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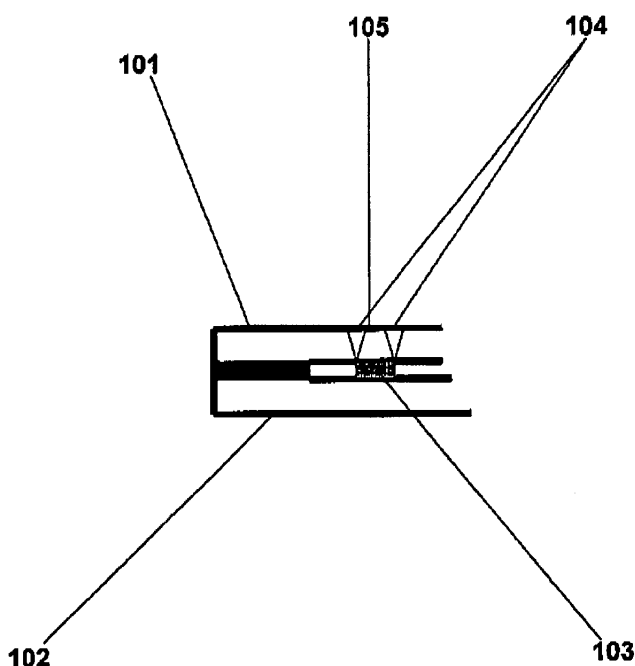
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(54) **Pressure tear valve**

(57) A pressure tear valve is provided comprising:
a) a first sheet (101)
b) a second sheet (102) in opposition to the first sheet (101);
c) a notch (104) in a face of the first sheet (101) facing away from the second sheet (102), the notch (104) defining a first portion of first sheet (101) adjacent a first side of the notch (104) and a second portion of first sheet (101) adjacent a second side of the notch (104); and

d) a weld (103) which welds the first portion only of the first sheet (101) to the second sheet (102) wherein the depth of the notch (104) is less than the thickness of the first sheet (101), and wherein the first sheet (101) and second sheet (102) comprise thermoplastic material.
The pressure tear valve can be conveniently incorporated into microwave bag packaging for a frozen food preparation to relieve steam overpressure, by rupture of the notch, which builds up when the frozen food preparation is reheated.

Fig.1



Description

[0001] This invention relates to an improved pressure tear valve and a method of manufacture therefor.

[0002] In EP 1 422 164 A1 (Volkmar Frenzel Eiscrem & Tiefkühlkost), a pressure tear valve is disclosed for use in microwaveable packaging for frozen meals. The valve is located in a sealing seam and comprises a partially unsealed and thereby weakened region of seam. On microwaving the meal, steam pressure ruptures the seal at the weakened region allowing controlled and safe venting of steam.

[0003] CA 2 470 054 A1 (Huhtamaki Ronsberg Zweigniederlassung der Huhtamaki Deutschland GmbH & Co.) discloses an alternative arrangement for weakening a particular region of a sealing seam through use of a seal with an apex projecting into the packaging which focuses the steam pressure stresses at that point thereby to bring about local separation of the sealing seam at that point.

[0004] GB 2 414 226 A (Dai Nippon Printing Co- Ltd.) discloses a further variant wherein a valve comprises an orifice produced, for example, as a punched hole or laser cut, surrounded by a sealed perimeter. As the sealed perimeter is of narrower width than the sealing seams surrounding the foodstuff, the sealed perimeter preferentially ruptures as the steam pressure increases thereby to allow the steam to vent through the orifice.

[0005] The foregoing pressure tear valves still require relatively high internal pressures to operate and thus do not entirely eliminate the risk of burns to consumers from venting of high pressure steam. Furthermore valves which only operate at high pressures require the main sealing seams to be stronger than would ordinarily be required and are therefore wasteful of material resources.

Brief Description of the Invention

[0006] A solution to the foregoing problems is provided by, in a first aspect of the invention, a pressure tear valve comprising:

- a) a first sheet;
- b) a second sheet in opposition to the first sheet;
- c) a notch in a face of the first sheet facing away from the second sheet, the notch defining a first portion of first sheet adjacent a first side of the notch and a second portion of first sheet adjacent a second side of the notch; and
- d) a weld which welds the first portion only of the first sheet to the second sheet,

wherein the depth of the notch is less than the thickness of the first sheet, and

wherein the first sheet and second sheet comprise thermoplastic material.

