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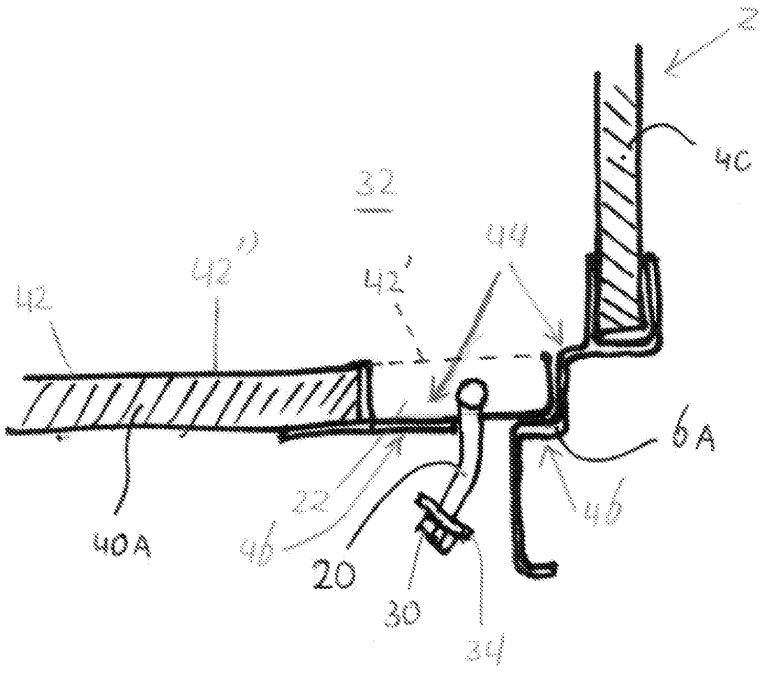
(54) Composite shipping container having a lashing eye

(57) Shipping container (2) comprising a plurality of walls (4) that form, in use, at least a floor wall (4B) and a plurality of side walls of the shipping container. The shipping container comprises a frame (6A) for mechanically fixing at least one of the walls thereto. The at least one of the walls comprises a fiber-reinforced composite wall material. The shipping container is provided with a lashing eye (20) that is fastened to the frame of the shipping container, and wherein the at least one of the walls is provided with a cavity for receiving therein at least part of the lashing eye.

FIG 4A



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Description

[0001] The invention relates to 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 at least one of the side walls and the floor wall thereto. The invention also relates to a lashing eye. The invention further relates to an assembly for assembling a shipping container. The invention also provides use of a lashing eye of a shipping container. The invention further provides a method of assembling a lashing eye to a frame for a shipping container.

[0002] 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, inland navigation vessels, and/or naval vessels. During such transfer, a hoisting crane may be used for lifting the shipping containers from the ship and depositing the shipping containers on land, on a truck, or on another ship.

[0003] 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.

[0004] 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 total weight of a filled shipping container. However, a known steel shipping container itself usually forms a significant part of said total weight as well. A relatively large weight of the shipping container introduces various possible problems. It may for example increase fuel costs during transport of the shipping container over sea, land, or rail, or may limit an amount of shipping containers placed on a ship.

[0005] In order to decrease a weight of a shipping container, it has recently been proposed in US 7,059,488 to use a fiber-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. However, when actually building a shipping container using composite material, a number of problems may arise.

[0006] During transport, a shipping container may be handled several times from the moment of loading goods into the shipping container until the moment of unloading said goods at the final destination of the shipping container. E.g., during transport, the shipping container might be tilted. Furthermore, during transport, other lateral forces might build up during acceleration or de-acceleration. Therefore, the goods usually need to be fixed against shifting and tumbling. In this way, a probability for damage to the goods may be reduced. Furthermore, a probability of a shift of a central point of gravity of the shipping container caused by moving goods inside the shipping container may be reduced. Such a shift may cause unsafe situations during shipping container handling like hoisting and other transport movements of the shipping container. Therefore, shipping containers usually comprise lashing eyes to which e.g. a rope can be connected. By means of said rope, a load can be tightened inside the shipping container. The fixing of the goods inside the shipping container by means of lashing eyes has therefore become a standard practice in the shipping container transport industry.

[0007] In a known steel shipping container, such lashing eyes may be welded to a wall of the shipping container. Then, the lashing eyes may be connected to a corrugate steel side wall, in particular to an inner side of an outwardly projecting corrugation, so that the lashing eyes do not limit a space for moving pallets and boxes into and out of the shipping container. However, a side wall comprising a fiber-reinforced material usually lacks such corrugations. Then, fixing lashing eyes inside the shipping container without compromising said space for moving pallets and boxes into and out of the shipping container, may become problematic.

[0008] It is therefore an object of the invention to provide an improved shipping container that at least partly meets a problem mentioned above.

[0009] Accordingly, the invention provides a shipping container, preferably a composite 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 comprising a frame for mechanically fixing at least one of the walls thereto, wherein the at least one of the walls comprises a fiber-reinforced composite wall material, in particular a fiber-reinforced plastic wall material, wherein the shipping container is provided with a lashing eye that is fastened to the frame of the shipping container, and wherein the at least one of the walls is provided with a cavity for receiving therein at least part of the lashing eye. Preferably, the at least one of the walls preferably comprises a laminate structure comprising two, preferably outer, laminate layers, wherein at least one, preferably both, of said laminate layers are, at least partly, formed by a fiber-reinforced composite wall material. Preferably, 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.

