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(54) Container comprising at least one double wall and method of insulating a double wall of a container

(57) Container (1) comprising at least one double wall (2) having a bottom wall member (3) and an inner and an outer wall member (4,5). The inner wall member (4) and outer wall member (5) each has a bottom edge (6,7) and an upper edge (8,9), and are spaced from each other. The inner and outer wall member (4,5) are connected to each other by the bottom wall member (3) at their respective bottom edges (6,7). The bottom wall member (3), inner and outer wall member (4,5) enclose an intermediate space (10). At least one hermetically sealed bag (11,12) of flexible, air tight material is arranged in the intermediate space (10), has at least one sealed opening (13), and is further filled with insulation material. Said bag (11,12) is evacuated. In a method of insulating a double wall (2) of a container (1) the at least one bag (11,12) is arranged in the intermediate space (10) such that the at least one opening (13) is accessible from the upper side. The bag (11,12) is filled with insulation material via the at least one opening (13), where after an evacuation pressure is applied on the inside of the bag (11,12), and after a sufficient vacuum has been reached the at least one opening (13) of the bag (11,12) is hermetically sealed.

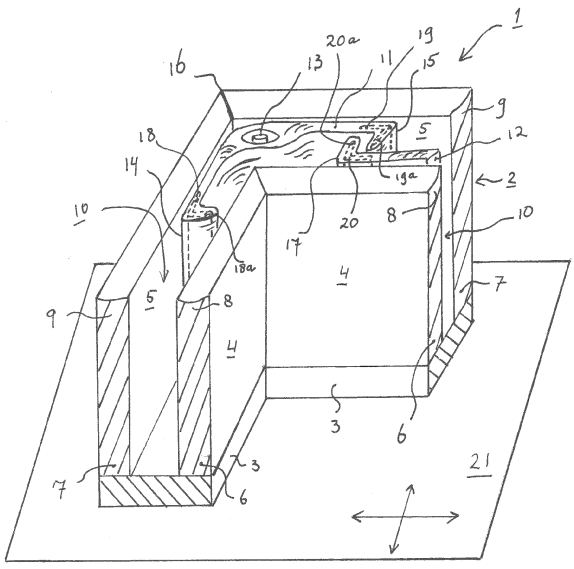

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to the art of thermally insulated containers (e.g. freight containers) or cabinet structures (such as refrigerators) and more particularly relates to a container comprising at least one double wall provided with insulation material.

BACKGROUND ART

[0002] Such a cabinet structure is for example known from US-A-6,109,712. In this known cabinet structure an insulation material is placed atop a first wall portion of the cabinet before the cabinet is assembled. A barrier sheet, e.g. a metallic foil, is positioned over the insulation material such that annular edge portions extending over the insulation material is in contact with the wall portion. The annular edge portions are sealed to the wall portion after which the space surrounded by the barrier sheet and the wall portion is evacuated, and the barrier sheet is hermetically sealed. The cabinet is assembled such that another wall portion is positioned at the side of the insulation material opposite the first wall portion, and a second insulation material, preferably polyurethane foam, is injected between the two walls. One of the disadvantages of such insulation is that the thickness of the final insulation material is irreproducible and can display variations in thickness and thus insulation properties. Furthermore folding of the annular edge seal can occur which, together with the permeable nature of the wall portion can over time lead to loss of vacuum and thus insulation. In addition in particular it is not possible to arrange such insulation material in corner areas of a container or a cabinet structure leading to a less favourable insulation, and in corner areas only the second insulation material (e.g. polyurethane foam) can be applied. Besides, the metallic foil is very sensitive and just a minor impact may lead to a disruption of the hermetic seal leading to loss of vacuum and thus thermal insulation. Due to these problems such insulation is insufficient for use in professional construction environment, and thus is not suitable for e.g. vacuum insulated air freight containers.

[0003] Another manner of insulating containers or cabinets is by using prefabricated, and preformed vacuum insulation panels (VIPs), which comprise a hermetically sealed aluminium barrier surrounding granular insulation material. These VIPs are produced in predetermined dimensions and placed next to each other to cover a respective wall of the container or cabinet. This manner of insulation provides the problem that due to the predetermined dimensions of the VIPs it is not always possible to correctly insulate containers or cabinets with non-matching dimensions. In addition the aluminium barrier is very fragile, and in particular at places where two VIPs are put next to each other thermal leakage can occur.

