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(54) **Transport pressure vessel having open side edge with bonded inner opposing faces**

(57) Described is a pressure vessel (1) for air transport of packed articles included in a chamber surrounded by at least one flexible sheet. The sheet has side edges (2-1,2-2) bonded together leaving open at least part of one side edge giving access to the chamber, which at least partly open side edge (4) has inner opposing faces (5-1,5-2) at least one of which is provided with an adhesive (6). In an embodiment of the vessel one sheet end

at the at least partly open side edge has an extending flap (9), which flap and/or the outer side of the sheet whereon in lands after folding are/is provided with an additional adhesive. In a further embodiment of the vessel at least one outer side of the at least one sheet is provided with at least one adhesive strip whereon the bonded inner opposing faces, after folding the sheet concerned at least one time, can be adhered.

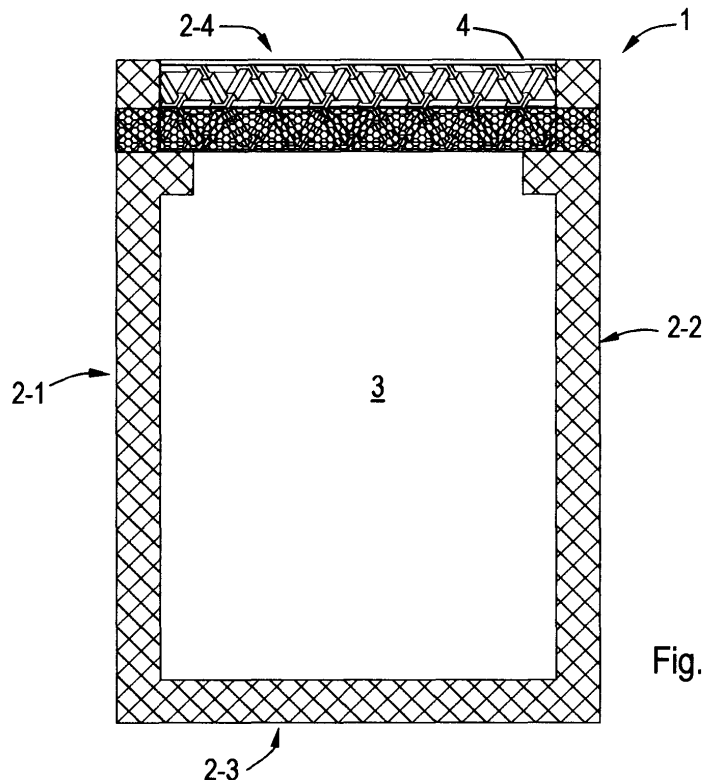


Fig.1A

## Description

[0001] The present invention relates to a pressure vessel comprising a chamber surrounded by at least one flexible sheet.

[0002] The present invention is also related to a method of packaging an article for transport in a chamber of a pressure vessel.

[0003] Such a pressure vessel and method for transporting hazardous articles for example in aeroplanes are disclosed in EP-A-0,804,372. The known pressure vessel is closed at two opposite side edges, at the bottom edge and at the top edge by being joined by heat welds. A slit shaped or circularly shaped aperture provided in a wall extending between the edges is substantially parallel to the top edge and is spaced from the heat welds by a distance sufficient to leave a surrounding smooth target area for a flap adhesively securing the aperture. The adhesive provided on the flap is an aggressive adhesive having a strength that is sufficiently high to preclude the possibility of reusing the pressure vessel after opening. Such an aggressive adhesive can only be acquired from a selected group of acrylic pressure sensitive adhesives or silicone adhesives.

[0004] It is a disadvantage of the known pressure vessel and method that use is made of a sturdy vessel encased on all its side edges, whereby a slit is provided in the chamber wall which after putting the article therein has to be closed again by means of some specially selected adhesive in order to withstand differential pressures between the chamber and the ambient atmosphere.

