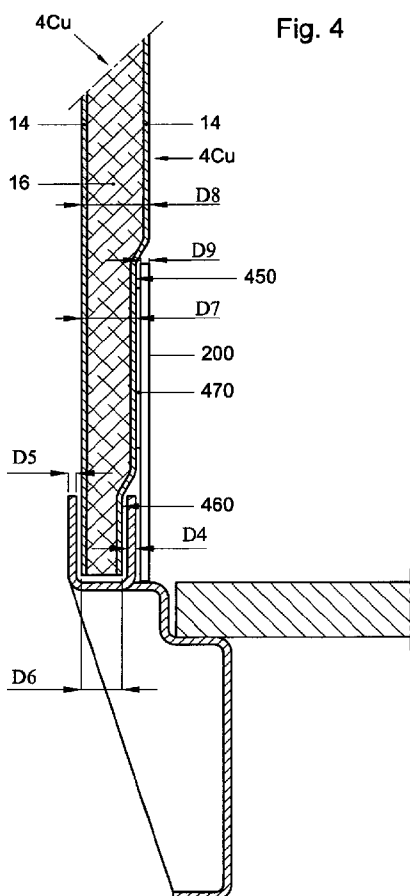




- (51) **International Patent Classification:**  
**B65D 90/02** (2006.01)    **B32B 5/28** (2006.01)  
**B65D 90/08** (2006.01)    **B65D 88/12** (2006.01)
- (21) **International Application Number:**  
PCT/EP2012/061209
- (22) **International Filing Date:**  
13 June 2012 (13.06.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
11169825.4    14 June 2011 (14.06.2011)    EP  
11169828.8    14 June 2011 (14.06.2011)    EP  
11169831.2    14 June 2011 (14.06.2011)    EP  
11169833.8    14 June 2011 (14.06.2011)    EP  
11169836.1    14 June 2011 (14.06.2011)    EP
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,

[Continued on next page]

(54) **Title:** COMPOSITE SHIPPING CONTAINER HAVING SCUFF PLATES**Fig. 4**

(57) **Abstract:** The invention provides a shipping container (2) comprising: a plurality of walls (4) that form, in use, at least a top wall (4A), a floor wall (4B), and a plurality of side walls (4C) of the shipping container (2). At least one of the side walls (4C) comprises a composite structure, and in mechanical, load transferring contact with, both outer laminate layers, said core layer in use supporting the outer laminate layers. The fibre-reinforced composite wall structure of the at least one side wall is recessed along a length direction of the side wall to form a recessed side wall portion positioned adjacent the floor wall of the container. In addition, a protective plate of between 1-10 mm thickness is attached to the side wall at the location of the recessed side wall portion.



DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**(84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH,

**Published:**

— *with international search report (Art. 21(3))*

### COMPOSITE SHIPPING CONTAINER HAVING SCUFF PLATES

The invention relates to a shipping container comprising: - a plurality of walls that form, in use, at least a top wall, a floor wall, and a plurality of side walls of the shipping container, and - a frame for mechanically fixing at least one of the side walls and the floor wall thereto.

Shipping containers are often used for transport of goods over sea or land. Cargo ships can be loaded with many shipping containers. In a harbour, these shipping containers can be transferred to e.g. trucks or inland naval vessels. During such transfer, a hoisting crane may be used for raising the shipping containers from the ship and depositing the shipping containers on land, on a truck or on another ship.

During transport on sea or when stored on land, shipping containers may be stacked on top of each other. A shipping container may therefore experience a substantial load from other shipping containers that are present on top of said shipping container. In addition, during lifting a shipping container by means of a hoisting crane, significant stresses may be experienced by the shipping container. In order to withstand these different types of loads, known shipping containers are usually made of corrugated steel. Steel walls of the known shipping containers are strong enough to be able to withstand these loads.

However, known steel shipping containers also have disadvantages. One of these is that such shipping containers are relatively heavy. Shipping containers may be filled with goods which may form a significant part of the weight of a filled shipping container. However, the weight of a known steel shipping container itself usually forms a significant part of said total weight as well. An increased weight of the shipping container introduces various possible problems. It may for example increase fuel costs during transport of the container over sea, land, rail, limit an amount of shipping containers placed on a ship.

In order to decrease a weight of a shipping container, it has recently been proposed in US 7,059,488 to use a fibre-reinforced material (or, in other words, a composite material) for manufacture of walls of a shipping container. Such material couples a relatively low weight to a relatively high strength.

Furthermore the composite side walls are softer than steel inner walls, and thereby more easily scratched when mechanical forces are applied to the wall with hard objects, such as pallets containing metal nails. Especially during loading and offloading, pallets are scratching against the composite panels at the bottom side

of the panel, close to the container floor. To prevent damage of the composite side panels near the bottom, a protective scuff plate can be attached to that portion of the composite panel. A scuff plate is a thin plate (between 1 – 5 mm) of a very strong material. US2007/0194602 discloses a trailer with a thermoplastic fibreglass-reinforced plastic scuff plate. The scuff plate is fused against the wall liner.

It has been found that, if sandwich construction is used, optimum side walls should be dimensioned relatively thick of about 15- 50 mm in cross section. However, standardised dimensions (e.g. according to an ISO standard) limit both the inner and outer dimension of a container, thereby may limit a maximum thickness of the at least one side wall. For example, for a standard 10, 20 or 40ft shipping container a prescribed width is 8 ft (amounting to 2.44 m). Furthermore the internal width is also prescribed, which amounts for the 40ft container to 7.8' ft (2.35m). With a 45ft pallet-wide container it even gets more tight as the outer dimension is 2500 mm, the inner width is 2440 mm, and the required space for three Euro-pallets is 2400, leaving just 2x 30 mm space for sidewall thickness, and 40/3 mm in between the Euro-pallets, all required for loading/off loading. Relevant standards may be for example: ISO 668:1995 Freight containers, classification dimensions and ratings; ISO 830:1999 Freight containers, vocabulary; NEN ISO 1496, structural integrity and testing standards for containers; NEN ISO 1161, corner fittings and strength requirements; and/or COMMITTEE DRAFT ISO/CD 18185-6 seal requirements. Thus when a scuff plate is attached on the composite panel on both inner side walls, the inner diameter of the container is compromised with 2 – 10 mm. This is not acceptable taking into account the necessity to fit a number of standard euro pallets.

It is therefore an object of the invention to provide an improved composite shipping container that at least partly meets a problem mentioned above.

