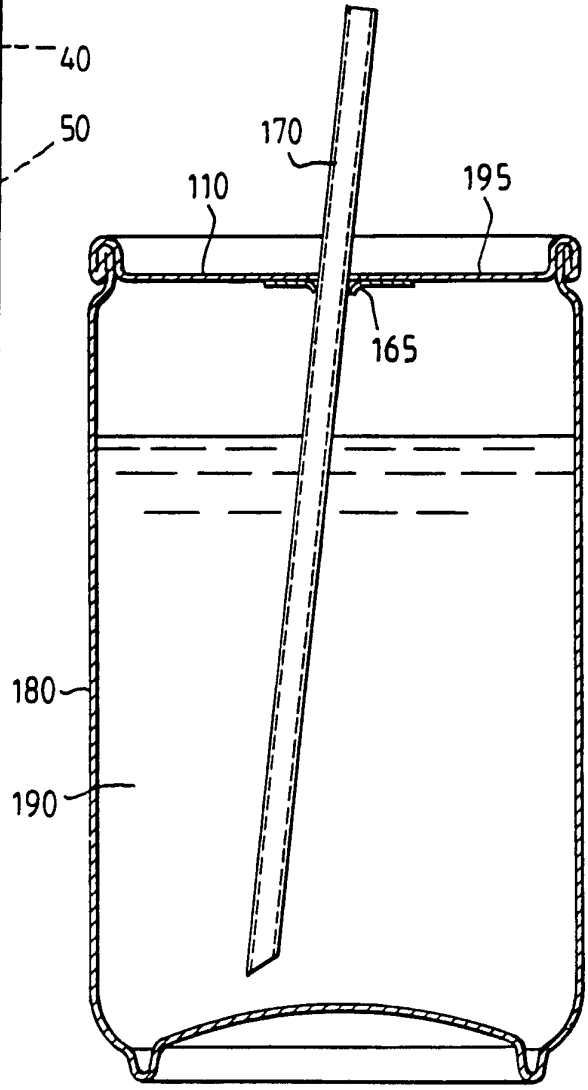


Fig.2