[0005] It is an object of the present invention to provide an improved pressure vessel and method which although capable of withstanding substantial differential pressures can be manufactured less costly and in a reduced number of steps, while still being simple to handle by normally skilled personal, and which only requires selection of mainstream, more general available adhesives.

[0006] Thereto the pressure vessel according to the invention is **characterised in that** the sheet has side edges bonded together leaving open at least part of one side edge giving access to the chamber, which at least partly open side edge has inner opposing faces at least one of which is provided with an adhesive.

[0007] It is an advantage of the pressure vessel according to the invention that in the course of manufacturing the vessel during the bonding of the side edges, normally one side edge or a part thereof, is left open and not bonded in order to form an entrance to the chamber. This reduces production costs compared to vessels which are encased and bonded on all their side edges. In addition the step of explicitly cutting a slit like aperture in the flat chamber wall can further advantageously be cancelled, as the left open side edge part simply provides an access opening. This leads to further cost savings during manufacturing of the vessel according to the invention. Furthermore larger openings can easily be made

by simply leaving open a large side edge of the pressure vessel according to the invention.

[0008] By providing an adhesive on one or both inner faces of the open side edge the opening formed by the open side edge or part thereof is still further advantageously simply closed by pressing the side edges and thus the inner opposing faces together. The possibilities of making errors during closing of the inventive vessel are reduced considerably.

[0009] An embodiment of the pressure vessel according to the invention is **characterised in that** one sheet end at the at least partly open side edge has an extending flap which flap and/or the outer side of the sheet whereon it lands after folding are/is provided with an additional adhesive. It is an advantage of this embodiment according to the invention that the flap extending at the sheet end can be folded in a direction to fold the side edge after closing, while the flap is being adhered to the outer side of the other sheet end. In this way two consecutive adhesive barriers at least partly acting together, are provided between the chamber and the ambient atmosphere viz. the adhesive barrier on the bonded inner faces of the closed side edge, and the flap versus outer sheet end adhesive barrier. Advantageously less sophisticated and more general available non aggressive types of adhesive can be selected from a broader range of types, as each barrier of the series arrangement of barriers only has to withstand part of a total pressure exerted by a possible pressure difference present between the chamber and the ambient atmosphere. If aggressive adhesive types are chosen, due to the succession of adhesive barriers, still higher pressure differences can be resisted thereby, but then the vessel can not be reused after opening.

[0010] A further embodiment of the pressure vessel according to the invention is **characterised in that** at least one outer side of the at least one sheet is provided with at least one adhesive strip whereon the bonded inner opposing faces, after folding double the sheet end concerned at least one time, can be adhered.

[0011] By folding the bonded inner faces possibly with the inclusion of the above mentioned bonded flap one or more times a sequence of adhesive barriers is realised which are capable of withstanding very high pressure differences without the required application of specially selected aggressive adhesives.

[0012] A still further embodiment of the pressure vessel according to the invention is **characterised in that** the pressure vessel comprises wrap around means for holding the vessel together, such as a band, brace, belt, fastener, sleeve, wrapper, rope, tape or ribbon which means surround the vessel.

The application of such wrap around holding means restricts the maximum size to which the volume of the pressure vessel can increase as a consequence of a pressure loss that may occur in an aeroplane transporting the vessel with article including its possibly hazardous content.

[0013] At present the pressure vessel and method according to the invention will be elucidated further together

with their additional advantages, while reference is being made to the appended drawing, wherein similar components are being referred to by means of the same reference numerals. In the drawing:

Fig. 1A shows a first embodiment of an initially open vessel according to the invention;

Fig. 1B shows the vessel of fig. 1A after at least partially being closed;

Fig. 2A shows a second embodiment of an initially open vessel according to the invention;

Fig. 2B shows the vessel of fig. 2A after at least partially being closed.

Fig. 3A and 3B show schematic sectional views of the open edges of the first and second embodiment of the vessels above; and

Fig. 4 shows a vessel according to the invention provided with wrap around means.