SUMMARY OF THE INVENTION

[0004] It is an object of the invention to provide a container comprising at least one double wall which is insulated in accordance with the requirements of daily use, in for example the air transport sector, with respect to construction, durability and maintenance. In addition it is an object of the invention to provide a correct and durable insulation of containers or cabinets also in corner areas of such containers or cabinets and irrespective of the dimensions of such containers or cabinets. Furthermore it is an object of the invention to provide a method of insulating a double wall of a container which provides the possibility of insulating containers in-situ.

[0005] In order to obtain at least part of at least one of these problems the present invention provides a container comprising at least one double wall, said double wall having a bottom wall member and an inner and an outer wall member, said inner wall member and outer wall member each having a bottom edge and an upper edge, said inner wall member and outer wall member being spaced from each other and connected to each other by the bottom wall member at their respective bottom edges, said bottom wall member, inner wall member and outer wall member enclosing an intermediate space, wherein said intermediate space comprises at least two hermetically sealed bags, each bag being of flexible, air tight material, each of said bags being arranged in the intermediate space and having at least one sealed opening, each of said bags further being filled with insulation material, each bag being evacuated, said bags each having opposite side edges extending substantially perpendicular to the bottom wall member, and wherein said bags overlap each other at their side edges. Since the bags overlap one another it is possible to insulate all the space between the inner and outer wall member thus reducing thermal leakage.

[0006] In case the double wall of the container comprises a corner, an improved thermal insulation is obtained in the embodiment of a container of the invention in which said at least one bag comprises a first side edge and a second side edge, said first side edge being positioned on one side with respect to the corner and said second side edge being positioned on the other side of the corner.

[0007] In a further embodiment of a container according to the invention each bag is provided on its inner side with a profiled element which extends in the direction of the side edge thereof, said profiled element having an engagement part, the engagement parts two overlapping two bags being in engagement with each other. In this way also in case the container is subjected to extreme vibration or handling, the overlap of the two overlapping bags persists.

[0008] A particular suitable insulation material for a container according to the invention is a granular material, preferably composed of silica grains.

[0009] In still a further embodiment of a container ac-

cording to the invention, the at least one sealed opening is fitted with a tubular connection, said tubular connection being recessed. In this way the tubular connection does not protrude which makes the hermetically sealed bag less fragile, and thus the thermal insulation more durable. In addition a more durable insulation can be obtained when said flexible, air tight material is an impact resistant plastic material.

[0010] The invention further relates to a method of insulating a double wall of a container, said method comprises the steps of:

- providing a container comprising at least one double wall, said double wall having a bottom wall member and an inner and an outer wall member, said inner wall member and outer wall member each having a bottom edge and an upper edge, said inner wall member and outer wall member being spaced from each other and connected to each other by the bottom wall member at their respective bottom edges, said bottom wall member, inner wall member and outer wall member enclosing an intermediate space, said intermediate space being accessible from an upper side of the double wall defined by the upper edges of the inner wall member and the outer wall member;
- providing at least one bag of flexible, air tight material, said at least one bag being hermetically sealed with the exception of at least one opening;
- arranging the at least one bag in the intermediate space such that the at least one opening is accessible from the upper side;
- filling the bag with insulation material via the at least one opening;
- after the bag has been filled with insulation material, connecting the at least one opening to an evacuation system and applying an evacuation pressure on the inside of the bag; and
- after a sufficient vacuum has been reached hermetically sealing the at least one opening of the bag. In this way it is possible to in-situ and custom made insulate containers having double walls.

[0011] In an embodiment of a method according to the invention, in which the method comprises the steps of providing said double wall with a corner, providing said at least one bag with a first side edge and a second side edge, and arranging said at least one bag in the corner of the double wall such that said first side edge being positioned on one side with respect to the corner and said second side edge being positioned on the other side of the corner, it is effectively and easy possible to correctly insulate corner areas of containers or cabinets.