[0010] The inventors realised that a strength of the at least one of the walls comprising the fibre-reinforced composite wall material, may benefit from a relative large wall thickness. Thus, for example, a distance between the laminate layers is maximised. Maximisation of said

distance may be limited by standardised dimensions of the shipping container, e.g. according to ISO norms. However, an inner surface of the at least one of the walls may be flat instead of corrugated. Such may be desirable for having a relatively strong wall. Then, by means of the cavity, a lashing eye can be combined with the at least one side wall comprising the laminate structure. The cavity may enable placing the lashing eye outside a space for moving pallets and boxes into and out of the shipping container. Thus, limiting, by means of the lashing eye, a space inside the shipping container for moving pallets and boxes into and out of the shipping container, may at least partly be prevented.

[0011] In an embodiment, the at least one of the walls bounds an inner space of the shipping container, wherein the lashing eye and the cavity are dimensioned so that the at least part of the lashing eye can be received in the cavity without having the lashing eye project out of the cavity into the inner space of the shipping container. Preferably, the at least one of the walls has an inner surface that faces an inner space of the shipping container and extends substantially in a wall plane, the wall plane bounding the inner space of the shipping container and extending over the cavity. Preferably, the lashing eye and the cavity are dimensioned so that the at least part of the lashing eye can be received in the cavity without having the lashing eye project through the wall plane into the inner space of the shipping container.

[0012] Preferably, the plurality of walls further form, in use, a top wall of the shipping container, wherein the at least one of the side walls extends from the lower side rib in the side wall direction towards the top wall.

[0013] In an embodiment, the lashing eye is fastened movably to the frame of the shipping container. Moving the lashing eye may enable removing the lashing eye out of, or into, an inner space of the shipping container. As a result, when moved out of the inner space, loading goods into or out of the shipping container may be unhindered by the lashing eye. When the lashing eye is moved into the inner space, the lashing eye may be used for connecting a rope thereto for tightening goods loaded in the inner space of the shipping container. In an embodiment, the lashing eye is movable from a retracted position to an extracted position and vice versa. Preferably, in the retracted position, the at least part of the lashing eye is received in the cavity so that the lashing eye lacks projection into the inner space of the shipping container. Preferably, the lashing eye and the cavity are dimensioned so that the at least part of the lashing eye, when in the retracted position, is received in the cavity without having the lashing eye project through the wall plane into the inner space of the shipping container. Preferably, in the extracted position, the at least part of the lashing eye projects out of the cavity into the inner space of the shipping container. Preferably, the lashing eye and the cavity are dimensioned so that the at least part of the lashing eye, when in the extracted position, projects out of the cavity through the wall plane into the inner space of the shipping container.

[0014] The at least one of the walls may be the floor wall, the top wall, or one of the side walls. Then, respectively, the wall plane may e.g. be a bottom plane, a side plane, or a top plane.

[0015] In an embodiment, the frame comprises a lower side rib arranged for fixing thereto the floor wall and at least one of the side walls so that the at least one of the side walls extends from the lower side rib in use upwards, preferably towards the top wall, wherein the lashing eye is fastened movably to the lower side rib. The frame, in particular the lower side rib, may comprise steel. Fastening the lashing eye to the frame, in particular to the lower side rib, may enable a relatively strong connection between the shipping container and the lashing eye. Thus, goods may be tightened relatively firmly in the shipping container. Preferably, the floor wall and/or the at least one of the side walls is provided with the cavity.

[0016] In an embodiment, the lashing eye comprises a first eye portion and a second eye portion spaced apart from the first eye portion, wherein the frame, in particular the lower side rib, comprises a first frame aperture and a second frame aperture spaced apart from the first frame aperture, wherein the first eye portion in use may movably extend through the first frame aperture and the second eye portion in use may movably extend through the second frame aperture. As a result, the lashing eye is movable with respect to the frame of the shipping container by movement of the first and second eye portion through respectively the first and second frame aperture. Preferably, the first eye portion and the second eye portion are mutually mechanically connected by means of a third eye portion extending at least from the first eye portion to the second eye portion.

[0017] In an embodiment, the frame, in particular the lower side rib, has an inner side facing towards an inner space of the shipping container, and the frame, in particular the lower side rib, has an outer side facing away from the inner space of the shipping container, wherein the third eye portion is positioned at the inner side of the frame, in particular at the inner side of the lower side rib. As a result, at least part of the inner side may be positioned in between the third eye portion and at least part of the outer side.

[0018] In an embodiment, the first eye portion and the second eye portion extend from the inner space of the shipping container through the first frame aperture respectively the second frame aperture in a direction directed away from the inner space of the shipping container and terminate respectively in an end of the first eye portion and an end of the second eye portion. Preferably, said ends are each provided with a thickening arranged for preventing the ends to pass through the first and second frame apertures towards the inner space of the shipping container.