Accordingly, the invention provides a shipping container comprising a plurality of walls that form, in use, at least a floor wall, and a plurality of side walls of the shipping container, and a frame for mechanically fixing one or more of the side walls and the floor wall thereto, wherein the frame comprises a bottom side rail arranged for fixing thereto the floor wall and the side walls so that the side walls extend from the bottom side rail in a side wall direction in use directed upwards, wherein at least one of the plurality of side walls comprises a fibre-reinforced composite wall material, said at least one side wall comprising an inner face which is in use facing an interior of said container, wherein the inner face of the at least one side wall is recessed along a length direction of the side wall to form a recessed side wall portion positioned adjacent

the floor wall of the container; and wherein a protective plate of between 1-10 mm thickness is attached to the side wall at the location of the recessed side wall portion.

With this solution damage risk is reduced, inner size not compromised resulting in maximal average thickness of the sidewall.

According to a further embodiment, the protective plate is fixed to the recessed side wall portion, such as to reinforce the side wall at the recessed side wall portion. Such fixing may be achieved by means of any suitable manner of fixing, such as the use of bolts, rivets, nails, and the like. However, in order to achieve proper distribution of forces across the panel, the fixing of the protective plate to the side wall is preferably achieved using an adhesive composition, such as (but not limited to) a glue or a resin, or an adhesive strip.

In relation to the above, the skilled person will appreciate that efficient use of space within a container is of utmost importance. Transportation of goods across long distances over land and seas is expensive, and any unused space within a shipping container therefore unnecessarily adds on to the costs. Goods are therefore packed and stacked in such a manner as to 'just fit' into the containers, leaving very little margin for moving the goods into and out of the containers. The use of protective scuff plates as described prevents damage to the side walls of the containers, and in view of the little margins for loading the benefits of this are clear. It will also be appreciated that the recessed side wall portion for accommodating the protective scuff plate also provides a major benefit in view of the loading margins (typically 20 though 40 mm on each side of the container), since otherwise the 1 through 10 mm thick protective scuff plate reduces the already small loading margins significantly.

However, although the synergy between the protective plate and the recessed side wall portion is evident, it will be appreciated that the recessed portion of the side wall locally reduced the strength thereof. Receiving high bending loads, the recessed side wall portions may form a weak spot of the side walls, and any breaking or tearing may take place in that region. This is however prevented in the embodiment wherein the protective plate is fixed to the recessed side wall portion, in particular if fixing means are used that enable proper distribution of loads. In this manner, the side wall is reinforced by the protective scuff plate.

The invention will now be described, in a non-limiting way, with reference to the accompanying drawings, in which:

Brief description of the drawings

Figure 1 schematically shows a perspective view of a shipping container, in a first embodiment according to the invention;

Figure 2 schematically shows a perspective view of corner part of a shipping container, indicated in figure 1;

Figure 3 schematically shows a perspective view of a further embodiment of detail 2C in Figure 1;

Figure 4 shows a cross sectional view of the embodiment of Figure 3

Figure 5 schematically shows a perspective view of a side part of a shipping container, indicated in figure 1;

Figure 6 shows a perspective view of at least part of a floor wall; and

Figure 7 shows a cross-section of a bottom side rail in one embodiment.

Unless stated otherwise, like reference numerals refer to like elements throughout the drawings.

Figure 1 schematically shows a perspective view of a shipping container 2, in a first embodiment according to the invention. The shipping container 2 comprises a plurality of walls 4. The plurality of walls 4 form, in use, at least a top wall 4A, a floor wall 4B, and a plurality of side walls 4C of the shipping container. More in general, the term 'composite shipping container' may be used for indicating a shipping container comprising a fibre-reinforced composite wall material. The shipping container 2 further comprises a frame 6 for mechanically fixing at least one, e.g. two, of the side walls 4C, and the floor wall 4B thereto. Thus, two or more, e.g. all, walls 4 of the shipping container may be fixed to said frame 6.

The frame 6 comprises at least a bottom side rail 6A (or in other words, a lower side rail 6A) to which the floor wall 4B and the at least one of the side walls 4C are fixed. As a result, the at least one of the side walls 4C extends from the bottom side rail 6A in a side wall direction 8 towards the top wall 4A. The side-wall direction 8 may be substantially parallel with a surface, e.g. an outside surface 10, of the at least one side wall 4C, in particular of an upper part of the at least one side wall 4C.

The shipping container 2 may be a 40 foot shipping container, or may have another, preferably standardised, size. A maximum width, measured in a direction perpendicular to the outside surface 10 of the at least one side wall 4C, of a type of shipping container may usually be standardised, e.g. according to an ISO standard.

Also, a minimum distance between the at least one side wall 4C and another, opposite, side wall is usually standardised, e.g. according to the ISO standard. Thus, a maximum wall thickness of the at least one side wall may be defined by a difference between said maximum thickness and said minimum distance. To prevent a possibility of significant bulging, or even buckling, of the at least side wall, it may be beneficial to have a relatively large thickness of the at least one side wall. The side wall comprises a laminate structure further exemplified in Figure 2. A typical of the laminate structure thickness ranges between 3 and 5 cm with a core material of for example light polymer foam of between 40 – 120 kg/m<sup>3</sup>. In a variation, the fibre-reinforced composite wall material is formed by another composite structure, such as a pultrudate. Pultrudates are formed by means of a pultrusion process, which process is known as such to the skilled person. Examples (non-limiting) of core materials could be; PVC, PET, PA, PU,- foams. For reefer applications, the walls may be even thicker, for example, up to 100 mm. Thus, preferably, parts protruding out of bottom side rail along the transverse direction, may be substantially prevented. Then, a relatively large thickness of the at least one side wall may be realised, while the ISO standard can still be met.

Figure 2 schematically shows a perspective view of a cross-sectional detail 2C of a shipping container 2, indicated in figure 1. Here, a schematic construction of a corner part 2C is disclosed. The corner part 2C comprises cross member bars 40 that may be attached, e.g. welded, to an inner side of a base part 18 forming a part of the container frame 6. Further frame parts are formed by posts 6p that hold the fibre-reinforced plastic laminate structure of the side wall 4. A protective plate 200 of between 1-10 mm thickness is attached to the laminate structure at the location of the recessed side wall portion. In an embodiment, the protective plate 200 is formed of a metal or fibreglass-reinforced plastic plate or non fibreglass reinforced plastic plate. This could be both thermoset or thermoplast material. A suitable product is commercially available as Twintex manufactured by Owens Corning. Preferably, the protective plate 200 is formed of a fibre glass reinforced thermosetting resin.