[0012] In a further embodiment of a method according to the invention, the method further comprises the steps of:

- providing at least two bags of flexible, air tight material, each of said bags being hermetically sealed with the exception of at least one opening; providing each of the bags with opposite side edges;
- arranging at least two bags in said intermediate space such that the at least one opening of each bag is accessible from the upper side, such that the side edges extend substantially perpendicular to the bottom wall member of the double wall, and such that the bags overlap each other at respective side edges;
- filling each of the bags with insulation material via the at least one opening;
- after each of the bags has been filled with insulation material, connecting the at least one opening to an evacuation system and applying an evacuation pressure on the inside of the bag;
- after a sufficient vacuum has been reached hermetically sealing the at least one opening of each of the bags; and
- the step of arranging the bags in the intermediate space is performed such that the amount of overlap is such that after evacuation of both bags the bags still overlap each other. By overlapping the bags thermal leakages paths from the inner wall member to the outer wall member and vice versa are at least largely prevented. Preferably the method comprises the step of providing each bag on its inner side with a profiled element which extends in the direction of the side edge thereof, each profiled element having an engagement part, and the step of arranging the at least two bags in the intermediate space such that after the evacuation pressure has been applied on the bags the engagements parts of the profiled elements of two overlapping bags engage each other.

[0013] Although at least one opening in a bag suffices for filling the bag with insulation material and evacuating the bag, for larger bags it is advantageous that the method comprises the step of providing said at least one bag with at least one filling opening for filling the bag with insulation material and with at least one separate evacuation opening, and the step of sealing all said openings after a sufficient vacuum has been reached. By using more openings the method can be performed faster and thus more economical. Preferably an embodiment of a method according to the invention comprises the step of closing the double wall by connecting a top wall member to the upper edges of the inner wall member and the outer wall member.

[0014] A very reproducible and effective filling of the bag with insulation material leading to an optimal thermal insulation can be obtained in a preferred embodiment of a method according to the invention in which during the step of filling the at least one bag with insulation material the double wall is vibrated. Preferably the method comprises at least one step chosen from the group consisting of: using as insulation material granular material, preferably silica grains, and using as flexible material impact

resistant plastic.

[0015] Further features and advantages of the present invention will appear from reading the description which follows, provided by way of nonlimiting example and with reference to the accompanying drawing, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Figure 1 is a schematic view partly in cross-section, partly in perspective of a corner part of a double wall of a container in accordance with the invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0017] With reference to Figure 1 a method of insulating a double wall of a container in accordance with the present invention will now be elucidated.

[0018] In said method a container 1 is provided, which container 1 comprises at least one double wall 2. The double wall 2 has a bottom wall member 3, an inner wall member 4 and an outer wall member 5. The inner wall member 4 and outer wall member 5 each has a bottom edge 6; 7 and an upper edge 8; 9. The inner wall member 4 and outer wall member 5 are spaced from each other and connected to each other by the bottom wall member 3 at their respective bottom edges 6; 7. The bottom wall member 3, the inner wall member 4 and outer wall member 5 enclose an intermediate space 10 which is accessible from an upper side of the double wall 2 defined by the upper edges 8; 9 of the inner wall member 4 and the outer wall member 5.

[0019] In the embodiment shown in Figure 1 two bags 11, 12 (partly) of flexible, air tight material are indicated. It will be clear for a person skilled in the art that in dependency of the dimensions of the double wall and the bags more (or fewer) bags can be used to insulate the complete intermediate space.

[0020] Both bags 11, 12 are hermetically sealed with the exception of at least one opening 13 (only the opening 13 for the bag 11 is visible in Figure 1), which is accessible from the upper side. In the shown embodiment only one opening 13 is present for both evacuation and filling (to be discussed later), but it is apparent that more openings can be present and that separate openings for evacuation and filling can be present in different embodiments of the invention. An impact resistant, flexible plastic is used for the bags which is impervious for air. In different embodiments of the inventions other materials for the bags which allow the long-term evacuation of the bags can be used.

[0021] As can be seen in Figure 1 the first bag 11 comprises a first side edge 14 and a second side edge 15, and the bag 11 is arranging such that said first side edge 14 is positioned on one side with respect to the corner 16 and said second side edge 15 is positioned on the other side of the corner 16. The bag 11 thus extends over the corner area of the double wall 2. The second bag 12 also comprises side edges (one of which with reference number 17 is visible in Figure 1). All these side edges 14, 15; 17 extend substantially perpendicular to the bottom wall member 3 of the double wall 2.

[0022] The bags 11, 12 are arranged in the intermediate space 10 such that the bags 11, 12 overlap each other at respective side edges 15; 17.

[0023] In the embodiment shown in Figure 1 each bag 11, 12 is provided on its inner side with a profiled element 18, 19; 20 which extends in the direction of the side edge 14, 15; 17 thereof. Each profiled element 18, 19; 20 has an engagement part 18a, 19a; 20a, in the shown embodiment formed by an L-shaped arm extending substantially perpendicular to the plane of the inner and outer wall members 4, 5. The profiled elements comprises rounded of edges to prevent damaging the bags. Please note that it will be clear for a person skilled in the art that other profiled elements comprising engagement parts can be used in different embodiments.