[0019] In an embodiment, the first and second eye portions are each provided with a threaded end. Preferably, the thickenings are formed by nuts provided on said

threaded ends.

[0020] In an embodiment, the lashing eye further comprises a cross-member that is provided with a first cross-member aperture and a second cross-member aperture through which the first and second eye portions movably extend, wherein the thickenings are arranged for preventing to pass through the first and second cross-member apertures. Preferably, the cross-member is positioned in between the thickenings and the frame, in particular in between the thickenings and the lower side rib.

[0021] In an embodiment, the cavity has a bottom, wherein the first and second frame apertures are provided in the bottom of the cavity. As a result, the lashing eye may preferably sink towards the retracted position as a result of gravity.

[0022] In an embodiment, the cavity is formed by a frame part, in particular a lower side rib part, that extends laterally from the lower side rib in a direction directed transverse to a longitudinal direction of the lower side rib.

[0023] In an embodiment, the lashing eye is fastened immovably to the frame of the shipping container.

[0024] In an embodiment, the frame comprises an upper side rib arranged for fixing thereto the top wall and at least one of the side walls so that the at least one of the side walls extends from the upper side rib towards the floor wall. Preferably, the lashing eye is fastened immovably to the upper side rib. Preferably, the top wall and/or one of the side walls is provided with the cavity. Preferably, the lashing eye is welded to the upper side rib.

[0025] In an embodiment, the cavity is provided in between the at least one of the side walls and the upper side rib. In an embodiment the cavity is formed by a recess or opening provided in at least one side wall of the shipping container. Said opening may, in use, form also form a ventilation channel of the shipping container.

[0026] The invention also provides the lashing eye and an assembly comprising the lashing eye and a remaining part, e.g. comprising the walls, of the shipping container. Thus, there is provided an assembly for assembling a shipping container, preferably a composite shipping container, said assembly comprising a plurality of walls that form, in use, at least a floor wall, a plurality of side walls, and preferably a top wall of the shipping container, and comprising a frame for mechanically fixing at least one of the walls thereto, wherein the at least one of the walls comprises a fiber-reinforced composite wall material, in particular a fiber-reinforced plastic wall material, wherein the assembly further comprises a lashing eye, the lashing eye and the frame being arranged for fastening the lashing eye to the frame of the shipping container, wherein the at least one of the walls is provided with a cavity for receiving therein at least part of the lashing eye. Preferably, the at least one of the walls comprises a laminate structure comprising two, preferably outer, laminate layers, wherein at least one, preferably both, of said laminate layers are, at least partly, formed by the fiber-reinforced composite wall material. Preferably, 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.

[0027] The invention also provides use of a lashing eye of a shipping container according to the invention, for tightening goods loaded in the shipping container, e.g. by connecting a tightening means such as a rope to the lashing eye. Preferably, the use comprises, before said tightening, moving the lashing eye from a retracted position to an extracted position. Preferably, the at least one of the walls bounds an inner space of the shipping container. Preferably, the lashing eye and the cavity are dimensioned so that the at least part of the lashing eye can be received in the cavity without having the lashing eye project out of the cavity into the inner space of the shipping container. Preferably, in the retracted position, at least part of the lashing eye is received in the cavity so that the lashing eye lacks projection into the inner space of the shipping container. Preferably, in the extracted position, the at least part of the lashing eye projects out of the cavity into the inner space of the shipping container.

[0028] The invention further provides a method of assembling a lashing eye to a frame for a shipping container, the lashing eye comprising a first eye portion and a second eye portion spaced apart from the first eye portion, the method comprising moving the first eye portion and the second eye portion respectively through a first frame aperture in the frame and a second frame aperture in the frame that is spaced apart from the first frame aperture, so that the first eye portion extends through the first frame aperture and the second eye portion extends through the second frame aperture, the method further comprising, after said moving, providing on an end of the first eye portion a thickening and on an end of the second eye portion a thickening, for preventing the ends to pass through the first and second frame apertures. Preferably, the shipping container is a shipping container according to the invention.

[0029] The invention will now be described, in a non-limiting way, with reference to the accompanying drawings, in which:

Brief description of the drawings

[0030]

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

Figure 2A schematically shows a, partly transparent, perspective view of a cross-sectional detail of a shipping container;

Figure 2B further shows another detail, indicated in figure 2A;

Figure 2C shows a further detail, also indicated in figure 2A;

Figure 2D shows the further detail from another an-

gle;

Figure 3A shows a perspective view of a detail of a shipping container in the first embodiment, with a lashing eye in a retracted position;

Figure 3B shows the detail of figure 3A from a different angle, and with the lashing eye in an extracted position;

Figure 4A shows a transversal cross section perpendicular to a lower side rib of a shipping container in a second embodiment according to the invention, with a lashing eye in a retracted position;

Figure 4B shows a transversal cross section perpendicular to a lower side rib of a shipping container in the second embodiment according to the invention, with a lashing eye in an extracted position;

Figure 5A shows a perspective view of a part of a shipping container in a third embodiment according to the invention;

Figure 5B shows a detail indicated in figure 5A;

Figure 5C shows, in a transparent view along a top wall and a side wall 4C, a further detail indicated in figure 5A.