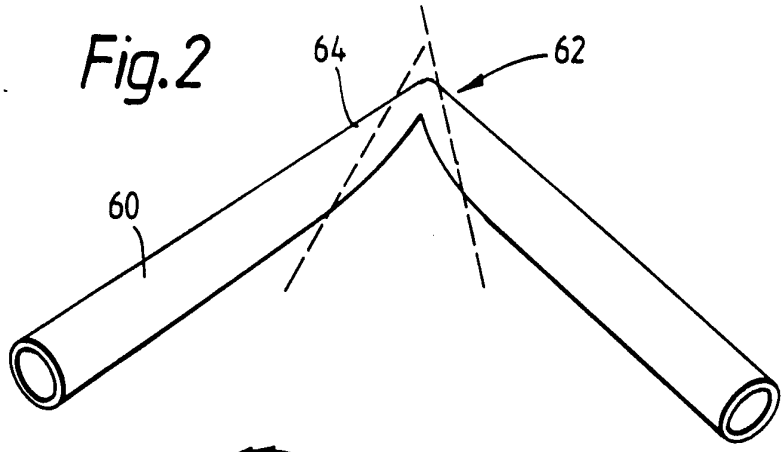
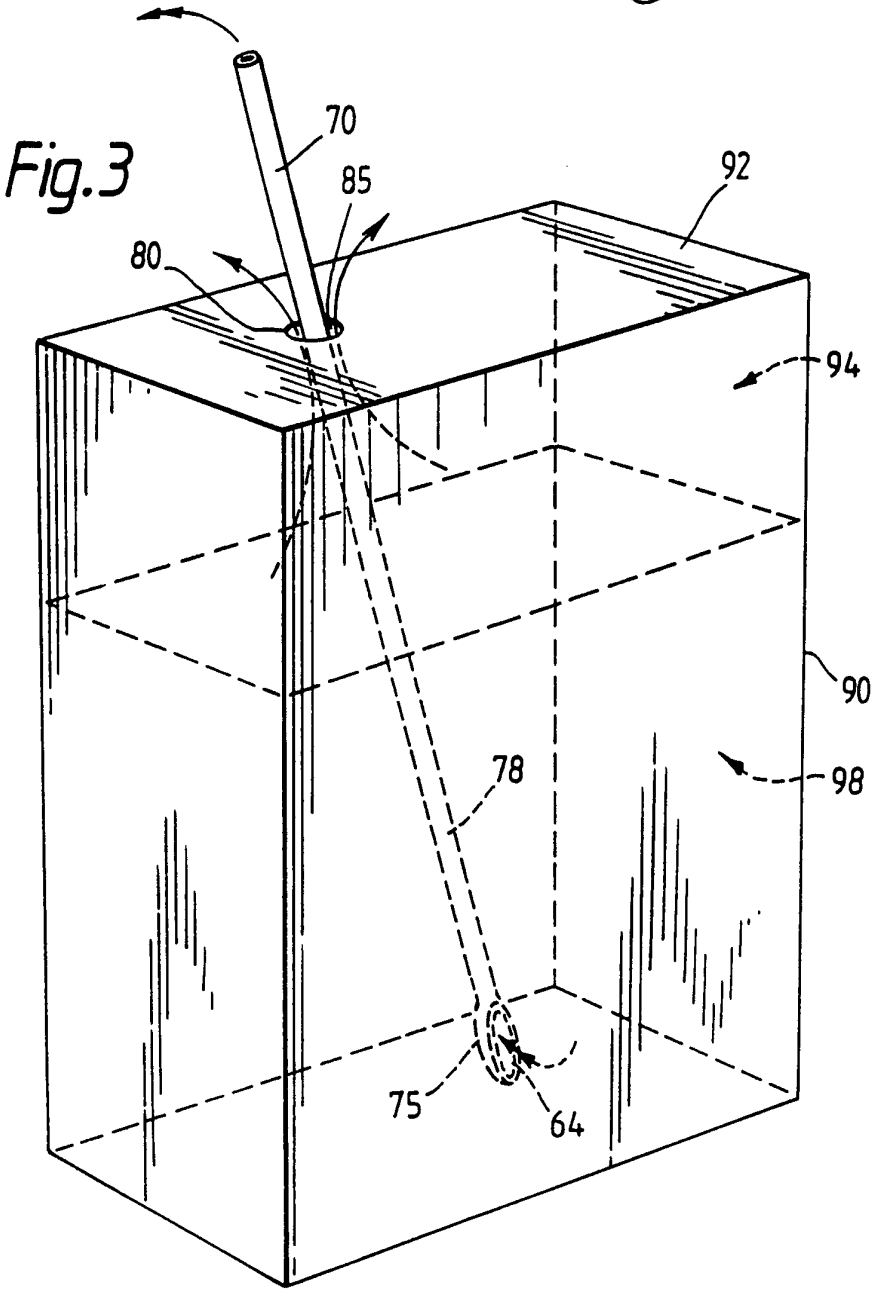