[0024] When the bags 11, 12 are correctly arranged as shown in Figure 1, each of the bags 11, 12 is filled with insulation material, in the present embodiment with silica grains, via the opening 13. 14. During filling the bags 11, 12 with insulation material the double wall construction 2 is vibrated by moving a platform 21 on which the double wall construction 2 is supported in different directions as indicated by the arrows. This vibration results in a proper filling of the bags with granular material.

[0025] After each of the bags 11, 12 has been filled with insulation material, the opening 13 is connected to an evacuation system (known per se) and an evacuation pressure is applied on the inside of the bags 11, 12. As a result of the application of an evacuation pressure the dimension of the bags 11, 12 is reduced, thereby causing the profiled elements 19, 20 to move away from each other. At a certain moment the engagement parts 19a, 20a engage one another so that the initially realized overlap of the two bags 11, 12 remains.

[0026] After a sufficient vacuum has been reached in the bags 11, 12, the opening 13 is hermetically sealed by any known means, resulting in a vacuum insulated container.

[0027] The upper side of the double wall 2 can be closed by connecting a top wall member (not shown in Figure 1) to the upper edges 8, 9 of the inner wall member 4 and the outer wall member 5.

[0028] Please note that in the rare case one of the bags is damaged and the hermetical seal is compromised replacement of said bags can be easily performed.

[0029] Thus a container 1 with an isolated double wall 2 is obtained in which said double wall 2 has a bottom wall member 3 and an inner wall member 4 and an outer wall member 5. Said inner wall member 4 and outer wall member 5 each has a bottom edge 6, 7 and an upper edge 8, 9 and are spaced from each other and connected to each other by the bottom wall member 3 at their re-

spective bottom edges 6, 7. The bottom wall member 3, inner wall member 4 and outer wall member 5 enclose an intermediate space 10, in which at least one hermetically sealed bag 11, 12 of flexible, air tight material is arranged. The bags 11, 12 are arranged in the intermediate space 10 and have at least one sealed opening 13, which is recessed in order not to protrude from the bag. Each bag 11, 12 is filled with insulation material (preferably silica grains) and is evacuated.

Claims

1. Container comprising at least one double wall, said double wall having a bottom wall member and an inner and an outer wall member, said inner wall member and outer wall member each having a bottom edge and an upper edge, said inner wall member and outer wall member being spaced from each other and connected to each other by the bottom wall member at their respective bottom edges, said bottom wall member, inner wall member and outer wall member enclosing an intermediate space, wherein said intermediate space comprises at least two hermetically sealed bags, each bag being of flexible, air tight material, each of said bags being arranged in the intermediate space and having at least one sealed opening, each of said bags further being filled with insulation material, each bag being evacuated, said bags each having opposite side edges extending substantially perpendicular to the bottom wall member, and wherein said bags overlap each other at their side edges.

2. Container according to claim 1, wherein said double wall comprises a corner, said at least one bag comprises a first side edge and a second side edge, said first side edge being positioned on one side with respect to the corner and said second side edge being positioned on the other side of the corner.

3. Container according to claim 1 or 2, wherein each bag is provided on its inner side with a profiled element which extends in the direction of the side edge thereof, said profiled element having an engagement part, the engagement parts two overlapping two bags being in engagement with each other.

4. Container according to any one of the preceding claims, wherein the insulation material is a granular material, preferably composed of silica grains.

5. Container according to any one of the preceding claims, wherein the at least one sealed opening is fitted with a tubular connection, said tubular connection being recessed.

6. Container according to any one of the preceding claims, wherein said flexible, air tight material is an impact resistant plastic material.

7. Method of insulating a double wall of a container, said method comprises the steps of:

   - providing a container comprising at least one double wall, said double wall having a bottom wall member and an inner and an outer wall member, said inner wall member and outer wall member each having a bottom edge and an upper edge, said inner wall member and outer wall member being spaced from each other and connected to each other by the bottom wall member at their respective bottom edges, said bottom wall member, inner wall member and outer wall member enclosing an intermediate space, said intermediate space being accessible from an upper side of the double wall defined by the upper edges of the inner wall member and the outer wall member;
   - providing at least one bag of flexible, air tight material, said at least one bag being hermetically sealed with the exception of at least one opening;
   - arranging the at least one bag in the intermediate space such that the at least one opening is accessible from the upper side;
   - filling the bag with insulation material via the at least one opening;
   - after the bag has been filled with insulation material, connecting the at least one opening to an evacuation system and applying an evacuation pressure on the inside of the bag; and
   - after a sufficient vacuum has been reached hermetically sealing the at least one opening of the bag.