[0007] For the purposes of this description, the term

"notch" is defined as an indentation or simply a cut.

[0008] One advantage of the inventive pressure tear valve is that it is more sensitive to overpressure than prior art valves. Without wishing to be bound by theory, it is thought that it is the pressure acting on the area adjacent to the valve which causes it to tear and this leads to the valve opening at a much lower pressure.

[0009] The over-pressure required to operate the inventive valve can be controlled simply by adjustments to the depth of the notch.

[0010] A further advantage is the flexibility in regard to location on the packaging afforded by the inventive valve as it does not need to be placed within the sealing seams. Furthermore the inventive valve does not require a pre-prepared orifice prone to contamination.

[0011] The first sheet and second sheet can be unitary, that is to say, part of the same sheet. The first sheet and second sheet may comprise the same or different thermoplastic material. The thermoplastic material may be selected from the group consisting of polypropylene, polyamide, polystyrene, polycarbonate, poly(lactic acid) and high density polyethylene. The first and second sheets may also be in laminate form comprising two or more materials at least one of which is a thermoplastic material such as those already mentioned. Non-thermoplastic materials may include metal in the form of metalised films.

[0012] The thickness of the first sheet and/or the second sheet may be in the range 15-100 microns, preferably 25-80 microns, desirably 35-70 microns.

[0013] The notch may adopt any form but preferably describes (when viewed from above) a straight line or a semi-circle or a V-shape. More preferably, the notch may be (when viewed from above) in the form of an annulus and the first portion of first sheet defined by the area bounded (or encircled) by the notch. The annular notch can be in the form of a circle or a square or a triangle or a polygon or an irregular form. The pressure stresses are applied in a uniform manner when the annular notch is in the form of a circle. In contrast when the annular notch is in the form of a square or a triangle or a polygon, the pressure stresses are focussed on the apexes. The notch may optionally be discontinuous, for example it may, when arranged to form an annulus, comprise a single notch or two or more notches.

[0014] In another aspect of the invention, a bag is provided comprising a pressure tear valve according to the invention, wherein the first sheet and second opposing sheet are additionally sealed to each other thereby to form at least one closed cavity comprising the pressure tear valve. In one embodiment, the bag may comprise a first and second closed cavity, wherein the first and second closed cavities share a wall, and wherein the pressure tear valve is located in the shared wall thereby to permit, when in use, fluid communication between the first and second closed cavities following operation of the pressure tear valve under pressure.

[0015] The dual cavity bag may be used for packaging

a two component frozen ready meal where one cavity may contain, for example, frozen pasta and the other, for example, a frozen sauce. On re-heating the frozen ready meal in a microwave, steam pressure within only one of the cavities operates the pressure tear valve permitting the two food components to combine and mix. In fact a particular advantage of the dual cavity bag of the invention is that no pressure difference between the two cavities is required to operate the pressure tear valve.

[0016] Ultrasonic welding is a well known technique for welding plastics materials. It involves the conversion of electrical energy into heat energy by high frequency mechanical vibration. A small projection, known as an energy director, on a first part of two parts to be welded, is flexed at an amplitude generally in the range 20-80 microns by an oscillating force at a frequency of 10-70kHz, but more generally in the range 20-40kHz, thereby to cause modulus losses and intense friction between it and the second part to be welded which remains static. The modulus losses and friction are localised at the interface of the first part and the second part and therefore the resultant heat quickly melts the plastics material which then flows across the interface to create a joint.

[0017] Thus in a further aspect of the invention, a method of manufacturing a pressure tear valve according to the invention is provided comprising the steps of:

- a) bringing opposing faces of the first sheet of first thermoplastic material and the second sheet of second thermoplastic material into contact;
- b) applying a sonotrode to an exterior face of the first sheet; and
- c) operating the sonotrode at a frequency of 10-70kHz and an amplitude of 20-80 microns for 10-1000 milliseconds.