Figure 6A shows a perspective view of a lashing eye of a shipping container in the third embodiment;

Figure 6B shows a side view of the lashing eye of a shipping container in the third embodiment; and

Figure 6C shows a front view of a lashing eye of a shipping container in the third embodiment.

[0031] Unless stated otherwise, like reference numerals refer to like elements throughout the drawings.

[0032] 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 2. The shipping container 2 further comprises a frame 6 for mechanically fixing at least one, e.g. all, of the walls 4 thereto. Thus, a top wall 4A, a floor wall 4B, and a side wall 4C may be fixed to said frame 6.

[0033] The frame 6 comprises a lower side rib 6A (or in other words, a lower side rail 6A) arranged for fixing thereto the floor wall 4B and at least one of the side walls 4C. As a result, the at least one of the side walls extends from the lower side rib 6A towards the top wall 4A. The frame 6 further comprises an upper side rib 6B (or in other words, an upper side rail 6B) arranged for fixing thereto the top wall 4A and at least one of the side walls 4C so that the at least one of the side walls extends from the upper side rib 6B towards the floor wall 4B.

[0034] Figure 2A schematically shows a, partly transparent, perspective view of a cross-sectional detail I1 of the shipping container 2, indicated in figure 1 but seen from a different angle compared to figure 1. A floor plate 40A, e.g. made of wood, may form part of the floor wall 4B. In figure 2, the floor plate is transparent. Figure 2B further shows another detail I2, indicated in figure 2A. Figure 2C shows a further detail I3, also indicated in figure 2A. Figure 2D shows the further detail I3 from another angle.

[0035] With respect to figure 2A, it can be noted that at least one of the side wall comprises a fiber-reinforced composite wall material. The shipping container 2 may thus be a composite shipping container. More in general, the term 'composite shipping container' may be used for indicating a shipping container comprising a fiber-reinforced composite wall material. The at least one of the side walls 4C may comprise a laminate structure 12. 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 the fiber-reinforced composite wall material. The fiber-reinforced composite wall material may comprise fiber layers oriented in different directions. The fiber layers may be embedded in a matrix, e.g. an organic matrix, e.g. a resin. An amount of said fiber layers, an orientation of fibers of said fiber layers, and an order of said fibers 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 16 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 the fibre-reinforce wall material, in particular the 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. Thus, in a variation, at least one of the walls may comprise 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 fiber-reinforced composite wall material. 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/m3. The laminate structure may comprises the core layer arranged in between, and in mechanical load transferring contact with, the laminate layers, said core layer in use supporting the laminate layers. 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. However, in another variation, the fiber-reinforced composite wall material may be formed by another composite structure, such as a pultrudate. Pultradates are formed by means of a pultrusion process, which process is known as such to the skilled person. More in general, all side walls (e.g. four side walls) of the shipping container 2, and optionally the top wall 4A of the shipping container 2, may comprise the laminate structure 12. Thus, a relatively large weight

decrease can be realised.

[0036] The inventors realised that a strength of the at least one of the walls comprising the fibre-reinforced wall material, benefits from a relative large wall thickness. Thus, for example, the distance between the laminate layers is maximised. Maximisation of said distance may be limited by standardised dimensions of the shipping container, e.g. according to ISO norms. 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.

[0037] With respect to figures 2A-2D, it can be noted that the shipping container is provided with a lashing eye 20. The lashing eye 20 may be fastened to the frame 6 of the shipping container 2, in particular to the lower side rib 6A of the shipping container. In this example, the lashing eye 20 is fastened movably to the frame of the shipping container 2, in particular to the lower side rib 6A of the shipping container. Thus, the lashing eye 20 can be moved with respect to the frame 6 of the shipping container 2, in particular with respect to the lower side rib 6A of the shipping container 2. In this example, the lashing eye 20 is fastened movably to the lower side rib 6A.

[0038] At least one of the walls 4 of the shipping container 2 may be provided with a cavity for receiving therein at least part of the lashing eye. In the example of figure 2, the cavity 22 is positioned in the floor wall 4B of the shipping container 2, in particular in the floor plate 40A of the floor wall 4B.

[0039] Composite shipping containers 2 are offering the potential of a considerable weight saving compared to the standard steel shipping containers. This makes composite shipping containers 2 attractive for both the shipper of cargo and the transporting company for improving their competitiveness. However, shipping containers 2 with composite walls 4 preferably have flat walls 4 on both the inside of the shipping container and the outside of the shipping container 2. Therefore the convenient place, formed by corrugated walls, for placing the lashing eyes is usually not available. For standard operation, a composite shipping container preferably meets all standard requirements, including the availability of lashing eyes 20. Without the lashing eyes, the practical use of the shipping container may be limited.

[0040] To solve a problem mentioned above for composite shipping containers, one or more wall of the composite shipping container 2 and the lashing eyes in the composite shipping container, may be specially designed. Then, standardised requirements may be met.