**[0014]** The figures 1A, 1B, 2A and 2B show embodiments of a pressure vessel 1. Vessel 1 may be manufactured from one sheet which is to be folded double and where after two fringes or edges of the then single sheet, for example opposite side edges 2-1 and 2-2, are to be bonded. Also the bottom edge 2-3 is bonded and the top edge 2-4 is left open giving access through an opening 4 to a thus formed chamber 3. The vessel 1 may also be manufactured from two or at wish more separate sheets placed on top of one another, but then three of the edges, generally referred to as 2, of the sheets are to be bonded, while leaving open a fourth edge 2-4, which forms the access opening 4 to the chamber 3. The at least one flexible sheet which surrounds the chamber 3, is made of a plastic, preferably a transparent, more preferably a laminated plastic, still more preferably having a thickness of at least 150  $\mu\text{m}$ . In case of a laminated plastic the plastic comprises several layers, on of which is a minimal stretch layer. This provides a vessel 1 having a fixed maximum outer volume determined by the dimensions of the minimal stretch layer.

Part of the open edge 2-4 may be bonded as shown in fig. 1A, similar to the left and right edges 2-1 and 2-2, in order not to provide an opening 4 which covers the whole open edge 2-4. This in particular prevents rupture of sheet material and prevents leakage of air out of the upper left and right corners of the chamber 3 if the vessel 1 is transported in an aeroplane that experiences a sudden drop of air pressure of the ambient atmosphere.

As the figures 3A and 3B show in detail the at least partly open side edge 2-4 has inner opposing faces 5-1 and 5-2 at least one of which is provided with an adhesive 6. In the figs 3A and 3B both faces 5-1 and 5-2 are provided with adhesive 6, which adhesive will be covered originally by a well known fly leaf which on application of the vessel 1 after an article to be transported is inserted in the chamber 3 through the opening 4, is to be removed by hand. Subsequently outer sheet sides 7-1 and 7-2 near the open side edge 2-4 are pressed together in order to form

a firm airtight bond between the inner opposing faces 5-1 and 5-2. Apart from applying adhesive 6 on the faces, again generally referred to now with reference numeral, 5 these faces may have respective seal rims not shown in the drawings in order to close the opening 4 alternatively by bonding the corresponding seal rims, such as by applying heat to these rims. In general the respective side edges 2 are bonded together by welding, heat sealing, gluing, fusion or the like.

**[0015]** Fig 1A shows a first embodiment of the vessel 1 which has its opening 4 at the upper top edge 2-4. The inner faces 5-1 and/or 5-2 (see fig. 3A) are here provided with the adhesive 6. After the bonding of the inner faces 5 the edge 2-4 is folded double once or twice or as often as necessary. One or more adhesive strips 8, 8-1, 8-2 (see figs. 2A and 2B) are provided on several positions on one or both outer sides 7-1, 7-2. The already bonded inner opposing faces 5 can be joined or adhered to at least one of these outer sides after folding the sheet edge 2-4 concerned at least one time or alternatively rolling the joined edge 2-4 up.