Fig.3



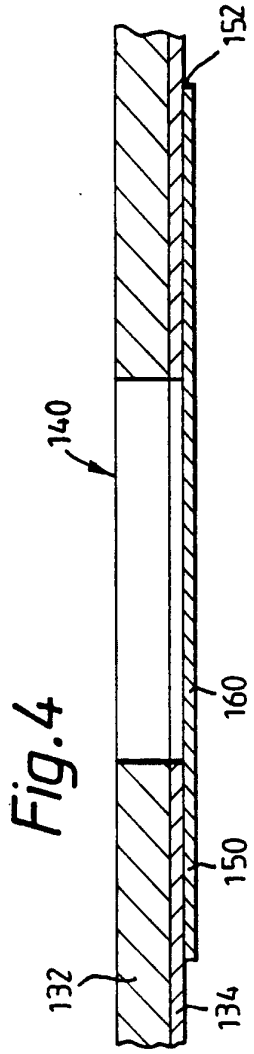


Fig.4

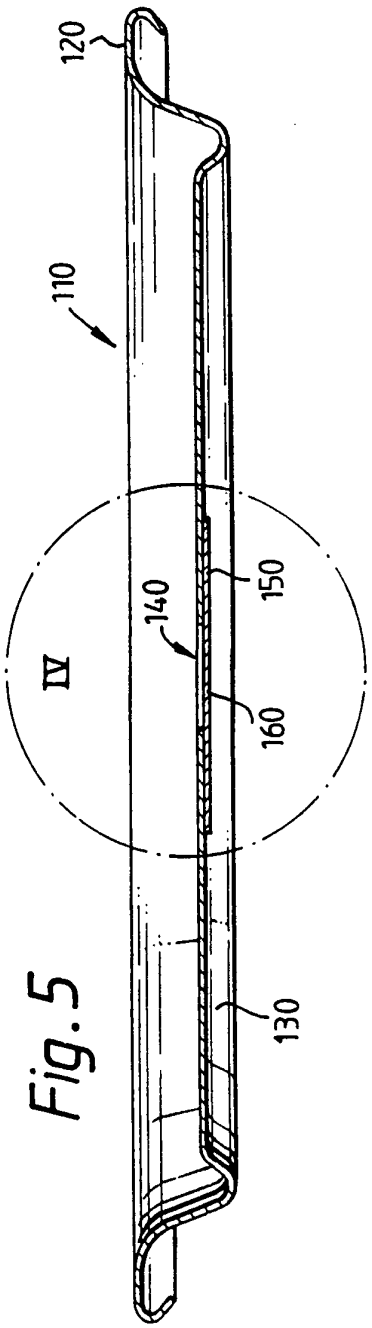


Fig.5

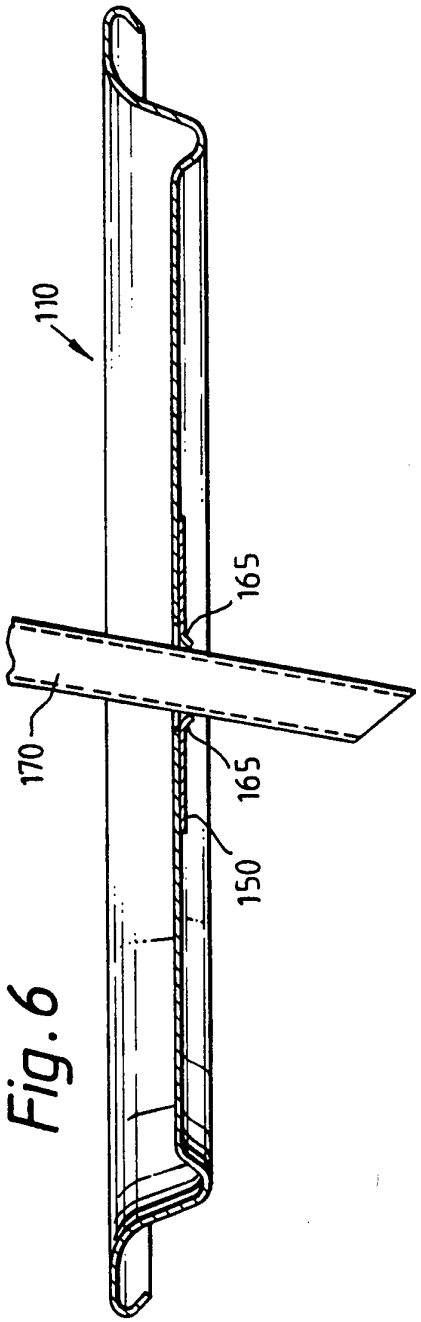


Fig.6