8. Method according to claim 7, wherein the method comprises the steps of providing said double wall with a corner, providing said at least one bag with a first side edge and a second side edge, and arranging said at least one bag in the corner of the double wall such that said first side edge being positioned on one side with respect to the corner and said second side edge being positioned on the other side of the corner.

9. Method according to claim 7 or 8, wherein the method further comprises the steps of:

   - providing at least two bags of flexible, air tight material, each of said bags being hermetically sealed with the exception of at least one opening; providing each of the bags with opposite side edges;
   - arranging at least two bags in said intermediate space such that the at least one opening of each

bag is accessible from the upper side, such that the side edges extend substantially perpendicular to the bottom wall member of the double wall, and such that the bags overlap each other at respective side edges;
- filling each of the bags with insulation material via the at least one opening;
- after each of the bags has been filled with insulation material, connecting the at least one opening to an evacuation system and applying an evacuation pressure on the inside of the bag;
- after a sufficient vacuum has been reached hermetically sealing the at least one opening of each of the bags; and
- the step of arranging the bags in the intermediate space is performed such that the amount of overlap is such that after evacuation of both bags the bags still overlap each other.

10. Method according to claim 9, wherein the method comprises the step of providing each bag on its inner side with a profiled element which extends in the direction of the side edge thereof, each profiled element having an engagement part, and the step of arranging the at least two bags in the intermediate space such that after the evacuation pressure has been applied on the bags the engagements parts of the profiled elements of two overlapping bags engage each other.

11. Method according to any one of the claims 7 - 10, wherein the method comprises the step of providing said at least one bag with at least one filling opening for filling the bag with insulation material and with at least one separate evacuation opening, and the step of sealing all said openings after a sufficient vacuum has been reached.

12. Method according to any one of the claims 7 - 11, wherein the method comprises the step of closing the double wall by connecting a top wall member to the upper edges of the inner wall member and the outer wall member.

13. Method according to any one of the claims 7 - 12, wherein the method comprises the step of vibrating the double wall during the step of filling the at least one bag with insulation material.

14. Method according to any one of the claims 7 - 13, wherein the method comprises at least one step chosen from the group consisting of: using as insulation material granular material, preferably silica grains, and using as flexible material impact resistant plastic.

