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- (72) Inventor; and
- (71) Applicant : **FIKKERT, Tom Franklin** [NL/NL]; Ruiters-
steeg 4, NL-9752 VB Haren (NL).
- (72) Inventor: **FIKKERT, Tom Franklin**; Ruiterssteeg 4, NL-
9752 VB Haren (NL).
- (74) Agent: **LUBBERDINK, Pim**; Arnold & Siedsma, Bezuid-
enhoutseweg 57, NL-2594 AC Den Haag (NL).
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[Continued on next page]

(54) Title: INJECTION-MOULDED PLASTIC CRATE AND METHOD THEREFOR

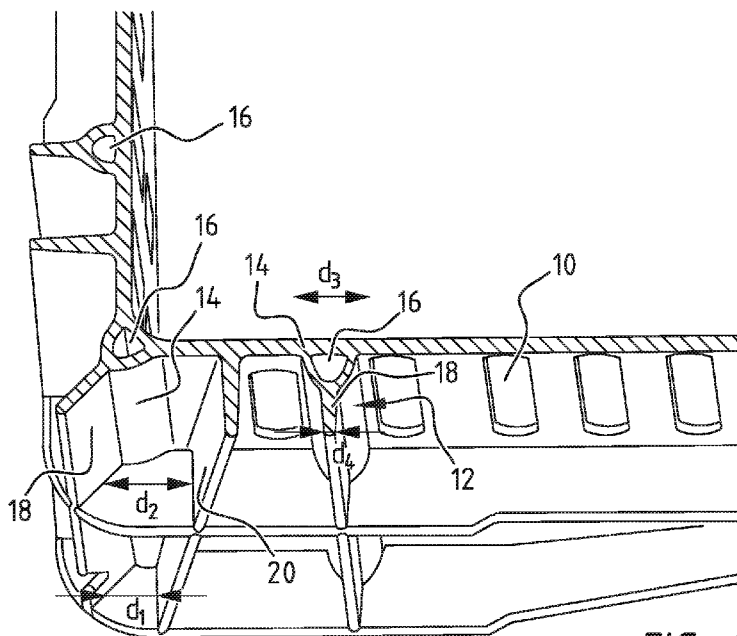


FIG. 2

(57) Abstract: The invention relates to an injection-moulded plastic crate and a method for manufacture thereof. The injection-moulded plastic crate comprises: - a bottom; and - upright walls extending from the bottom, wherein a substantially vertical stiffening rib is arranged on at least one of the upright walls, characterized in that the vertical stiffening rib takes a hollow form.

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INJECTION-MOULDED PLASTIC CRATE AND METHOD THEREFOR

The invention relates to an injection-moulded plastic crate. Such crates are used to transport all kinds of articles, such as vegetables, fruit and flower bulbs. Plastic crates are known in practice which have a bottom and upright walls extending from the bottom. This is a rectangular bottom, wherein four upright walls are provided.

Such crates are often stacked. The bottom crate in the stack must be able to bear the weight of the crates with content above it. This is for instance more than 500 kg. This is standard for the design of the crate: any crate can after all be the bottom crate in the stack during use.

Crates are usually manufactured from polyethylene (also polythene). The crate is however given a relatively heavy form in order to be able to bear sufficient weight. This results in relatively high transport costs and likewise in relatively high production costs, since a relatively large amount of material has to be used. It is possible to produce the crates from the stiffer polypropylene. A polyethylene crate weighing about 1.7 kg has for instance a strength similar to that of a polypropylene crate of the same volume weighing only about 1.3 kg. Polypropylene has the drawback however that it becomes brittle at the low temperatures which are usual during use of the crate (for instance for vegetables, fruit and flower bulbs).

An object of the invention is to obviate or at least reduce the above stated problems by providing a lightweight crate which can nevertheless bear a relatively high weight.