Figure 3 schematically shows a perspective view of a further embodiment of detail 2C in Figure 1. In particular, in this embodiment, the fibre-reinforced plastic laminate structure of the at least one inner side wall 4 is recessed along a length direction of the side wall to form a recess 450 positioned adjacent the floor wall 400 of the container. Bottom side rail 18 may be welded to a corner casting 180. The plate 200 is a plate of between 1-10 mm thickness and is attached to the

laminate structure 4 at the location of the recess 450. Attachment can be done by gluing or welding techniques known in the art.

Figure 4 shows a cross sectional view of the embodiment of Figure 3. The recess 450 is formed with a height above the floor wall 400 of about 30-100 cm. By providing a core layer 16 with a preformed recess, for example, by moulding, milling or the like; and vacuum forming the laminate layers 14 the recess 450 can be suitably formed. A further recess 460 is formed in such a way that a thickness of a lower side wall portion is smaller than a thickness of the recessed side wall portion in the recess for the plate. As seen in figure 4, the lower side wall portion is fixed in between the flanges of the bottom side rail.

A thickness D6 of the lower side wall portion may be smaller than a largest thickness D7 of the recessed side wall portion. Preferably, the sum of the thickness D4 of the first flange, a thickness D5 of the second flange, and the thickness D6 of the lower portion of the at least one side wall, is similar, e.g. approximately equal, to the thickness D7 of the recessed part 450 of the at least one side wall 4C. Further, preferably, the thickness D9 of the plate 200 is substantially equal to the recess gap formed by the largest thickness D8 of the upper side wall portion 4Cu minus the thickness of recessed part 450, so that the plate and inner side wall extend as an integral part in a single plane. More preferably, the sum of the thickness of D9 and a thickness of and an (optional) adhesive layer, such as adhesive layer 470 described below, is substantially equal to the recess gap formed by the largest thickness D8 of the upper side wall portion 4Cu minus the thickness D7 of recessed part 450.

An adhesive 470, such as a glue or resin, or an adhesive strip or tape, is preferably present in between plate 200 and the recess 450, fixing the protective plate 200 to the side wall 4C. The fixing results in a reinforcement of the side wall at the location of the recess 450 by means of the protective scuff plate 200. Preferably, the fixation is effected by the use of an adhesive, such as for example double-sided acrylic foam tape.

In this way, the plate is embedded in the inner wall portion 4Ci and the inner width of the container is uncompromised.

Figure 5 schematically shows another sectional view of a cross-sectional detail 2S of the shipping container 2, indicated in Figure 1. The at least one of the side walls 4C comprises a laminate structure 12. The shipping container 2 may thus be a composite shipping container. The laminate structure 12 comprises a first and a second, i.e. at least two, outer laminate layers 14A respectively 14B. At least one

of said outer laminate layers 14A, 14B, preferably both of said outer laminate layers, are at least partly formed by a fibre-reinforced composite wall material. The fibre-reinforced composite wall material may comprise fibre layers oriented in different directions. The fibre layers may be embedded in a matrix, e.g. an organic matrix, e.g. a resin. An amount of said fibre layers, an orientation of fibres of said fibre layers, and an order of said fibres layers may be adapted for optimizing a strength of the laminate structure 12.

The laminate structure 12 further comprises a core layer 16 arranged in between, and in mechanical load transferring contact with, both outer laminate layers 14A, 14B. In use, the core layer 16 supports the outer laminate layers 14A, 14B. The core layer may e.g. comprise a polymer foam. As a result of the core layer, a vulnerability of the laminate structure 12 for impacts on the at least one side wall 4C is reduced. The use of a laminate structure for building walls 4, e.g. side walls, of shipping containers 2 may result in a substantial weight decrease of such shipping containers 2, compared to the traditional shipping containers having corrugated steel sheet walls.

More in general, all side walls (e.g. four side walls) of the shipping container 2, and optionally the top wall of the shipping container 2, may comprise the laminate structure 12. Thus, a relatively large weight decrease can be realised.

The bottom side rail (bottom side-rail) 6A comprises a base part, indicated in Figure 5 by an imaginary dashed box 18 that contains said base part. The base part 18 includes a standing portion 18A for fixing the floor wall thereto. The standing portion 18A extends along the bottom side rail 6A. The standing portion 18A also extends along an, in use, upward direction 11. The base part 18 may typically be provided from a blank steel plate in a hot or cold rolled process, wherein the base part 18 is formed as a metal profile.

The base part 18 further comprises a first transverse portion 18B. The first transverse portion 18B extends from the standing portion 18A in a transverse direction 20. Said transverse direction 20 is transverse, e.g. approximately parallel, to the side wall direction 8 and points away from the floor wall 4B. The bottom side rail 6A further comprises a first flange 22. The first flange 22 extends, from the first transverse portion 18B of the base part 18, along the side wall direction 20, or at least upwards. The at least one side wall 4C may be fixed to the first flange 22. For example, the at least one side wall 4C is glued to the first flange 22. The bottom side rail 6A may further comprise a second flange 26 that extends, in use, upwards, e.g. along the side

wall direction 8, from the first transverse portion 18B of the base part 18. Thus, the first and second flange may extend along the side wall direction 8, and along a longitudinal direction 9 of the bottom side rail, approximately in parallel. The at least one side wall 4C may be fixed, e.g. glued, to the second flange 26. Furthermore, the first and second flange may be supported on the first transverse portion. Such may increase a strength of the at least one bottom side rail 6A.

The first flange 22, the second flange 26, and the first transverse portion 18B may together form a substantially U-shaped cavity that extends along the bottom side rail 6A. Said cavity is arranged for receiving therein, and for fixing, e.g. glueing, therein, the at least one side wall 4C. More in general, the base part 18, the first flange 22, and the second flange 26 may preferably form one piece. E.g., the base part 18, the first flange 22, and the second flange 26 may be made out of one piece, e.g. by means of extrusion. As another example, the first flange and the second flange 22, 26 may be welded or glued to the base part 18. As yet another example, the base part and one of the first and second flange, e.g. the first flange or the second flange, may be made out of one piece, and the other one of the first and second flange may be attached, e.g. welded or glued, to the base part 18. In particular, the base part and the first flange may be formed from a sheet of metal, e.g. by means of a laminating mill. The second flange may be attached to said sheet after forming the base part and the first flange.