[0018] Preferably the frequency is in the range 20-40kHz. The amplitude may be in the range 30-70 microns, preferably 40-60 microns. The duration of operation of the sonotrode can be in the range 10-100 milliseconds.

[0019] The inventor has observed that the inventive pressure tear valves can be manufactured simply and reproducibly by the aforesaid method.

[0020] The sonotrode comprises a tip which when viewed from below mirrors the form of the notch (when viewed from above), that is to say if the required notch form is a straight line, the sonotrode tip is also in the form of a straight line, if the required notch form is a semi-circle, the sonotrode tip is also in the form of a semi-circle.

[0021] Another aspect of the invention is the provision of a method of manufacturing the dual cavity bag of the invention, the method comprising the steps of:

- a) forming the notch;
- b) bringing the face of a first additional sheet into opposition with one face of the first sheet;

- c) bringing the face of a second additional sheet into opposition with the other face of the first sheet;
- d) welding the first or second additional sheets to the first portion only of the first sheet; and
- e) sealing the first, first additional and second additional sheets together thereby to form a first closed cavity comprising the first and first additional sheets, a second closed cavity comprising the first and second additional sheets;

wherein the additional sheet welded to the first sheet in step (d) is the second sheet hereinabove.

[0022] In another aspect of the invention, a method of manufacturing the dual cavity bag of the invention is provided, the method comprising the steps of:

- a) bringing opposing faces of the first and second sheets into opposition;
- b) forming a notch in a face of the first sheet facing away from the second sheet;
- c) arranging a face of a third sheet in opposition to the notch;
- d) welding the second sheet to the first portion only of the first sheet; and
- e) sealing the first, second and third sheets together thereby to form a first closed cavity comprising the first and second sheets and a second closed cavity comprising the first and third sheets.

[0023] In a further aspect of the invention, a method of manufacturing the dual cavity bag of the invention is provided, the method comprising the steps of:

- a) bringing opposing faces of the first and second sheets into opposition;
- b) forming the pressure tear valve;
- c) arranging a face of a third sheet in opposition to the notch; and
- d) sealing the first, second and third sheets together thereby to form a first closed cavity comprising the first and second sheets and a second closed cavity comprising the first and third sheets.

Brief description of the Drawings

[0024] The invention will now be described in further detail and exemplified with reference to the following figures:

- Figure 1 shows a cross-section of a bag section with a pressure tear valve according to the invention;
- Figure 2 shows a cross-section of the bag section of figure 1 after operation of the pressure tear valve; and
- Figure 3 shows a cross-section of a pressure tear

valve according to the invention in a dual cavity bag after operation of the valve.

Detailed Description of the Invention

[0025] Figure 1 shows a cross-section of a microwaveable bag section with a pressure tear valve according to one embodiment of the invention. The bag comprises a first sheet of thermoplastic material (101) and an opposing second sheet of thermoplastic material (102). The first sheet includes an annular notch (104) which defines the exterior boundary of a first portion of first sheet (105). A weld (103), welds the portion of the first sheet (105) to the second sheet (102).

[0026] The first and second sheets (101, 102) can comprise polypropylene as 50 micron thick sheets. The thermoplastic material may also be selected from the group consisting of polyamide, polystyrene, polycarbonate, poly(lactic acid) and high density polyethylene. The thickness of the first sheet and/or the second sheet may be in the range 15-100 microns, preferably 25-80 microns, desirably 35-70 microns.

[0027] As shown in figure 2, in use, as the pressure inside the bag increases, for example as a result of water vapour released from a frozen food preparation contained in the bag under microwave heating, the bag balloons and eventually the annular notch (104) ruptures parting the first portion of first sheet (105) still welded to the second sheet (102) by the weld (103) from the rest of the first sheet (101) thereby to create a breach (201) in the first sheet permitting the egress of water vapour.