This object is achieved with the injection-moulded plastic crate according to the invention, comprising:

- a bottom; and
- upright walls extending from the bottom, wherein a substantially vertical stiffening rib is arranged on at least one of the upright walls, characterized in that the vertical rib takes a hollow form.

Giving the vertical ribs a hollow form increases the stiffness of the ribs. The construction is hereby strengthened and the crate can bear a greater load, while the weight of the crate is at the same time reduced by giving the ribs a hollow form.

The bottom is preferably substantially rectangular and four mutually connecting walls are provided. Four corners are hereby defined which can take a right-angled form or be rounded to some extent.

In a preferred embodiment the plastic comprises polyethylene (PE) and/or polypropylene (PP). In contrast to polypropylene, polyethylene does not become brittle at low temperatures. Polyethylene is however less stiff than polypropylene. However, by giving the vertical rib a hollow form use can still be made of polyethylene to provide a light-weight crate which can bear an increased load. The crate according to the invention can however also be embodied in

polypropylene or other suitable plastic.

The crate is preferably injection-moulded in one part. This results in an advantage in production, whereby costs are saved. The crate is preferably injection moulded, wherein use is made of fluid injection for the purpose of forming the hollow rib. This results in a rapid production cycle. Shrinkage of the plastic during production is moreover prevented by the fluid that is present. The fluid is for instance a gas such as nitrogen or carbon dioxide, or a liquid such as water.

In a preferred embodiment the stiffening rib is arranged on the outer side of the at least one upright wall.

The stiffening rib preferably extends over substantially the whole height of the respective upright wall, i.e. from the bottom to an upper edge of the crate.

The rib extends for instance over the whole height, or a minimum of 95% of the height. The rib extends for instance from the bottom to a point 8-10 mm below the upper side of the crate.

In a preferred embodiment the width of the stiffening rib measured in the longitudinal direction of the upright wall amounts to a maximum of 12 mm, preferably a maximum of 10 mm and most preferably a maximum of 8 mm.

It is per se known to give thick parts of plastic objects a hollow form. Deformation of thick parts due to shrinkage of the plastic during curing is thus prevented. This is applied for instance in handles of crates. According to the invention however, a relatively thin part (a maximum of 12 mm) takes a hollow form. This is moreover a vertical rib which, because it takes a hollow form, is provided with an increased stiffness.

In a further preferred embodiment the cavity in the stiffening rib has a diameter of a maximum of 6 mm, preferably a maximum of 5 mm and most preferably a maximum of 4 mm.

The width of the stiffening rib is preferably a maximum of 12 mm, a maximum of 10 mm, a maximum of 8 mm in combination with a cavity with a diameter of respectively a maximum of 6 mm, a maximum of 5 mm, a maximum of 4 mm.

The cavity in the stiffening rib preferably has substantially the same diameter over the length of the stiffening rib.

The cross-section of the cavity is preferably substantially round or elliptical.

In a preferred embodiment according to the invention the at least one stiffening rib comprises:

- a main part adjacent to the upright wall and comprising a cavity; and
- a plate-like part extending outward from the main part, wherein the width of the plate-like part is narrower than the width of the main part, measured in the direction along the upright wall.

The main part and the plate-like part are embodied integrally. The main part has for instance a substantially round cross-section, a substantially half-round cross-section or a substantially rectangular cross-section. Other shapes are however also possible according to the invention.

In a further preferred embodiment the width of the plate-like part measured in the direction along the upright wall amounts to a maximum of 5 mm, preferably a maximum of 4 mm, more preferably a maximum of 3 mm, still more preferably a maximum of 2 mm, and most preferably about 1.6 mm.

5 In a preferred embodiment the at least one stiffening rib is arranged in a corner of the crate.

When crates are stacked, a large part of the load comes to bear on the corner parts of the crate. The stiffening rib in the corner therefore increases the load which the crate can bear.