Without wanting to be bound by any theory, the inventors recognised that the first flange and the second flange may form an adhesive bonding surface for introducing shear stresses from the side wall into the bottom side rail 6A. Such a solution differs significantly from a known way of connecting a side wall made of corrugated steel sheet to a known bottom side rail, which is carried out by applying a single welding line. Experiments carried out by the inventors showed that the first and second flange are beneficial for preventing collapse of the bottom side rail 6A in a standardised test. Numerical simulations carried out by the inventors showed that the at least one side wall 4C may bend outwards and/or may buckle when a relative large load is applied on the shipping container 2 in a downward direction (e.g. in a direction opposite to the sidewall direction 8) or in transversal direction on the side wall (e.g. in a direction perpendicular to the sidewall). A probability for such bending and/or buckling may be reduced by applying the second flange 26 in addition to the first flange 22. Without wanting to be bound by any theory, the inventors recognised that the second

flange 26 may cause a better introduction of a load on the at least one sidewall 4C into the base part of the bottom side rail.

In a variation of the first embodiment, as indicated in Figure 5, the first transverse portion 18B of the base part 18 has a first end 24A located away from the floor wall 4B. The first flange may extend from the first end 24A of the first transverse portion 18B. The first transverse portion 18B of the base part 18 may optionally have a second end 24B located adjacent to the floor wall. The second end 24B of the first transverse portion may be connected to the standing portion 18A. Thus, the standing portion 18A may be connected to the first transverse portion 18B via the second end 24B of the first transverse portion 18B. Said first end 24A and said second end 24B generally extend along the at least one bottom side rail 6A.

Additionally, or alternatively, in said variation the at least one side wall 4C has the outside surface 10 and the first flange is fixed to the outside surface 10 of the at least one side wall 4C. Additionally, or alternatively, in said variation the base part 18 may further comprise a second transverse portion 18C extending from the standing portion along the transverse direction 20. The first and second transverse portions 18B respectively 18C are spaced apart along the side wall direction. As a result, the base part 18 may have a substantially C-shaped cross section. It is noted that, more in general, the first flange, the second flange, the first transverse portion, and/or the second transverse portion extend along the bottom side rail 6A.

The standing portion 18A may have an inner side 30 to which the floor wall of the shipping container can be attached, and has an outer side 32 opposite to the inner side 30. The bottom side rail 6A may further comprise a plurality of reinforcement elements 34. The bottom side rail 6A may e.g. comprise at least 30 and/or at most 60 reinforcement elements 34, typically approximately 40 reinforcement elements 34. Said reinforcement elements 34 are spaced apart along the bottom side rail 6A, in particular, in a 3-6 meter zone in between and substantially central to the front and back walls of the shipping container. The reinforcement elements 34 are fixed to the standing portion 18A on the outer side 32 of the standing portion 18A. The reinforcement elements are also fixed to the first transverse portion 18B of the base part 18. A mutual distance X between neighbouring reinforcement elements is in a range from 25 to 60 centimeter or even 25–80 centimeter; at least in the zones outside the center. Said distance may be measured from a center 36A of a first reinforcement element 34A to a center 36B of a second reinforcement element 34B. Reinforcement elements (or other parts) are 'neighbouring' if no other reinforcement elements are

located in between said neighbouring reinforcement elements (or respectively in between said other parts). The reinforcement elements 34 may be formed by reinforcement plates, e.g. may be reinforcement plates. A thickness  $D_2$  of the reinforcement plates may be at least 2 millimeter and/or at most 5 millimeter. The reinforcements elements may further be fixed to the second transverse portion 18C. In particular, the combination of the reinforcement elements and the first and second flange provide a relatively strong bottom side rail 6A.

The reinforcement elements will provide additional strength to the bottom side rail 6A. When in use the shipping container is under a heavy downward load or in transversal direction on the side wall (e.g. in a direction perpendicular to the sidewall) the reinforcement plates may decrease a possibility of yielding of the base part. As a result of said yielding, a C-shaped base part 18 may "close", e.g. by the first transverse portion and the second transverse portion coming closer together.

Figure 6 shows a perspective view of at least part of the floor wall 4B. Figure 6 shows two bottom side rails 6A, 6B. Figure 6 also shows reinforcement elements 34. The floor wall 4B of the shipping container comprises a plurality of cross-members 40. The cross-members 40 may be attached, e.g. welded, to the inner side 30 of the standing portion 18A of the base part 18. At least part, e.g. all, of the reinforcement elements 34 are positioned opposite to a cross member, to introduce the load in an effective manner from the side rib into the cross-member. The term 'floor wall' may be interpreted broadly, and may comprise merely the cross-members or may comprise the cross-members in combination with other parts, e.g. a (e.g. wooden) floor plate.

Figure 7 shows a cross-section of the bottom side rail 6A in an embodiment, and the floor plate 40A. Figure 7 also shows one of the cross-members 40 and one of the reinforcement plates 34. Figure 7 shows the floor plate 40A received by the recess 38. Figure 7 also shows the U-shaped cavity 44.

Embodiments of the invention are not limited to the foregoing description and drawings. E.g., the shipping container may lack a top wall. Equally all kinematic inversions are considered inherently disclosed and to be within the scope of the present invention. The use of expressions like: "preferably", "in particular", "especially", "typically" etc. may relate to optional features. The terms "comprising" and "including" do not exclude other elements. The term 'fixing' as used herein may comprise attaching, e.g. glueing. The indefinite article "a" or "an" does not exclude a plurality. Expressions like "lower", "upper", "inside", "inner", "outside", "outer", "top",

“bottom”, “upwards”, “downwards”, “sideways”, “floor”, and the like refer to a situation of normal use of the shipping container. Features which are not specifically or explicitly described or claimed may be additionally comprised in the structure according to the present invention without deviating from its scope.

CLAIMS

1. Shipping container comprising:
  - a plurality of walls that form, in use, at least a floor wall, and a plurality of side walls of the shipping container, and
  - a frame for mechanically fixing one or more of the side walls and the floor wall thereto, wherein the frame comprises a bottom side rail arranged for fixing thereto the floor wall and the side walls so that the side walls extend from the bottom side rail in a side wall direction in use directed upwards;

wherein at least one of the plurality of side walls comprises a fibre-reinforced composite wall material, said at least one side wall comprising an inner face which is in use facing an interior of said container,

wherein the inner face of the at least one side wall is recessed along a length direction of the side wall to form a recessed side wall portion positioned adjacent the floor wall of the container; and wherein a protective plate of between 1-10 mm thickness is attached to the side wall at the location of the recessed side wall portion.
2. Shipping container comprising according to claim 1, wherein the recessed side wall portion extends in a side wall direction toward the top wall along a length of 30-100 cm.
3. Shipping container according to claim 1 or 2, wherein the protective plate is formed of a metal or plastic plate.
4. Shipping container according to claim 1 or 2, wherein the at least one side wall comprises a fibre reinforced plastic panel.
5. Shipping container according to claim 4, wherein the plastic panel comprises a laminate structure comprising two outer laminate layers, wherein at least one, preferably both, of said laminate layers are, at least partly, formed by the fibre-reinforced composite wall material.
6. Shipping container according to claim 5, wherein the laminate structure further comprises a core layer arranged in between, and in mechanical load transferring contact with, the laminate layers, said core layer in use supporting the laminate layers.
7. Shipping container comprising according to claim 1; wherein the bottom side rail comprises a base part including a standing portion for fixing the floor wall

thereto, said standing portion extending along the bottom side rail and along an, in use, upward direction, the base part further comprising a first transverse portion extending from the standing portion in a transverse direction that is transverse to the side wall direction and points away from the floor wall, wherein the bottom side rail further comprises a first flange and a second flange that extend from the first transverse portion of the base part along the side wall direction, and that are supported on the first transverse portion, wherein the first flange and the second flange are arranged for fixing thereto the at least one side wall.