[0041] The lashing eye 20 comprises a first eye portion 20A and a second eye portion 20B spaced apart from the first eye portion 20A. The lower side rib 6A comprises a first frame aperture 23A and a second frame aperture 23B spaced apart from the first frame aperture 23A (see figure 2D). The first eye portion 20A in use extends through the first frame aperture 23A. The second eye portion 20B in use extends through the second frame aperture 23B. As a result, the lashing eye 20 is movable with respect to the frame 6 of the shipping container 2 by movement of the first and second eye portion 20A, 20B through respectively the first and second frame aperture 23A, 23B. The first and second frame aperture 23A, 23B are, more in general, dimensioned to allow such movement. The first eye portion 20A and the second eye portion 20B are mutually mechanically connected by means of a third eye portion 20C. The third eye portion 20C may extend from the first eye portion 20A to the second eye portion 20B. Thus, in an embodiment, the first eye portion 20A, the second eye portion 20B, and the third eye portion 20C together may form a substantially U-shaped eye portion. It may be clear that the lashing eye may be an open eye or a closed eye.

[0042] When the lashing eye is unused, it may fall back into the retracted position due to gravity. Thus, a self-retracting lashing eye may be provided. Such advantage can be reached in particular when the cavity is provided in the floor wall 4B of the shipping container 2. However, it may also be reached when the cavity is provided in the side wall of the container. Then, lifting the connection bar of the U-shaped sliding lashing eye may enable the use of the lashing eye for tightening goods loaded in the shipping container.

[0043] The first eye portion 20A and the second eye portion 20B may extend from the inner space 24 of the shipping container through the first frame aperture 23A respectively the second frame aperture 23B in a direction F1 directed away from the inner space 32 of the shipping container 2. The first eye portion 20A and the second eye portion 20B may terminate respectively in an end 28A of the first eye portion (i.e. a first end 28A or a first end portion 28A) and an end 28B of the second eye portion (i.e. a second end 28B or a second end portion 28B). Said ends 28A, 28B may each be provided with a thickening 30. Said thickenings 30 may be arranged for preventing the ends 28A, 28B to pass through the first and second frame apertures 23A, 23B towards an inner space 32 of the shipping container (see figure 2A). In the example of figures 2A-2D, the first and second eye portions 20A, 20B may each be provided with a threaded end. The thickenings 30 may be formed by nuts provided on said threaded ends. In particular, the nuts are self-locking nuts.

[0044] In an embodiment of a method of assembling a lashing eye to the frame 6 of the shipping container 2, the first eye portion 20A and the second eye portion 20B may be moved respectively through the first frame aperture 23A respectively the second frame aperture 23B in the frame. As a result, the first eye portion 20A extends through the first frame aperture 23A and the second eye portion 20B extends through the second frame aperture 23B. Said method further comprises, after said moving, providing, e.g. screwing, on the end 28A of the first eye

portion 20A a thickening, e.g. a nut, 30 and on the end 28B of the second eye portion 20B a thickening, e.g. a nut, 30. Thus, it may be preventing that the ends 28A, 28B again pass through the first and second frame apertures 23A, 23B.

[0045] In a variation, one or more lashing eyes (arranged to be) fastened, or, in other words, attached, to the frame 6, in particular to the lower side rib 6A, comprise a U-shaped piece. Said piece may be made of iron or steel. Said piece may be moved partly through a pair of frame apertures or holes in the lower side rib. At an outer side of the frame, an end of the U-shaped piece may be threaded, e.g. like a bolt. Nuts may be threaded on said threaded ends in order to prevent the U-shaped piece to slide out of the frame apertures or holes. In this way, a moveable lashing eye can be created.

[0046] The lashing eye 20 may further comprise a cross-member 34. In an embodiment of a method according to the invention, the cross-member 34 may be provided over the first and second eye portions before providing the thickenings 30 on the ends 28A, 28B of the first respectively second eye portions 20A, 20B. The cross-member 34 is provided with a first cross-member aperture 34A and a second cross-member aperture 34B. The first and second eye portions 20A, 20B may movably extend through respectively the first cross-member aperture 34A and the second cross-member aperture 34B. The thickenings are arranged for preventing to pass through the first and second cross-member apertures. Thus, the cross-member 34 may provide extra strength to the lashing eye 20. In particular, a load on the lower side rib 6A may be more evenly distributed during use of the lashing eye 20.

[0047] Figure 3A shows a perspective view of a detail of the shipping container 2 in the first embodiment, with the lashing eye in a retracted position, i.e. retracted in the cavity 22. Figure 3B shows the detail of figure 3A from a different angle, and with the lashing eye in an extracted position, i.e. extracted out of the cavity. Figures 3A and 3B show a lower side rib 6A, the lashing eye 20, and bottom cross bars 40 that form at least part of the floor wall 4B. More in general, the term 'floor wall' may be interpreted broadly, and may comprise merely the cross bars or may comprise the cross bars in combination with other parts, e.g. the (e.g. wooden) floor plate. Thus, instead of the term 'floor wall', the term 'bottom structure' may be used. It may be clear from figures 3A and 3B that the cavity may be formed by a frame part, in particular a lower side rib part 6A', that extends laterally from the lower side rib 6A in a direction F2 directed transverse to a longitudinal direction F3 of the lower side rib.