[0028] Figure 3 shows one application of the pressure tear valve of the invention in a microwaveable dual cavity bag for a frozen food preparation comprising a first cavity (301) containing, for example a frozen sauce, and a second cavity (302) containing, for example frozen pasta, separated by a shared wall (303). The shared wall (303) includes a pressure tear valve (304) according to one embodiment of the invention and as previously described. The first and second cavities can comprise polypropylene as a 50 micron thick sheet. Alternatively, they can comprise independently of each other polypropylene, polyamide, polystyrene, polycarbonate, poly(lactic acid) or high density polyethylene. The plastics can be in the form of sheets of thickness in the range 15-100 microns, preferably 25-80 microns, desirably 35-70 microns.

[0029] In use, the frozen food preparation is heated in a microwave oven and water vapour released from the food preparation. The two cavities (301, 302) balloon under the increased water vapour pressure generated in each cavity (301, 302). At a threshold pressure, the pressure tear valve (304) opens in the same manner as previously described permitting the now liquid sauce in the first cavity (301) to flow into the second cavity (302) and mix with the now hot pasta.

[0030] A bag incorporating the inventive pressure tear valve can be manufactured by:

a) Loading a vertical form fill and seal machine (Delta XS) with a roll of 50 micron thick polypropylene film (ExxonMobil MB400);

b) Forming a 100mm diameter film tube with a forming shoulder by way of a longitudinal seal using an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns);

c) Bottom cross sealing the film tube using an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to form a blind tube;

d) Filling the blind tube with any desired foodstuff, for example, pasta;

e) Top cross sealing the blind tube with an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to produce a sealed tubular bag still attached to the remainder of the roll of polypropylene film;

f) Forming a valve using a ring-shaped tipped ultrasonic sealing tool (Herrmann; frequency of 20kHz; and an amplitude of 40 microns) welding the two walls of the tubular bag together;

g) Separating the sealed tubular bag from the remainder of the roll of polypropylene film using a guillotine; and

h) Freezing the bag and contents.

[0031] A dual cavity bag according to the invention incorporating the inventive pressure tear valve can be manufactured by:

a) Loading a vertical form fill and seal machine (Delta XS LV) with roll of 50 micron thick polypropylene film (ExxonMobi) MB 400);

b) Forming an annular notch in the polypropylene film thereby to form the exterior boundary of a first portion of the said sheet using a ring-shaped tipped ultrasonic sealing tool (Herrmann; frequency of 20kHz; and an amplitude of 40 microns);

c) Forming a 100mm first film tube with a first forming shoulder using a portion of the film by way of a first longitudinal seal using an ultrasonic sealing bar thereby to form a structure shaped like a figure of "6" when viewed from above (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to locate the annular notch inside the circular part of the figure of "6" facing away from the free end of the film;

d) Forming a second film tube with a second filling tube by sealing the free end of the film to the exterior of the first tube by way of a second longitudinal seal using an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to locate the annular notch on the interior wall separating the first and second film tubes;

e) Point sealing the exterior wall of the second film tube to the first portion of the interior wall defined by the annular notch using an ultrasonic welding tool (Herrmann; frequency of 20kHz; and an amplitude of 40 microns);

f) Bottom cross sealing the film tube using an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to form first and second blind tubes;

g) Filling both blind tubes (e.g. one with pasta and one with sauce);

h) Top cross sealing both blind tubes with an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to produce a sealed dual cavity tubular bag still attached to the remainder of the roll of polypropylene film;

i) Separating the dual cavity bag from the remainder of the roll of polypropylene film using a guillotine; and

j) Freezing the dual cavity bag and contents.

[0032] In one embodiment of this method, the first film tube may be formed in step (c) so that the notch is on the outside of the circular part of the figure "6" facing the free end of the film. The exterior wall of the first film tube must then be point sealed to the first portion of the interior wall defined by the annular notch in step (e).

[0033] In another embodiment of this method, step (b) may take place after formation of the first film tube in which case the notch must be on the outside of the circular part of the figure "6" facing the free end of the film. The exterior wall of the first film tube must then be point sealed to the first portion of the interior wall defined by the annular notch in step (e).