8. Shipping container according to claim 7, wherein the floor wall and the at least one of the side walls are fixed to the bottom side rail and the at least one of the side walls is fixed to the first flange and the second flange.
9. Shipping container according to claim 7 or 8, wherein the recessed side wall portion is arranged in an, in use, lower side wall portion of said at least one side wall, said lower side wall portion being fixed to the first and second flange, said lower side wall portion comprising at least one further recess in addition to the recessed side wall portion for receiving at least one of said first or second flange.
10. Shipping container according to claim 9, wherein a sum of a thickness of the first flange, the second flange, and the lower side wall portion, is similar to a thickness of the recessed side wall portion.
11. Shipping container according to claim 9, wherein a sum of a thickness of the first flange, the second flange, lower side wall portion, and plate is similar to a thickness of the upper side wall portion, so that the plate and inner side wall extend as an integral part in a single plane.
12. Shipping container according to claim 1, wherein the recessed side wall portion and the protective plate are fixed together for reinforcement of said at least one side wall at said recessed side wall portion.
13. Shipping container according to claim 1, wherein the recessed side wall portion and the protective plate are formed as an integral part.
14. Side wall for use in a shipping container in accordance with at least one of claims 1-13, said side wall comprising a fibre-reinforced composite wall material, and said side wall comprising an inner face which is in use facing an interior of said container, wherein the inner face is recessed along a length direction of the side wall to form a recessed side wall portion which is in use

positioned adjacent the floor wall of the container, said recessed side wall portion being arranged for receiving a protective plate of between 1-10 mm thickness.

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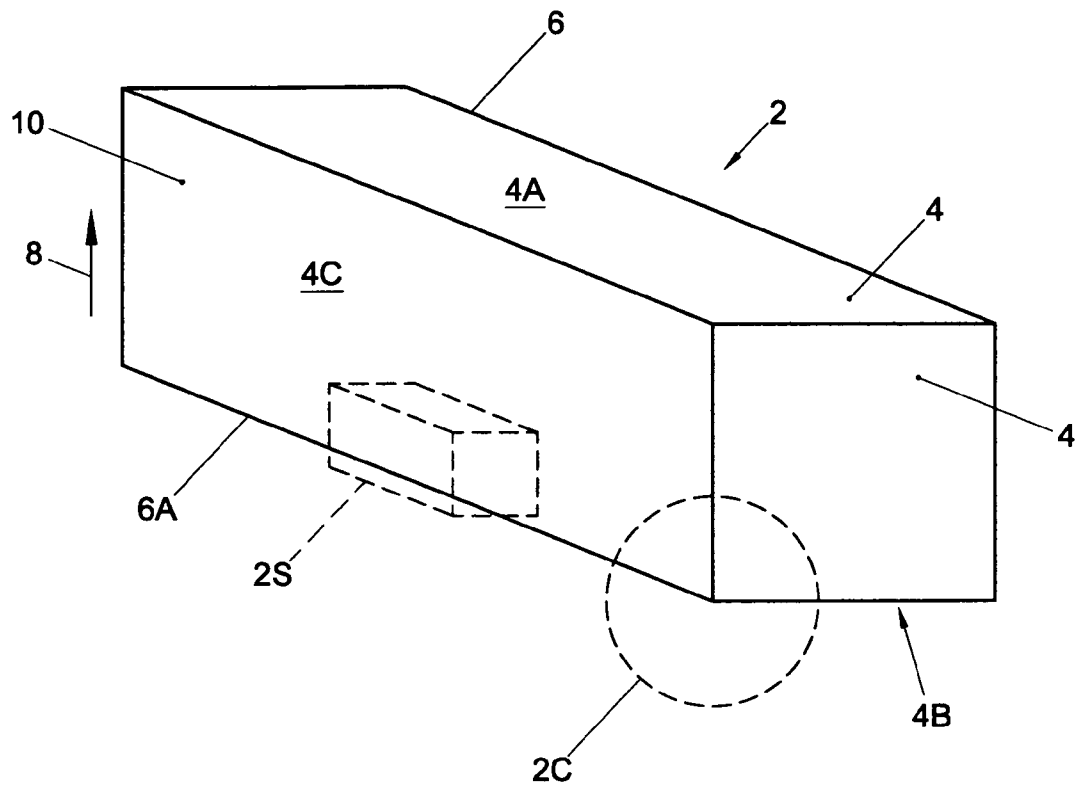