In a further preferred embodiment the crate comprises a second rib or a profile which is arranged on at least one of the upright walls and runs obliquely relative to the stiffening rib in the corner of the crate. The second rib or the second profile is for instance located a greater distance from the stiffening rib at the bottom of the crate than on the upper side of the crate. This imparts extra strength to the crate.

The crate is preferably a stackable crate.

In a preferred embodiment the upright walls have an open structure. Alternatively or additionally, the bottom preferably likewise has an open structure. Openings are preferably provided in the upright walls. This reduces the weight of the crate, while not detracting from the stiffness of the walls. The open structure moreover enables ventilation of the crate, so that both air and moisture can flow into and out of the crate.

15 The invention also relates to a method for injection moulding the crate as described above, the method comprising of:

- injecting a melted plastic into a mould; and
- injecting the plastic with a fluid, such as a gas, such that the stiffening rib is embodied as a hollow rib.

The fluid can be a gas such as nitrogen or carbon dioxide, or a liquid such as water.

25 Gas-assisted injection moulding or water-assisted injection moulding is per se known in the prior art. This technique is however applied so as to give relatively thick parts (more than 2 cm) a hollow form. Handles, for instance in the field of plastic crates, often take a hollow form so as to thereby prevent deformation of the plastic through shrinkage. The invention relates however to giving relatively thin parts, i.e. the stiffening rib, a hollow form in order to thus increase the stiffness.

The cavity in the stiffening rib is preferably formed solely by the injected fluid. This means that no additional means, such as cores which are moved into and out of the mould, are required for the purpose of forming the hollow rib. This makes the method easy to perform and avoids high mould costs.

35 In a preferred embodiment the mould defines a flow leader for a uniform filling of the mould, which flow leader comprises the stiffening rib. The mould defines the form of the crate to

be produced. When the plastic is injected into the mould, the plastic spreads from the injection point to the other parts of the mould. If the mould is not filled uniformly, this can have an effect on the product, which then has deviations from the desired design. So-called flow leaders and flow restrictors are applied in order to prevent this. A flow leader is a part which is thicker than adjacent parts, so that the plastic encounters less resistance in the flow leader during the injection moulding. The flow leaders are warmer than the adjacent parts during the injection moulding, so that the plastic flows more readily there. Injected fluid (gas or water) will likewise follow the path of least resistance and therefore flow via the flow leaders. The stiffening rib is formed according to the invention by such a flow leader.

10 The mould preferably comprises only one injection point. The injection point is preferably situated at a position corresponding to a substantially central position in the bottom of the crate. Flow leaders are for instance configured to extend from this central injection point in the bottom to the corner points of the crate for a uniform filling of the crate with the melted plastic. The fluid is preferably injected into the mould via the nozzle for injecting melted plastic. The fluid, such as a
15 gas, substantially follows the flow leaders, whereby the stiffening ribs at the corner points of the crate are given a hollow form. In the case that flow leaders are also present in the bottom, hollow stiffening ribs are likewise formed in the bottom.

A constant pressure is preferably used for injection of gas.

A short-shot process is preferably applied. This entails a determined quantity of plastic being
20 introduced into the mould which is per se insufficient to completely fill the mould. The mould is only completely filled by a fluid such as gas also being injected. The injection of the fluid such as gas can begin some time after filling of the mould has begun, or take place simultaneously. The material displaced by the fluid ultimately forms part of the crate. There can alternatively be a plurality of injection points for the fluid. Gas or water is for instance injected into one of the four
25 corner points of the crate, this being advantageous when the ribs are provided at the corner points.

The same advantages and effects as described above in respect of the crate according to the invention apply for the method according to the invention.

Further advantages, details and effects of the invention will be described on the basis of exemplary embodiments thereof, wherein reference is made to the following figures:

30 Figure 1 shows an injection-moulded plastic crate according to the invention;

Figure 2 shows a detail of the plastic crate of figure 1; and

Figure 3 shows a side view of the crate according to figures 1 and 2.