[0034] Alternatively a dual cavity bag according to the invention incorporating the inventive pressure tear valve can be manufactured by:

a) Loading a vertical form fill and seal machine (Delta XS LV) with roll of 50 micron thick polypropylene film (ExxonMobil MB 400);

b) Forming a 100mm first film tube with a first forming shoulder using a portion of the film by way of a first longitudinal seal using an ultrasonic sealing bar thereby to form a structure shaped like a figure of

"6" when viewed from above (Herrmann; frequency of 20kHz; and an amplitude of 70 microns);

c) Forming a valve using a ring-shaped tipped ultrasonic sealing tool (Herrmann; frequency of 20kHz; and an amplitude of 40 microns) welding the two walls of the first film tube together thereby to locate the annular notch outside the circular part of the figure of "6" facing the free end of the film;

d) Forming a second film tube with a second filling tube by sealing the free end of the film to the exterior of the first tube by way of a second longitudinal seal using an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to locate the annular notch on the interior wall separating the first and second film tubes;

e) Bottom cross sealing the film tube using an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to form first and second blind tubes;

f) Filling both blind tubes (e.g. one with pasta and one with sauce);

g) Top cross sealing both blind tubes with an ultrasonic sealing bar (Herrmann; frequency of 20kHz; and an amplitude of 70 microns) thereby to produce a sealed dual cavity tubular bag still attached to the remainder of the roll of polypropylene film;

h) Separating the dual cavity bag from the remainder of the roll of polypropylene film using a guillotine; and

i) Freezing the dual cavity bag and contents.

Claims

1. A pressure tear valve comprising:

- a) a first sheet;
- b) a second sheet in opposition to the first sheet;
- c) a notch in a face of the first sheet facing away from the second sheet, the notch defining a first portion of first sheet adjacent a first side of the notch and a second portion of first sheet adjacent a second side of the notch; and
- d) a weld which welds the first portion only of the first sheet to the second sheet,

wherein the depth of the notch is less than the thickness of the first sheet, and
wherein the first sheet and second sheet comprise thermoplastic material.

2. A pressure tear valve according to claim 1 wherein

the notch, when viewed from above, is in the form of an annulus and the first portion of first sheet is defined by the area bounded by the notch.

3. A pressure tear valve according to claim 2 wherein the annulus is a circle or a square or a triangle or a polygon or an irregular form. 5
4. A bag comprising a pressure tear valve according to any one of the preceding claims, wherein the first sheet and second opposing sheet are additionally sealed to each other thereby to form at least one closed cavity comprising the pressure tear valve. 10
5. A bag according to claim 4, wherein the bag comprises a first and second closed cavity, wherein the first and second closed cavities share a wall, and wherein the pressure tear valve is located in the shared wall thereby to permit, when in use, fluid communication between the first and second closed cavities following operation of the pressure tear valve under pressure. 20
6. A method of manufacturing a pressure tear valve according to any one of claims 1 to 3 comprising the steps of: 25
 - a) bringing opposing faces of the first sheet and the second sheet into contact;
 - b) applying a sonotrode to an exterior face of the first sheet; and 30
 - c) operating the sonotrode at a frequency of 10-70kHz and an amplitude of 20-80 microns for 10-1000 milliseconds. 35
7. A method of manufacturing a bag according to claim 5, the method comprising the steps of:
 - a) forming the notch;
 - b) bringing the face of a first additional sheet into opposition with one face of the first sheet; 40
 - c) bringing the face of a second additional sheet into opposition with the other face of the first sheet;
 - d) welding the first or second additional sheets to the first portion only of the first sheet; and 45
 - e) sealing the first, first additional and second additional sheets together thereby to form a first closed cavity comprising the first and first additional sheets, a second closed cavity comprising the first and second additional sheets; 50

wherein the additional sheet welded to the first sheet in step (d) is the second sheet of claim 1. 55
8. A method of manufacturing a bag according to claim 5, the method comprising the steps of:

- a) bringing opposing faces of the first and second sheets into opposition;
- b) forming a notch in a face of the first sheet facing away from the second sheet;
- c) arranging a face of a third sheet in opposition to the notch;
- d) welding the second sheet to the first portion only of the first sheet; and
- e) sealing the first, second and third sheets together thereby to form a first closed cavity comprising the first and second sheets and a second closed cavity comprising the first and third sheets.