Fig. 1

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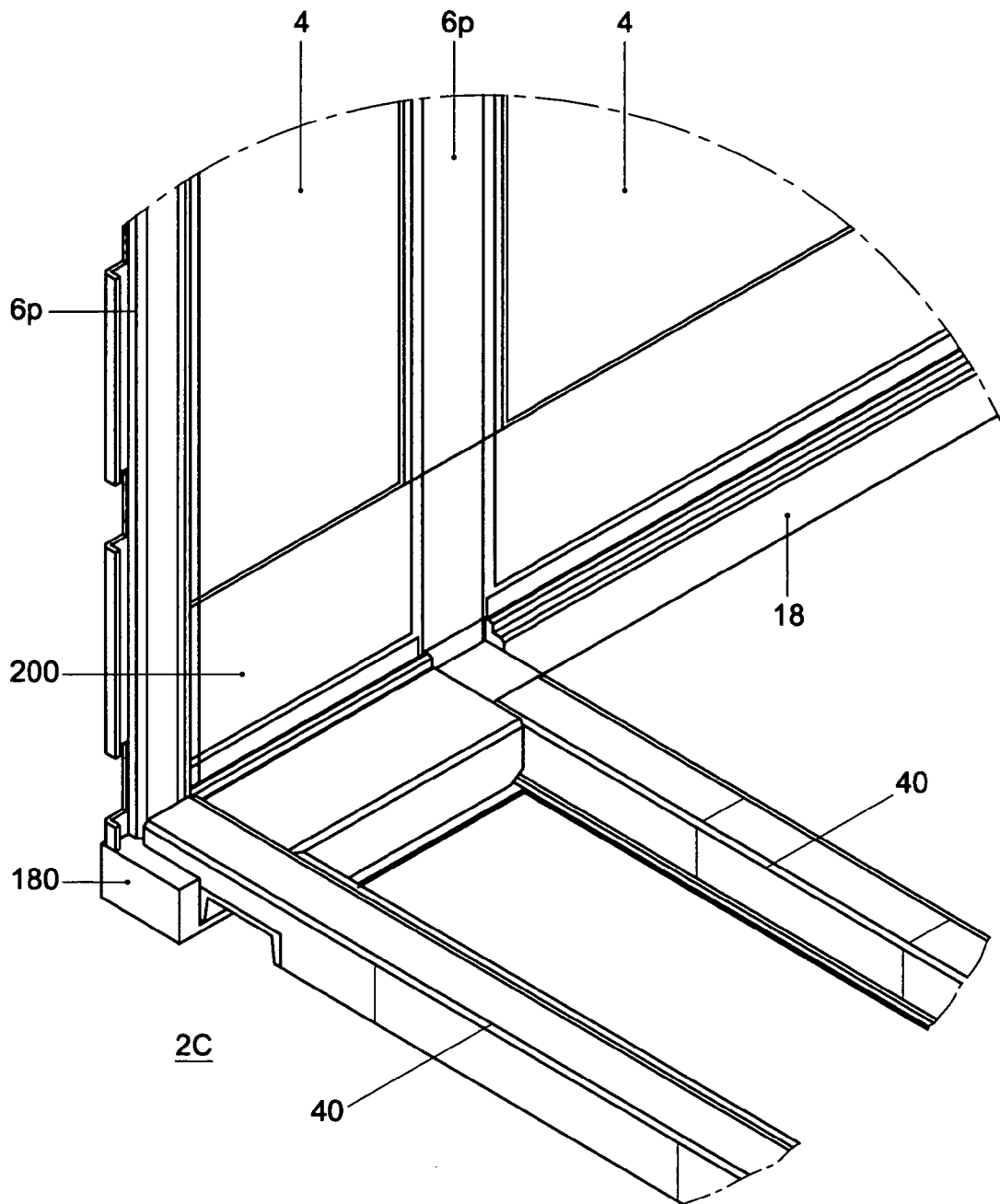


Fig. 2

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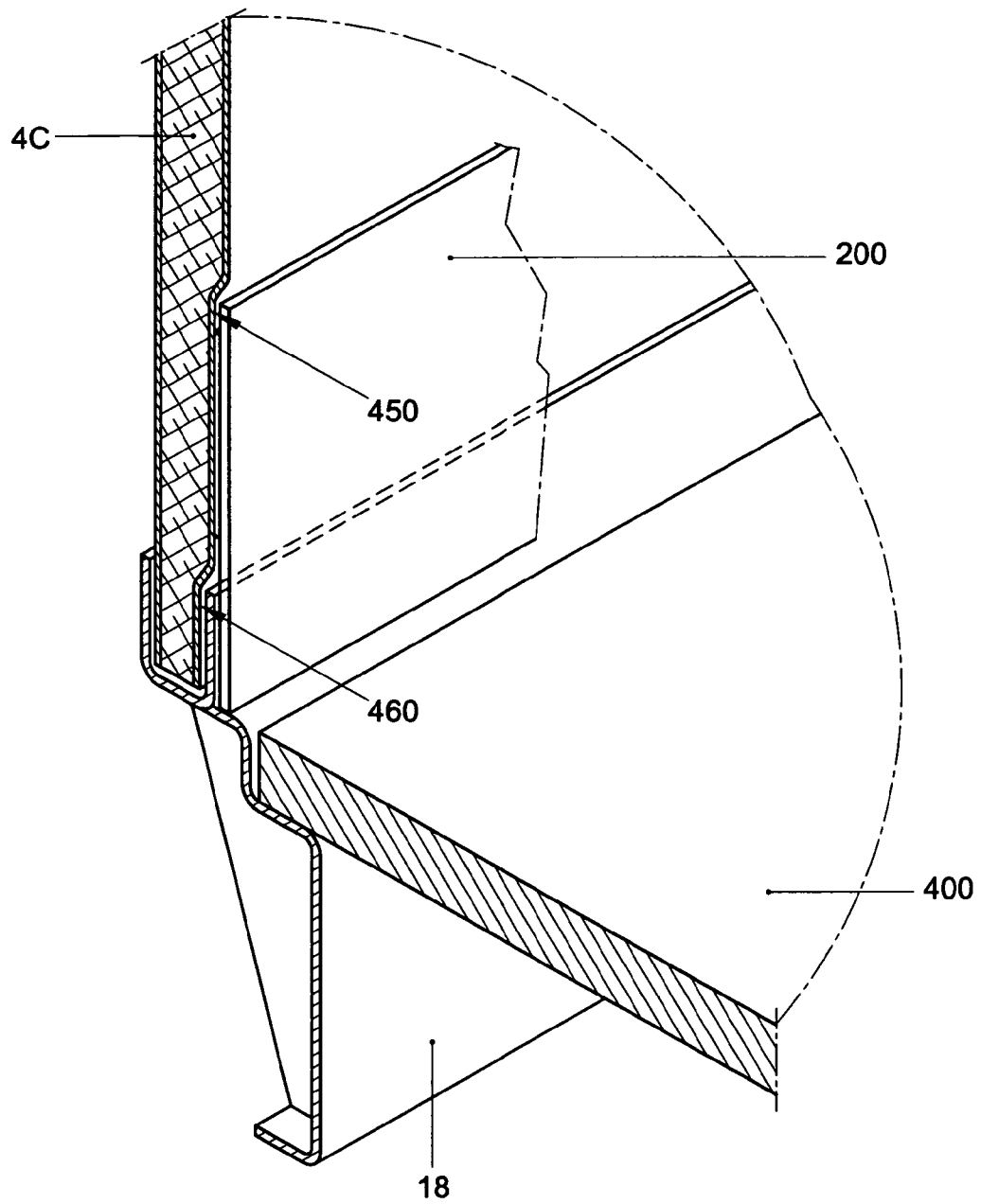