Crate 2 (figure 1) comprises a rectangular bottom 4 and four side walls 6. Upright walls 6 are provided with handles 8 which are formed as openings in walls 6. Each side wall moreover
35 comprises ventilation openings 10. Ribs 12 are provided for the purpose of strengthening upright walls 6. In the shown embodiment ribs 12 are situated at the corner points and other locations of

the crate.

Each stiffening rib 12 comprises a main part 14 (figure 2) adjacent to upright wall 6, which main part takes a hollow form due to gas injection during injection moulding of crate 2. Cavity 16 is situated in this main part. The main part is formed integrally with plate-like part 18. The cross-section of the main part tapers in the direction of the outer side of the crate and transposes into plate-like part 18. Plate-like part 18 does not take a hollow form. It is noted that plate-like part 18 is optional, the ribs can also be embodied with main part 14 alone.

In the shown embodiment a rib 12 is situated at the corner point of the crate, wherein the plate-like part forms an angle of about 45 degrees relative to upright walls 6. A further rib 12 is provided on each wall close to the corner rib. A plate-like profile is arranged between the corner rib and the further rib. This profile has an inclining position. The upper side of the oblique profile here lies closer to the corner rib than the underside of the oblique profile. The distance d1 between the oblique profile and the corner rib measured at an upper side of the crate is smaller than a distance d2 between these parts measured at a lower position.

A crate according to the invention has for instance a weight of 1.2 kg and sufficient load-bearing capacity.

A crate according to the invention for instance realizes a load-bearing capacity of a minimum of 100 kg, preferably a minimum of 250 kg, more preferably a minimum of 500 kg, still more preferably a minimum of 1000 kg, still more preferably a minimum of 1500 kg and most preferably a minimum of 2000 kg.

Crate 2 is produced by injection moulding with gas injection. Provided for this purpose is a mould which defines the contours of crate 2. A determined quantity of liquid plastic, such as polyethylene or polypropylene, is injected into the mould via an injection point.

This quantity is in itself insufficient to wholly fill the mould. In other words, the space in the mould is greater than the volume of the injected plastic. The plastic will only be distributed fully over the mould by the gas injection.

The injection point is located at a position corresponding to the centre of the bottom of the crate. The mould defines flow leaders from the injection point to the corner points of the crate. Flow leaders for the stiffening rib are defined from this corner point. Shortly after injection of the plastic, or even simultaneously, gas is injected which is distributed over the mould via the flow leaders, wherein hollow parts are formed, including hollow rib 12.

The above-stated example describes the injection moulding with gas injection. According to the invention injection moulding is also possible with injection of a liquid, for instance water.

The invention is by no means limited to the above described preferred embodiments thereof. The rights sought are defined by the following claims, within the scope of which many modifications can be envisaged.

Claims

1. Injection-moulded plastic crate, comprising:
- a bottom; and
 - 5 - upright walls extending from the bottom,
- wherein a substantially vertical stiffening rib is arranged on at least one of the upright walls, characterized in that
- the vertical stiffening rib takes a hollow form.
- 10 2. Crate as claimed in claim 1, wherein the plastic comprises polyethylene and/or polypropylene.
3. Crate as claimed in claim 1 or 2, wherein the stiffening rib is arranged on the outer side of the at least one upright wall.
- 15 4. Crate as claimed in claim 1, 2 or 3, wherein the stiffening rib extends over substantially the whole height of the respective upright wall.
5. Crate as claimed in any of the foregoing claims, wherein the crate is injection-moulded in one part.
- 20 6. Crate as claimed in any of the foregoing claims, wherein the width of the stiffening rib measured in the longitudinal direction of the upright wall amounts to a maximum of 12 mm, preferably a maximum of 10 mm and most preferably a maximum of 8 mm.
- 25 7. Crate as claimed in claim 6, wherein the cavity in the stiffening rib has a diameter of a maximum of 6 mm, preferably a maximum of 5 mm and most preferably a maximum of 4 mm.
8. Crate as claimed in any of the foregoing claims, the at least one stiffening rib comprising:
- a main part adjacent to the upright wall and comprising the cavity; and
 - 30 - a plate-like part extending outward from the main part,
- wherein the width of the plate-like part is narrower than the width of the main part, measured in the direction along the upright wall.
9. Crate as claimed in claim 8, wherein the width of the plate-like part measured in the direction along the upright wall amounts to a maximum of 5 mm, preferably a maximum of 4 mm, more
- 35 preferably a maximum of 3 mm, still more preferably a maximum of 2 mm, and most preferably about 1.6 mm.