[0048] Figure 4A shows a transversal cross section perpendicular to a lower side rib 6A of a shipping container in a second embodiment according to the invention, with a lashing eye 20 in a retracted position. Figure 4B shows a transversal cross section perpendicular to a lower side rib 6A of a shipping container in the second embodiment according to the invention, with a lashing eye 20 in an extracted position. Figures 4A and 4B further show the cavity 22, the floor plate 40A, and the side wall 4C.

[0049] The floor plate 40A may have an inner surface 42 that faces the inner space 32 of the shipping container 2. The inner surface 42 may extend substantially in a bottom plane 42", being an example of a wall plane. Said bottom plane 42" bounds the inner space 32 of the shipping container 2. Thus, the inner surface 42 of the floor plate 40A, and an imaginary extension of the inner surface along the cavity 22, extend in said bottom plane 42". In the retracted position, at least part of the lashing eye 20 is positioned in the cavity 22 so that the lashing eye 20 lacks projection through the bottom plane 42" into the inner space 32 of the shipping container 2. Thus, the lashing eye 20 and the cavity 22 may be dimensioned so that at least part of the lashing eye can be received in the cavity without having the lashing eye project through the bottom plane 42" into the inner space 32 of the shipping container 2. Hence, the lashing eye 20 and the cavity 22 may be dimensioned so that at least part of the lashing eye 20 can be received in the cavity 22 without having the lashing eye 20 project out of the cavity 22 into the inner space 32 of the shipping container 2. With the lashing eye 20 in the retracted position, the inner space 32 may be substantially free from the lashing eye 20. Then, the lashing eye 20 does not project through the bottom plane 42" into the inner space 32. As a result, loading of the shipping container may be substantially unhindered by the lashing eye 20. In particular, a standardised space of the shipping container for pallets having a standardised size, is not compromised.

[0050] With the lashing eye 20 in the extracted position, at least part of the lashing eye is positioned in the cavity so that the lashing eye projects through the bottom plane into the inner space 32 of the shipping container 2. Thus, in the extracted position, the at least part of the lashing eye 20 projects out of the cavity 22 into the inner space 32 of the shipping container 2. The lashing eye 20 and the cavity 22 may be dimensioned so that the at least part of the lashing eye 20, when in the extracted position, projects out of the cavity 22 through the bottom plane 42" into the inner space 32 of the shipping container 2. Then, the lashing eye 20 may be used for connecting a rope thereto and thus tightening a load inside the shipping container 2.

[0051] It may be clear from figures 4A and 4B that the lower side rib 6A has an inner side 44 facing towards the inner space 42 of the shipping container 2. The lower side rib 6A also has an outer side 46 facing away from the inner space 42 of the shipping container 2. The third eye portion is positioned in the inner space 32 of the shipping container 2. The third eye portion 20C is positioned at the inner side 44 of the lower side rib 6A.

[0052] Figures 4A and 4B also show the thickening 30 and the cross-member 34. The cross-member is positioned in between the thickening and the lower side rib 6A, in particular in between the thickening and the lower

side rib part 6A'. The cavity may have a bottom 48. The first and second frame apertures 23A, 23B may be provided in the bottom 48 of the cavity 22.

[0053] Figure 5A shows a perspective view of a part of a shipping container 2 in a third embodiment according to the invention. Figure 5B shows a detail I4 indicated in figure 5A. Figure 5C shows, in a transparent view along the top wall 4A and the side wall 4C, a further detail 5 indicated in figure 5A. In the third embodiment, the lashing eye 20 is fastened immovably to the frame of the shipping container. The frame 6 of the shipping container 2 comprises an upper side rib 6B arranged for fixing thereto the top wall 4A and at least one of the side walls 4C so that the at least one of the side walls extends from the upper side rib 6B towards the floor wall 4B. In particular, the lashing eye 20 is fastened immovably to the upper side rib 6B. The lashing eye 20 may be welded to the upper side rib 6B. The cavity 20 may be formed in the side wall 4C of the shipping container 2. In particular, the cavity may be formed by a recess or opening in the side wall 4C of the shipping container. Such is shown in figures 5A and 5C.

[0054] Figure 5B shows a lashing eye that does not protrude into the inner space 32 of the shipping container 2. Thus, analogous to the lashing eye of the shipping container 2 in the first and second embodiment when in the retracted position, the lashing eye 20 does not protrude in the inner space 32. Said inner space in use forms a net loading area of the shipping container 2. Thus, loss of volume for the cargo may be prevented. Also, damage to the cargo or the loading or unloading forklift trucks may be prevented. Since the shipping container 2, contrary to known steel shipping containers 2, preferably lacks corrugated walls, a convenient location for the lashing eyes 20 in an available space between two "half waves" of corrugations, may be lacking.

[0055] Figure 5B further shows the laminate structure 12 that comprises a core layer 16. The core layer is arranged in between, and in mechanical load transferring contact with, a first outer laminate layer 14A and a second outer laminate layer 14B. In use, the core layer 16 supports the outer laminate layers 14A, 14B. In the example of figure 15B, the side wall 4C comprises the laminate structure and the top wall 4A comprises the laminate structure 12.