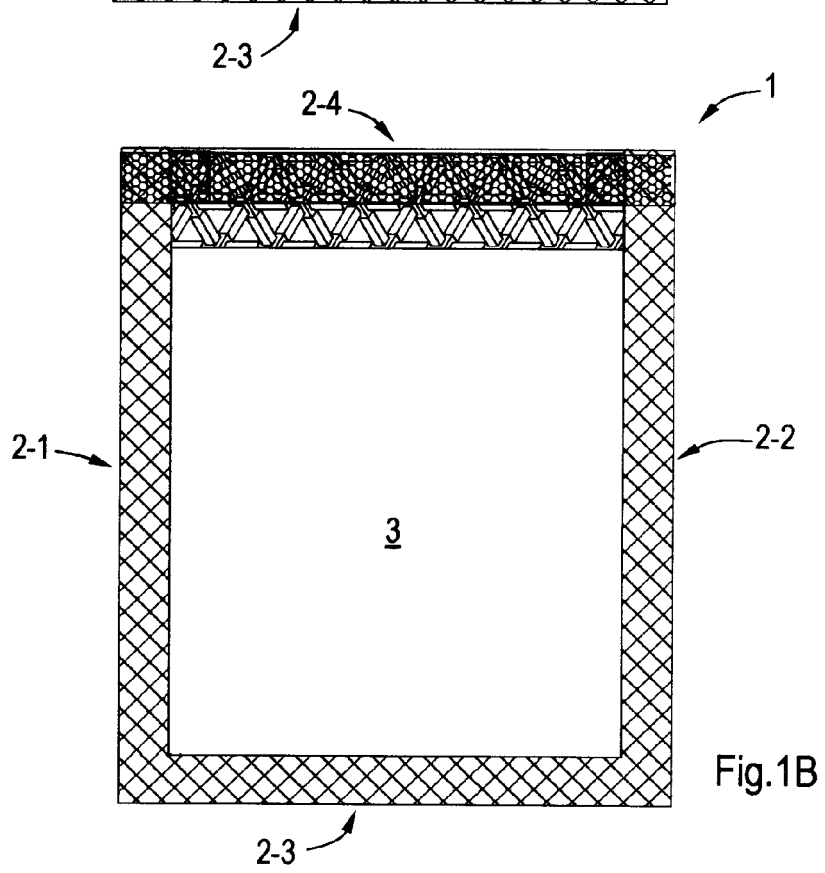
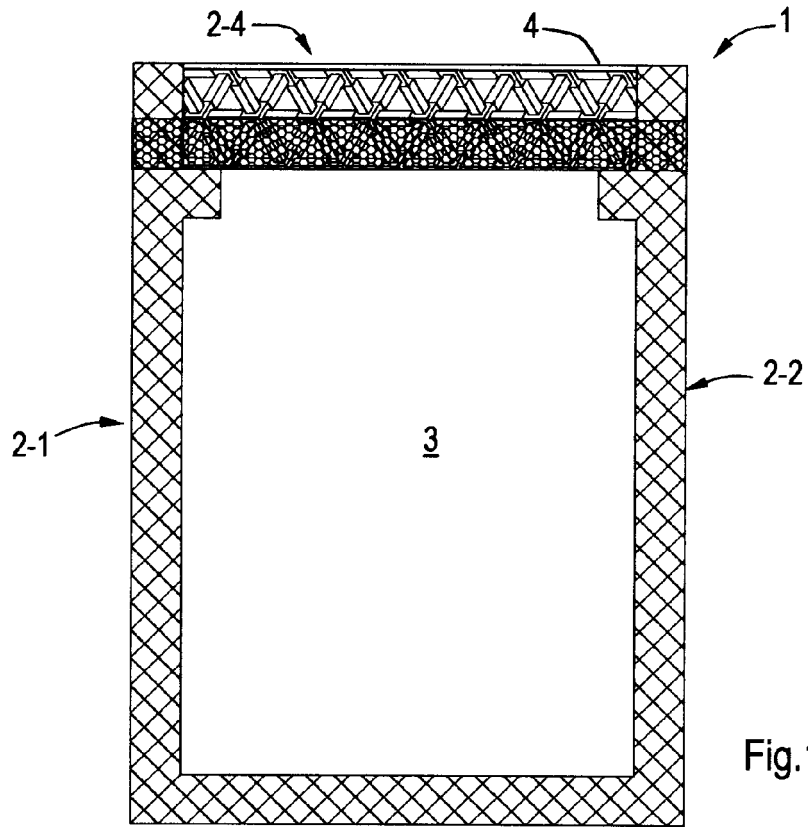
**[0016]** Fig 2A shows a second embodiment of the vessel 1. Now one sheet end has at the at least partly open side edge 2-4 an extending flap 9. The extending flap 9 and/or the outer side 7-2 of the sheet whereon in lands after folding are/is provided with adhesive 6. Also the inner faces 5-1 and/or 5-2 (see fig. 3B) are here provided with the adhesive 6. After the bonding of the inner faces 5 the extending flap 9 is folded double and adhered to the outer side 7-2. The adhered assembly of faces 5 and folded flap 9 is thereafter folded further and possibly adhered to one or more adhesive strips 8-1 again provided on several positions on possibly one or both outer sides 7-1, 7-2.