10. Crate as claimed in any of the foregoing claims, wherein the at least one stiffening rib is arranged in a corner of the crate.

11. Crate as claimed in claim 10, further comprising a second rib or a profile, which second rib or profile is arranged on at least one of the upright walls and runs obliquely relative to the stiffening rib in the corner of the crate.

12. Crate as claimed in any of the foregoing claims, wherein the crate is a stackable crate.

13. Crate as claimed in any of the foregoing claims, wherein the upright walls have an open structure.

14. Method for injection moulding a crate as claimed in any of the foregoing claims, the method comprising of:

- injecting melted plastic into a mould; and
- injecting the plastic with a fluid, such as a gas, such that the stiffening rib is embodied as a hollow rib.

15. Method as claimed in claim 14, wherein the cavity in the rib is formed solely by the injected fluid.

16. Method as claimed in claim 14 or 15, wherein the mould defines a flow leader for a uniform filling of the mould, which flow leader comprises the stiffening rib.

17. Method as claimed in claim 14, 15 or 16, wherein the mould comprises only one injection point.

18. Method as claimed in claim 17, wherein the injection point is situated at a position corresponding to a substantially central position in the bottom of the crate.

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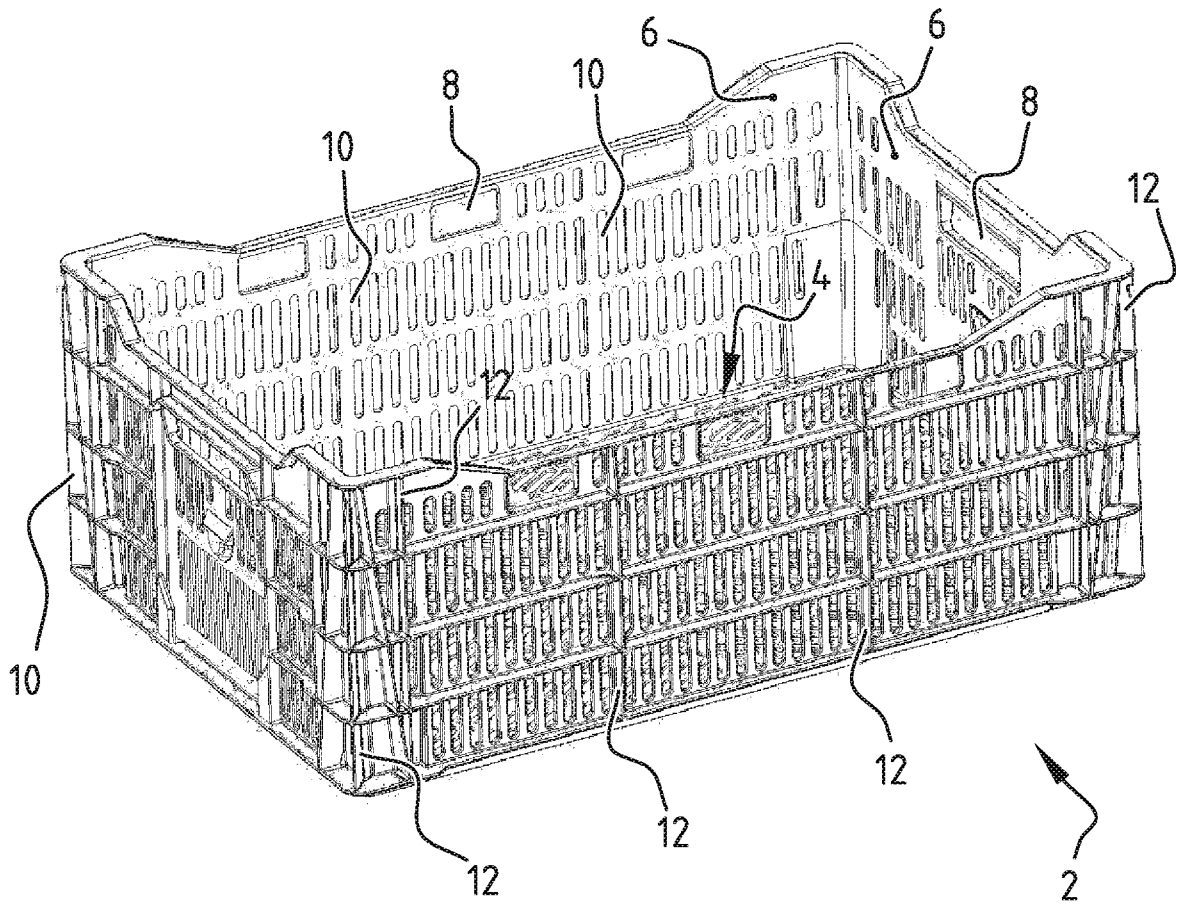