[0056] Figure 5B further shows a side plane 52" of the shipping container. An inner surface 52 of the side wall 4C may extend in said side plane. Said side plane may extend over the cavity 22. The side plane, and analogous a top plane and the bottom plane, may form a boundary between the inner space 32 of the shipping container 2 and one or more cavities 22. The lashing eye 20 may be received, e.g. welded, in the cavity 22 so that the lashing eye lacks projection into the inner space 32 of the shipping container. Thus, in this example the lashing eye 20 and the cavity 22 may be dimensioned so that the lashing eye is received in the cavity 22 without having the lashing eye project through the wall plane 52" into the inner space 32 of the shipping container 2.

[0057] Figure 6A shows a perspective view of a lashing eye 2 of the shipping container 2 in the third embodiment. Figure 6B shows a side view of the lashing eye 2 of the shipping container 2 in the third embodiment. Figure 6C shows a front view of the lashing eye 2 of the shipping container 2 in the third embodiment. At least part of the first and second eye portions 20A, 20B may be inclined with respect to, i.e. may make an angle a with, the ends 28A, 28B of respectively the first and second eye portions 20A, 20B. In particular, a plane along which at least part of the first and second eye portions 20A, 20B extend may make an angle α with a plane along which the first and second end portions 28A, 28B extend. Said angle a may be at most 30 degrees, in particular at most 20 degrees and/or at least 5 degrees, typically 15 degrees. A similar angle α is indicated in figure 2B.

[0058] In figure 6C, examples of dimensions of a lashing eye are indicated. A maximum dimension D1 of the lashing eye 20 measured in a direction F4 along which the first and second eye portions extend, may be at least 3 centimeter and/or at most 6 centimeter, typically 4.6 centimeter. A maximum width of the lashing eye 20 measured in a direction F5 directed transverse to the direction F4 along which the first and second eye portion extend, may be at most 9 centimeter and/or at least 5 centimeter, typically 6.4 centimeter.

[0059] The invention may thus provide a composite shipping container 2 having lashing eyes 20 connected to the lower side rib and the upper side rib of the shipping container. The lashing eyes 20 may e.g. be designed in such way that the lashing eyes 20 do not protrude in the inner space 32, i.e. a cargo area, of the shipping container 2 when not in use for tightening goods. The composite shipping container 2 may having lashing eyes 20 in the lower side rib, or, in other words, the lower side rail or bottom side rail, of the shipping container in such a design that the lashing eyes contain a sliding U-shaped iron bar. Preferably, a connecting bar of the U-shape piece does sink below the bottom plane 42" when not in use for tightening goods. A lashing eye may be connected to the frame 6 in the cavity in such a way that the lashing eye 20 does not protrude in the cargo area 32 of the shipping container 2. The composite shipping container 2 may have lashing eyes 20 connected to an upper side rib 6B and may have lashing eyes 20 connected to a lower side rib 6A.

[0060] Embodiments of the invention are not limited to the foregoing description and drawings. E.g., the shipping container may lack a top wall. As another example, the shipping container may comprise a plurality of lashing eyes. A plurality of lashing eyes may be fastened, e.g. movably, to a lower side rib, and/or a plurality of lashing eye may be fastened, e.g. movable, to another lower side rib. Alternatively or additionally, a plurality of lashing eyes may be fastened, e.g. immovably, to an upper side rib, and/or a plurality of lashing eye may be fastened, e.g. immovably, to another upper side rib. Lashing eyes fas-

tened to lower side rib(s) may be mutually similar, in particular similar to a lashing eye 20 in an embodiment according to the invention. Lashing eyes fastened to upper side rib(s) may be mutually similar, in particular similar to a lashing eye 20 in an embodiment according to the invention. 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 indefinite article "a" or "an" does not exclude a plurality. Expressions like '"lower", "upper", "inside", "inner", "outside", "outer", "top", "bottom", "upwards", "downwards", "side", "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 comprising a frame for mechanically fixing at least one of the walls thereto, wherein the at least one of the walls comprises a fiber-reinforced composite wall material, wherein the shipping container is provided with a lashing eye that is fastened to the frame of the shipping container, and wherein the at least one of the walls is provided with a cavity for receiving therein at least part of the lashing eye.

2. Shipping container according to claim 1, wherein the at least one of the walls comprises fiber reinforced plastic panel.

3. Shipping container according to claim 2, 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 fiber-reinforced composite wall material.

4. Shipping container according to claim 3, 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.

5. Shipping container according to one of claims 1-4, wherein the at least one of the walls bounds an inner space of the shipping container, wherein the lashing eye and the cavity are dimensioned so that the at least part of the lashing eye can be received in the cavity without having the lashing eye project out of the cavity into the inner space of the shipping container.

6. Shipping container according to one of claims 1-5, wherein the lashing eye is fastened movably to the frame of the shipping container.

7. Shipping container according to claim 6, wherein the lashing eye is movable from a retracted position to an extracted position and vice versa.