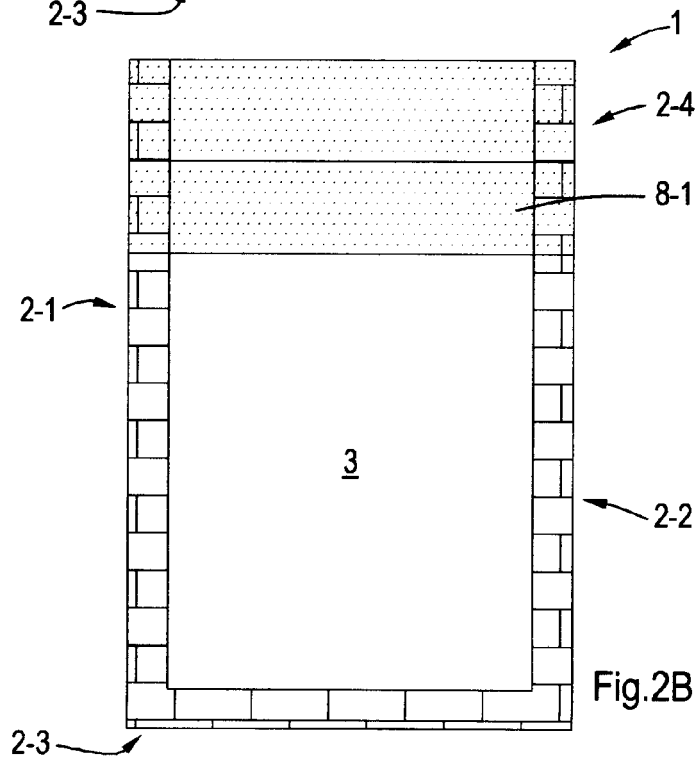
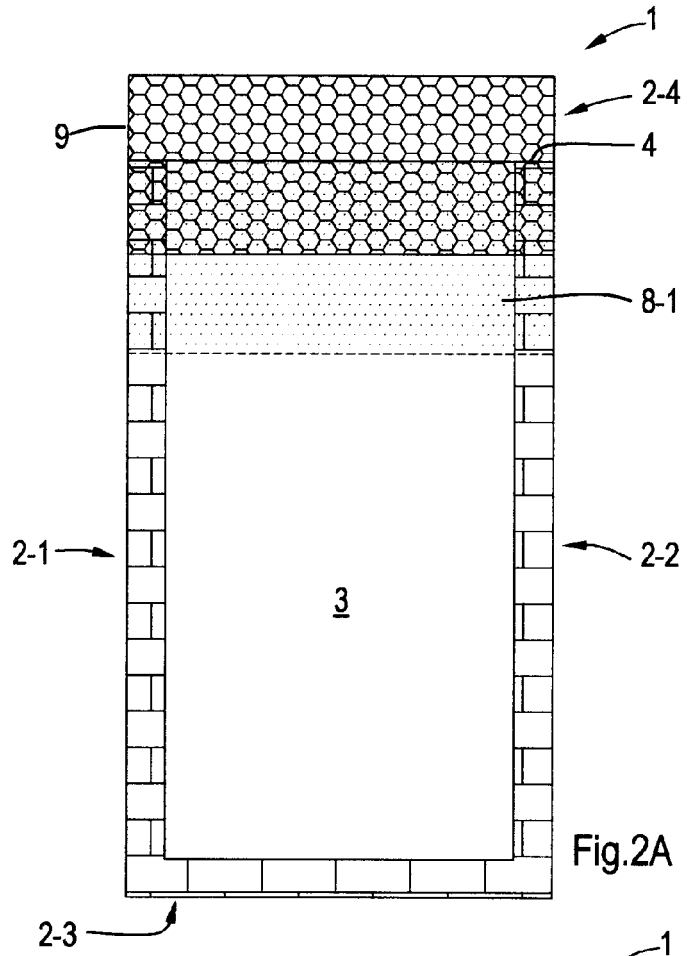
**[0017]** In addition as shown in fig. 4 the pressure vessel 1 may comprise wrap around means 10 for holding the closed vessel 1 together, for example embodied by a band, brace, belt, fastener, sleeve, wrapper, rope, tape or ribbon which means surround the vessel 1 and provides an extra resistance against an increase of volume of the chamber 3 and vessel 1 in case of an air pressure drop. The vessel 1 which may be closed by means of the extending flap 9 and wrapped as described above advantageously has a limited and fixed volume even if it is subjected to a sudden pressure drop. This results from the robust and sturdy embodiment of the wrap around means which limited the maximum attainable volume and dimensions of the thus packed vessel 1.