Fig. 3

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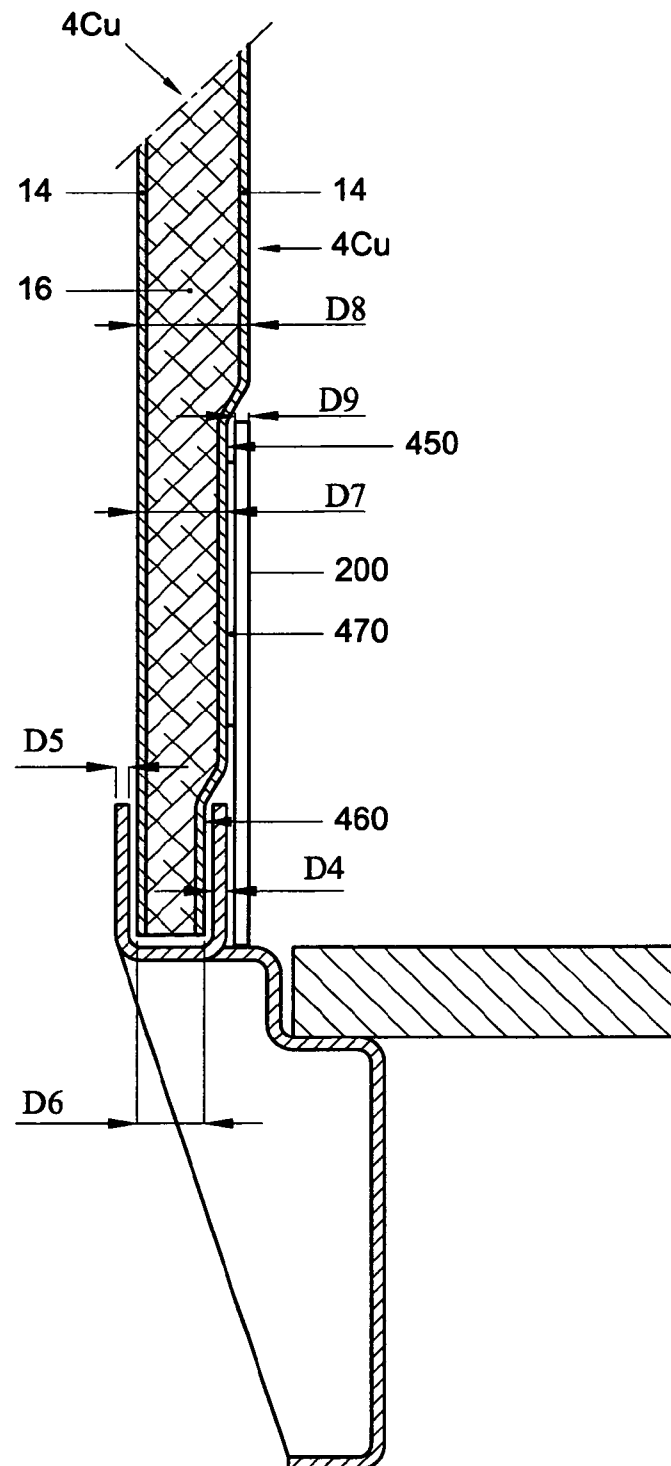
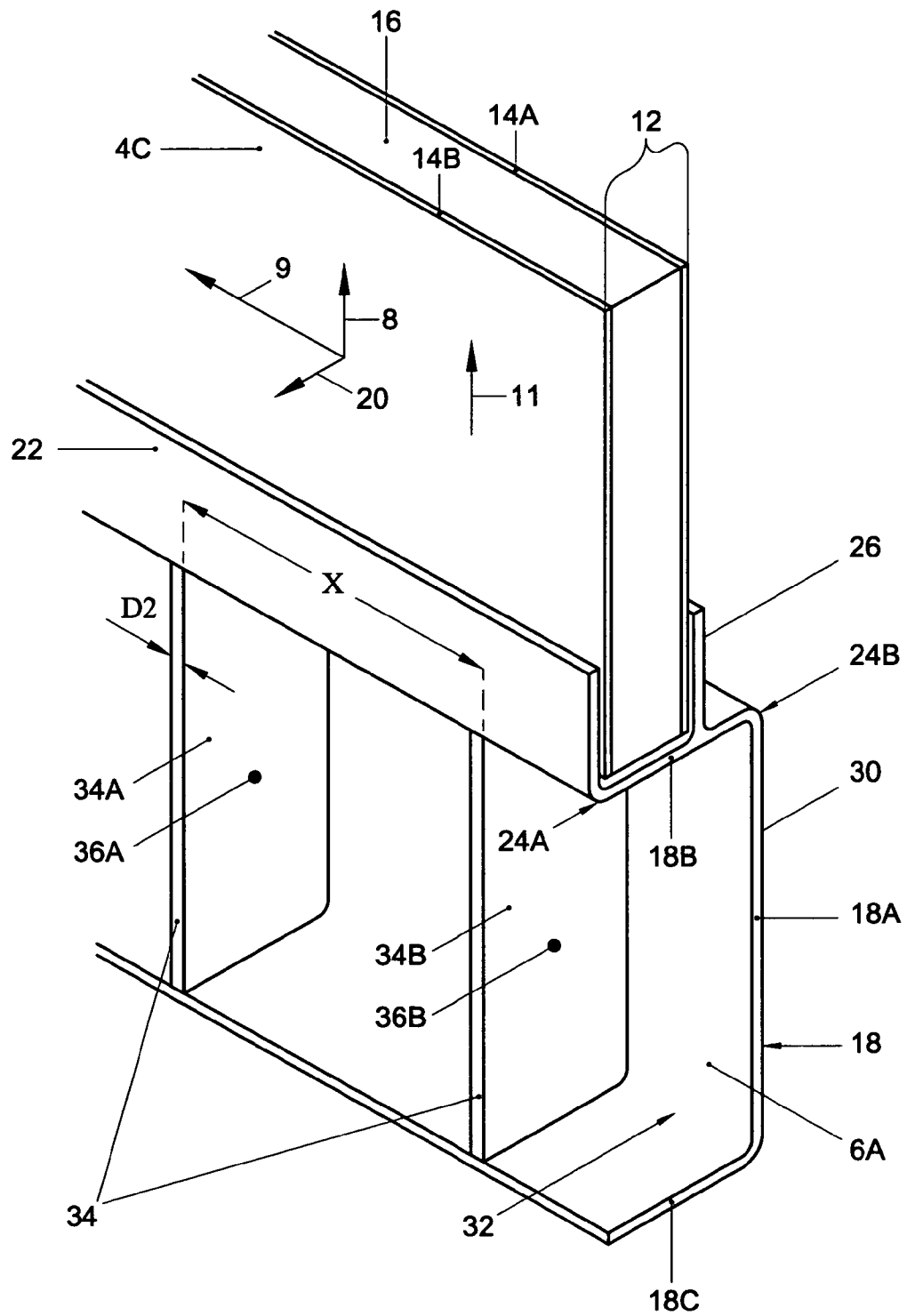