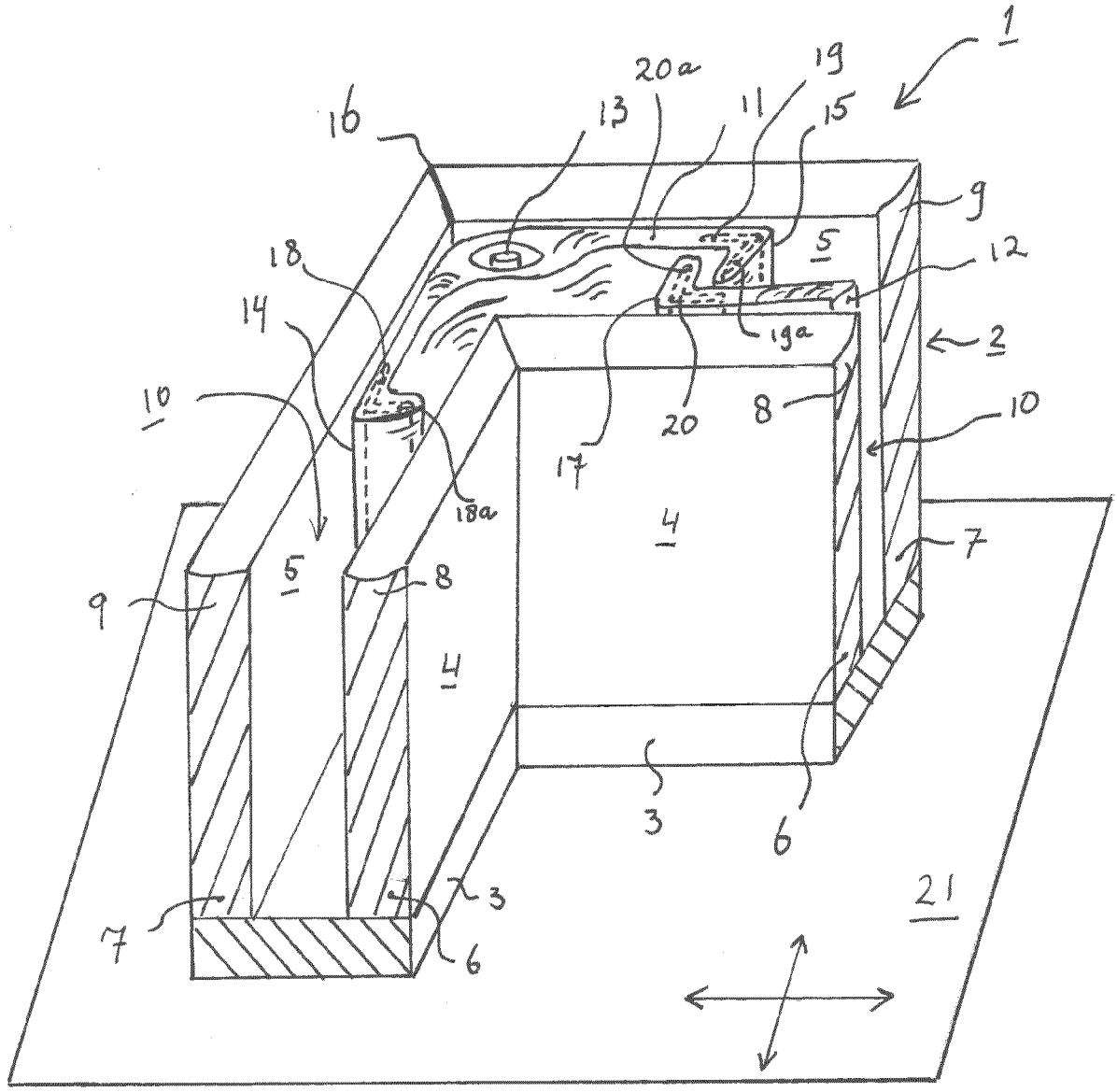
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Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 0563

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 2004/069789 A1 (OHNO TAKASHI [JP] ET AL) 15 April 2004 (2004-04-15) * page 2, paragraph 25 - page 4, paragraph 59 * * figures 1-5 * -----	1-14	INV. B65D81/38 B65D90/06 F16L59/065
A	JP 7 101476 A (NIPPON OXYGEN CO LTD) 18 April 1995 (1995-04-18) * abstract; figures 1-4 * -----	1,2,7,8	
A	JP 2006 161834 A (RENAISSANCE ENERGY INVESTMENT) 22 June 2006 (2006-06-22) * abstract; figures 2-4 * -----	1,3,4,7, 10,14	
A	US 2 128 336 A (FOLKE TORSTENSSON STURE) 30 August 1938 (1938-08-30) * page 1, column 1, line 30 - page 1, column 2, line 52 * * figures 1-3 * -----	5,11,13	
A	EP 0 645 576 A1 (ELECTROLUX AB [SE]) 29 March 1995 (1995-03-29) * page 2, line 34 - page 3, line 31 * * figures 1-6 * -----	7	TECHNICAL FIELDS SEARCHED (IPC) B65D F25D F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 June 2012	Piolat, Olivier

CATEGORY OF CITED DOCUMENTS

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& : member of the same patent family, corresponding document

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12-06-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004069789 A1	15-04-2004	JP 2004099145 A	02-04-2004
		US 2004069789 A1	15-04-2004
JP 7101476 A	18-04-1995	JP 2989447 B2	13-12-1999
		JP 7101476 A	18-04-1995
JP 2006161834 A	22-06-2006	JP 4303674 B2	29-07-2009
		JP 2006161834 A	22-06-2006
US 2128336 A	30-08-1938	NONE	
EP 0645576 A1	29-03-1995	AU 674989 B2	16-01-1997
		DE 69401889 D1	10-04-1997
		DE 69401889 T2	04-09-1997
		DK 0645576 T3	15-09-1997
		EP 0645576 A1	29-03-1995
		ES 2099564 T3	16-05-1997
		JP 7174290 A	11-07-1995
		NZ 264455 A	27-06-1995
		SE 501701 C2	24-04-1995
		SE 9303180 A	30-03-1995
		US 5509248 A	23-04-1996

EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6109712 A **[0002]**