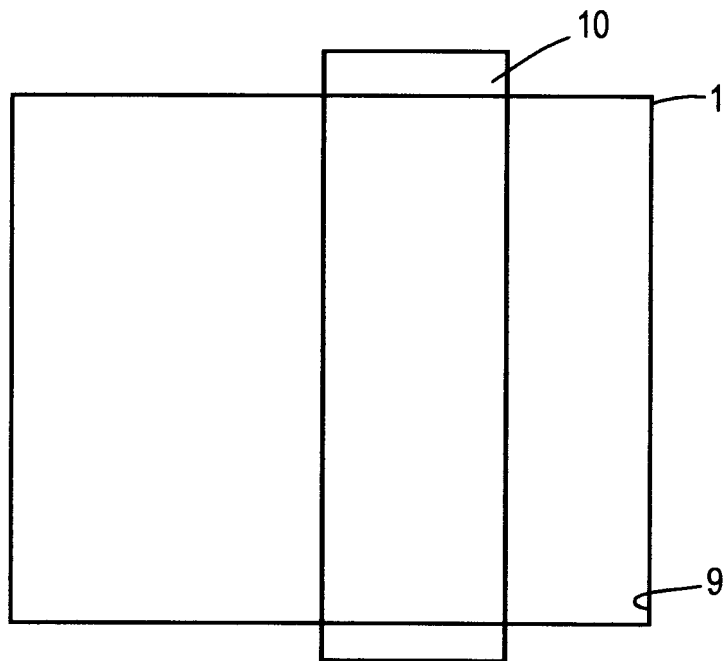
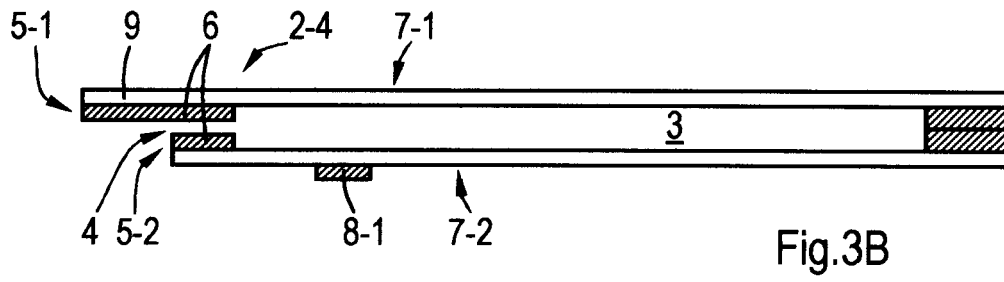
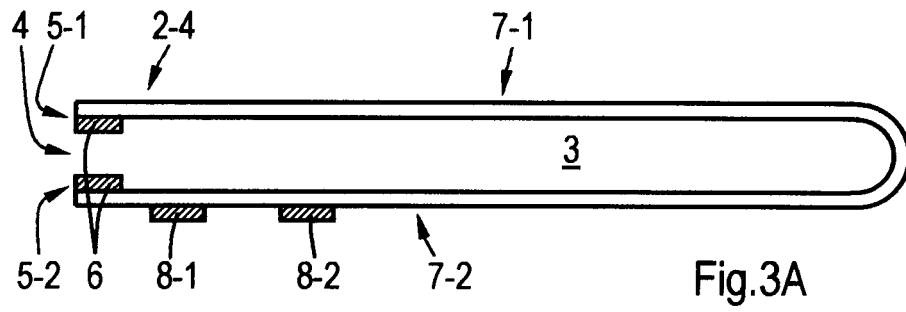
## Claims