9. A method of manufacturing a bag according to claim 5, the method comprising the steps of:

- a) bringing opposing faces of the first and second sheets into opposition;
- b) forming the pressure tear valve;
- c) arranging a face of a third sheet in opposition to the notch; and
- d) sealing the first, second and third sheets together thereby to form a first closed cavity comprising the first and second sheets and a second closed cavity comprising the first and third sheets.

Fig.1

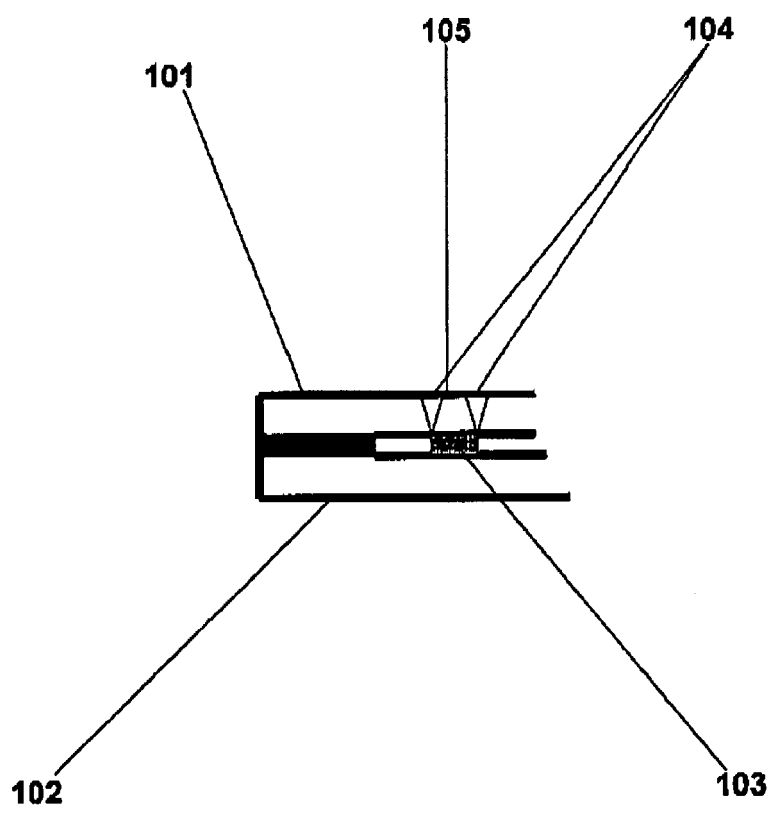


Fig.2

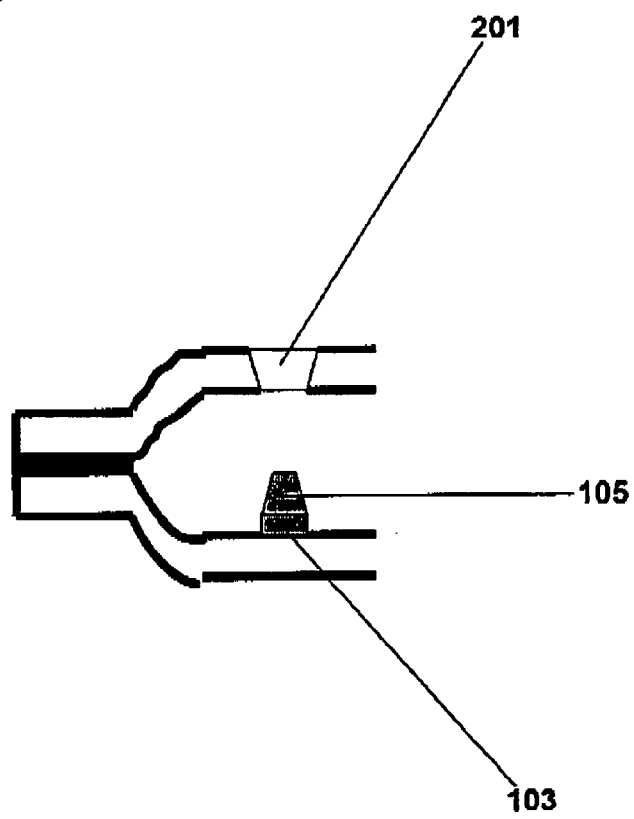
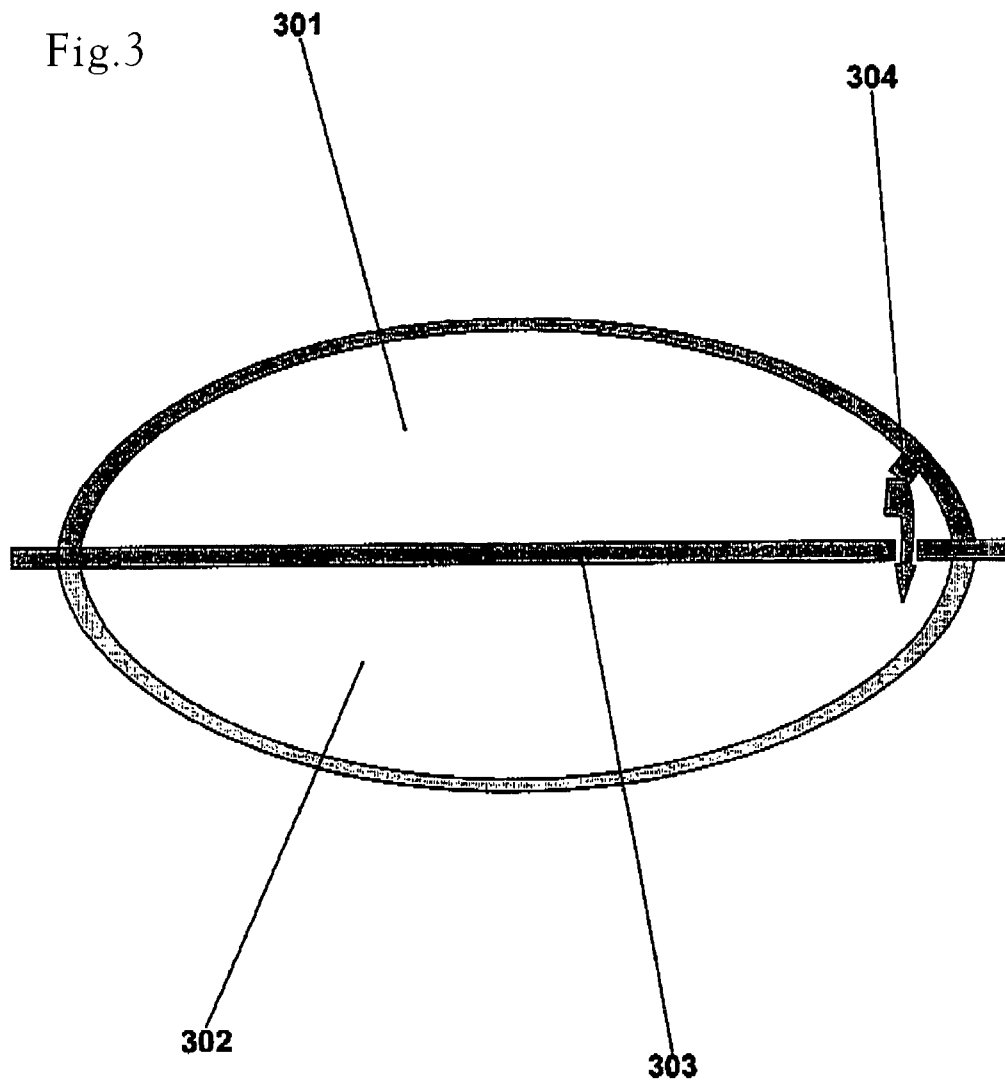


Fig.3





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 25 1007

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/02 (P04C01)



European Patent
Office

Application Number

EP 06 25 1007

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5

Pressure valve for releasing overpressure and a bag having the pressure valve.

2. claims: 6-9

Method for connecting two sheets together.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 25 1007

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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21-09-2006

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