FIG. 1

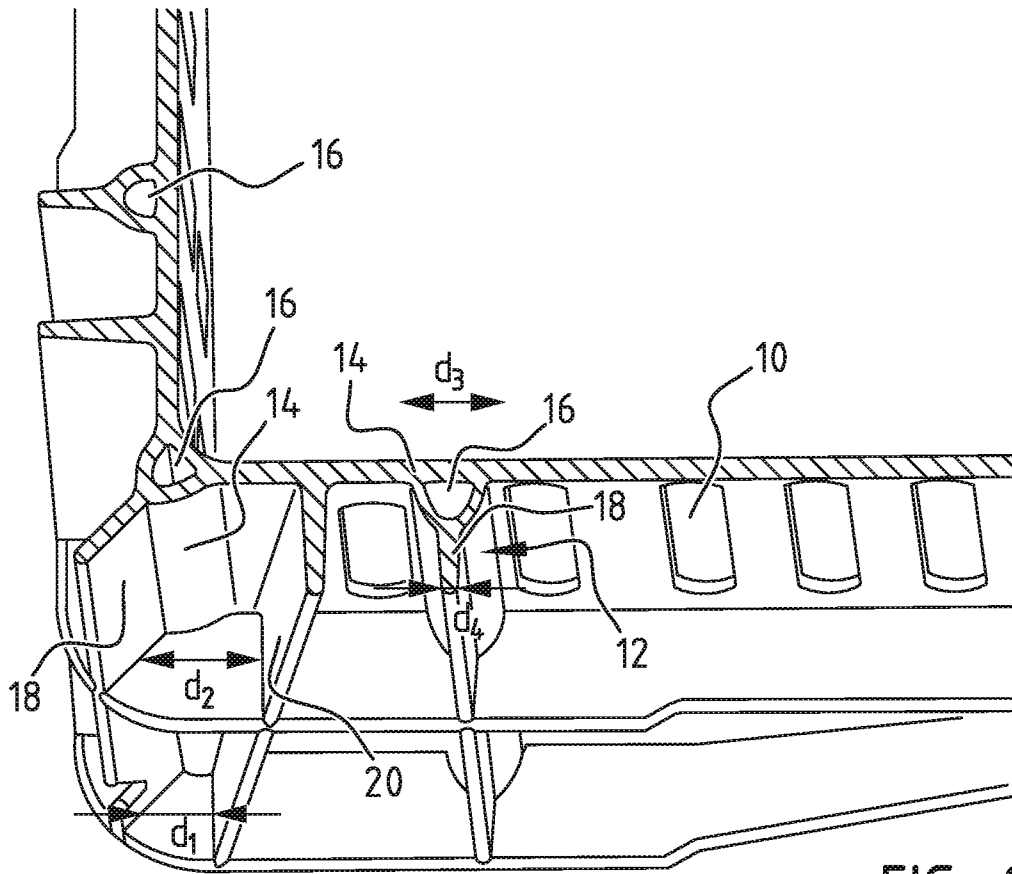


FIG. 2

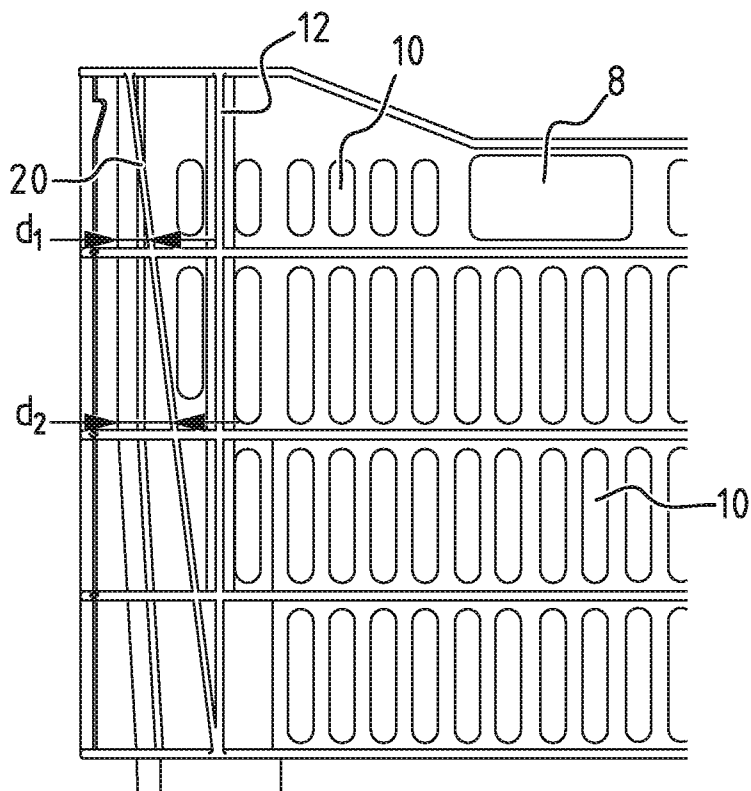


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2014/050797

A. CLASSIFICATION OF SUBJECT MATTER INV. B65D1/42 ADD. B29L31/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B65D B29L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 395 010 A (UMIKER HANS [CH]) 7 March 1995 (1995-03-07)	1,2,4-7, 10,12, 14-16
Y	column 1, line 54 - line 59 column 3, line 18 - line 22; figure 1 column 3, line 31 - line 33; figure 5 -----	3,11,13, 17,18
Y	EP 1 705 128 A2 (INFIA SRL [IT]) 27 September 2006 (2006-09-27) figure 3 -----	3,11
Y	US 4 520 941 A (HAGAN JOHN A [US] ET AL) 4 June 1985 (1985-06-04) figures -----	13
Y	US 5 855 277 A (APPS WILLIAM P [US] ET AL) 5 January 1999 (1999-01-05) column 4, line 64 - line 67 -----	17,18
-/--		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search <div style="text-align: center; font-size: 1.2em;">23 January 2015</div>	Date of mailing of the international search report <div style="text-align: center; font-size: 1.2em;">30/01/2015</div>	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <div style="text-align: center; font-size: 1.2em;">Bridault, Alain</div>	

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2014/050797

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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