1. A pressure vessel comprising a chamber surrounded by at least one flexible sheet, **characterised in that** the sheet has side edges bonded together leaving open at least part of one side edge giving access to the chamber, which at least partly open side edge has inner opposing faces at least one of which is

- provided with an adhesive.
2. The pressure vessel according to claim 1, **characterised in that** the chamber is surrounded by one folded sheet or by at least two flexible sheets each having side edges bonded together. 5
  3. The pressure vessel according to claim 1 or 2, **characterised in that** the side edges are bonded together by welding, heat sealing, gluing or fusion. 10
  4. The pressure vessel according to one of the claims 1-3, **characterised in that** one sheet end at the at least partly open side edge has an extending flap, which flap and/or the outer side of the sheet whereon in lands after folding are/is provided with an additional adhesive. 15
  5. The pressure vessel according to one of the claims 1-4, **characterised in that** at least one outer side of the at least one sheet is provided with at least one adhesive strip whereon the bonded inner opposing faces, after folding the sheet concerned at least one time, can be adhered. 20  
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  6. The pressure vessel according to one of the claims 1-5, **characterised in that** the pressure vessel comprises wrap around means for holding the vessel together, such as a band, brace, belt, fastener, sleeve, wrapper, rope, tape or ribbon which means surround the vessel. 30
  7. The pressure vessel according to one of the claims 1-6, **characterised in that** at least the at least partly open side edge of the pressure vessel including the bonded side edges is/are folded double one or more times. 35
  8. The pressure vessel according to one of the claims 1-7, **characterised in that** the respective adhesives are of the non aggressive type each having such an average strength that the total of the resulting adhesive barriers provide a closed pressure vessel possibly provided with wrap around means of claim 6, which vessel is capable of withstanding a pressure difference between the chamber and ambient atmosphere of at least 95 kPa. 40  
45
  9. The pressure vessel according to one of the claims 1-8, **characterised in that that** the at least one flexible sheet is made of a plastic, preferably a transparent, more preferably a laminated plastic comprising layers one of which is a minimal stretch layer. 50
  10. A method of packaging an article for transport in a chamber of a pressure vessel according to one of the claims 1-9, **characterised in that** after moving the article through an at least partly open side edge of the vessel into the chamber, inner opposing faces of the at least partly open side edge, at least one of which faces is provided with an adhesive, are pressed together. 55
  11. The method according to claim 10, **characterised in that** the inner opposing faces of the at least partly open side edge of the vessel, at least one of which faces is provided with an adhesive or a seal rim, are bonded together.









EUROPEAN SEARCH REPORT

Application Number  
EP 08 10 5849

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2004/258864 A1 (TRIEBOLD KEITH A [US] ET AL) 23 December 2004 (2004-12-23)	1-5,7-11	INV. B65D33/30 B65D81/20
Y	* paragraph [0042] - paragraph [0053]; figures 4a-4f *	6	
Y	----- EP 0 794 131 A (RUTLEDGE ARTHUR [CA] ZAYNEX CORP [BB]) 10 September 1997 (1997-09-10) * abstract *	6	
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			B65D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		16 April 2009	Serrano Galarraga, J
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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 08 10 5849

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16-04-2009

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**REFERENCES CITED IN THE DESCRIPTION**

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- EP 0804372 A [0003]