Fig. 4

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**Fig. 5**

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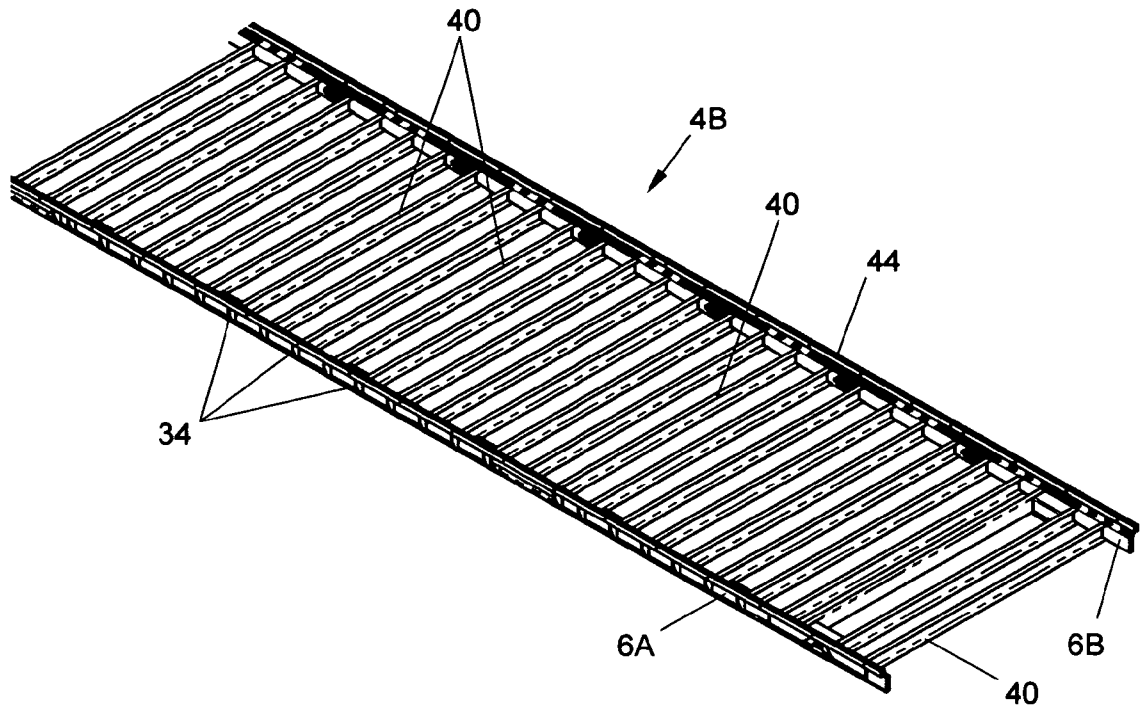


Fig. 6

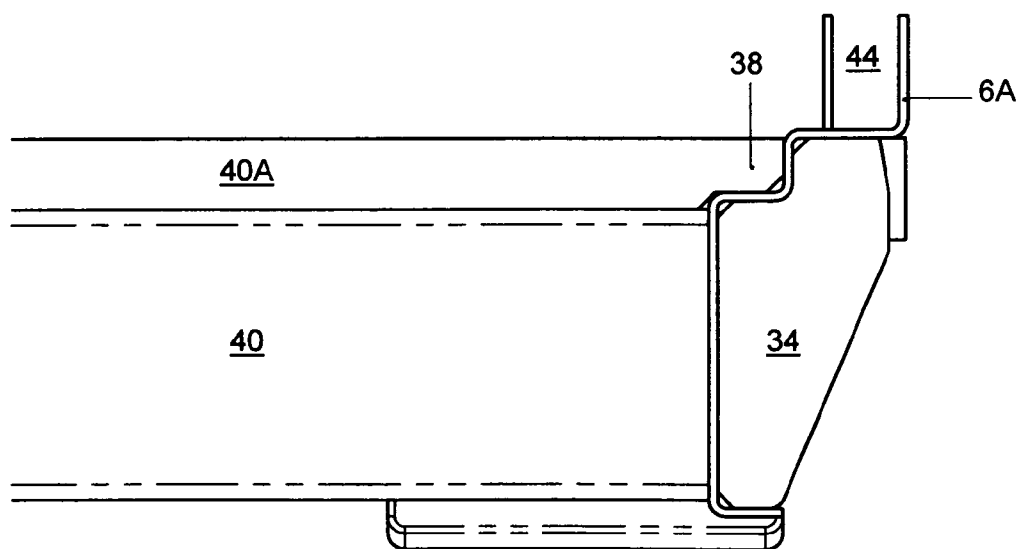


Fig. 7

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/061209

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>INV. B65D90/02      B65D90/08      B32B5/28<br>ADD. B65D88/12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                             |                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                             |                                                                                                                               |
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>B65D   B32B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                               |
| 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)<br>EPO-Internal, WPI Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                             |                                                                                                                               |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                             |                                                                                                                               |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                          | Relevant to claim No.                                                                                                         |
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| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -----<br>US 2007/194602 A1 (EHRlich RODNEY P [US])<br>23 August 2007 (2007-08-23)<br>cited in the application<br>paragraph [0012] - paragraph [0022];<br>figure 3                                           | 1-6,<br>12-14                                                                                                                 |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -----<br>US 5 449 081 A (SJOSTEDT ROBBIE J [US] ET AL) 12 September 1995 (1995-09-12)<br>column 6, line 33 - column 19, line 59;<br>figures 31,38,39<br>-----<br><div style="text-align: center;">-/-</div> | 1,14                                                                                                                          |
| <div style="display: flex; justify-content: space-between;"> <span><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.</span> <span><input checked="" type="checkbox"/> See patent family annex.</span> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                             |                                                                                                                               |
| <div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p> </div> </div> |                                                                                                                                                                                                             |                                                                                                                               |
| Date of the actual completion of the international search<br><br><div style="text-align: center; font-size: 1.2em;">13 September 2012</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                             | Date of mailing of the international search report<br><br><div style="text-align: center; font-size: 1.2em;">27/09/2012</div> |
| Name and mailing address of the ISA/<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                             | Authorized officer<br><br><div style="text-align: center; font-size: 1.2em;">Lämme1, Gunnar</div>                             |

## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/061209

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                              |                       |
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