8. Shipping container according claim 7, wherein, in the retracted position, the at least part of the lashing eye is received in the cavity so that the lashing eye lacks projection into the inner space of the shipping container.

9. Shipping container according to claims 7 or 8, wherein, in the extracted position, the at least part of the lashing eye projects out of the cavity into the inner space of the shipping container.

10. Shipping container according to one of claims 6-9, wherein the frame comprises a lower side rib arranged for fixing thereto the floor wall and at least one of the side walls so that the at least one of the side walls extends from the lower side rib in use upwards, wherein the lashing eye is fastened movably to the lower side rib.

11. Shipping container according to claim 10, wherein the floor wall and/or the at least one of the side walls is provided with the cavity.

12. Shipping container according to one of claims 6-11, wherein the lashing eye comprises a first eye portion and a second eye portion spaced apart from the first eye portion, and wherein the frame, in particular the lower side rib, comprises a first frame aperture and a second frame aperture spaced apart from the first frame aperture, wherein the first eye portion in use extends through the first frame aperture and the second eye portion in use extends through the second frame aperture, so that the lashing eye is movable with respect to the frame of the shipping container by movement of the first and second eye portion through respectively the first and second frame aperture.

13. Shipping container according to claim 12, wherein the first eye portion and the second eye portion are mutually mechanically connected by means of a third eye portion extending from at least the first eye portion to the second eye portion.

14. Shipping container according to claim 13, wherein the frame, in particular the lower side rib, has an inner side facing towards an inner space of the ship-

ping container, and wherein the frame, in particular the lower side rib, has an outer side facing away from the inner space of the shipping container, wherein the third eye portion is positioned at the inner side of the frame, in particular of the lower side rib.

15. Shipping container according to one of claims 12-14, wherein the first eye portion and the second eye portion extend from the inner space of the shipping container through the first frame aperture respectively the second frame aperture in a direction directed away from the inner space of the shipping container and terminate respectively in an end of the first eye portion and an end of the second eye portion, wherein said ends are each provided with a thickening arranged for preventing the ends to pass through the first and second frame apertures into the inner space of the shipping container.

16. Shipping container according to claim 15, wherein the first and second eye portions are each provided with a threaded end, wherein the thickenings are formed by nuts provided on said threaded ends.

17. Shipping container according to one of claims 12-16, wherein the lashing eye further comprises a cross-member that is provided with a first cross-member aperture and a second cross-member aperture through which the first and second eye portions movably extend, wherein the thickenings are arranged for preventing to pass through the first and second cross-member apertures, wherein the cross-member is positioned in between the thickenings and the frame, in particular in between the thickenings and the lower side rib.

18. Shipping container according to one of claims 1-17, wherein the cavity has a bottom, and wherein the first and second frame aperture are provided in the bottom of the cavity.

19. Shipping container according to one of claims 1-18, wherein the cavity is formed by a frame part, in particular a lower side rib part, that extends laterally from the lower side rib in a direction directed transverse to a longitudinal direction of the lower side rib.

20. Shipping container according to one of claims 1-19, wherein the plurality of walls form, in use, a top wall of the shipping container, wherein the at least one of the side walls extends from the lower side rib in the side wall direction towards the top wall.

FIG 1/15

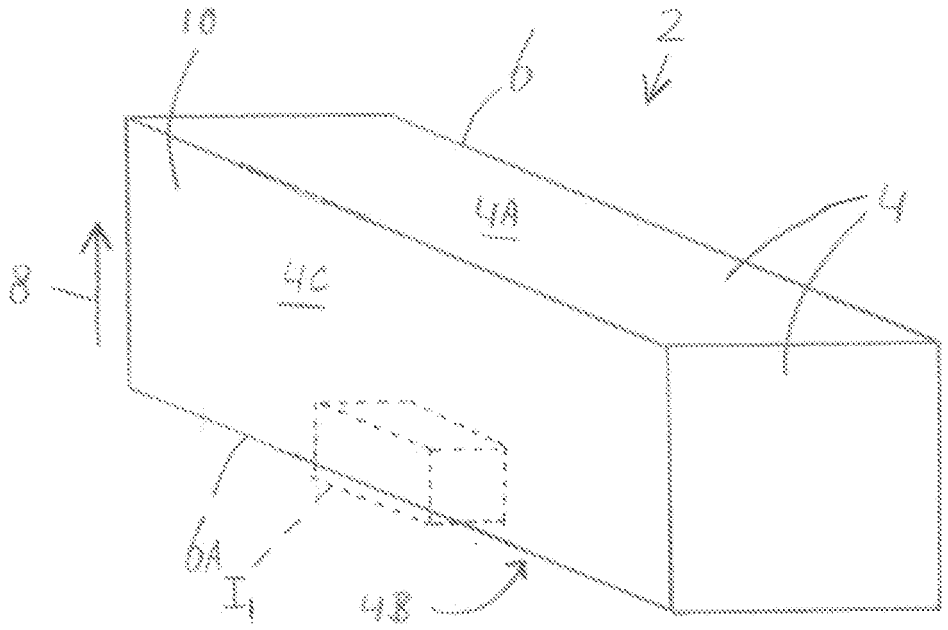


FIG 2A/15

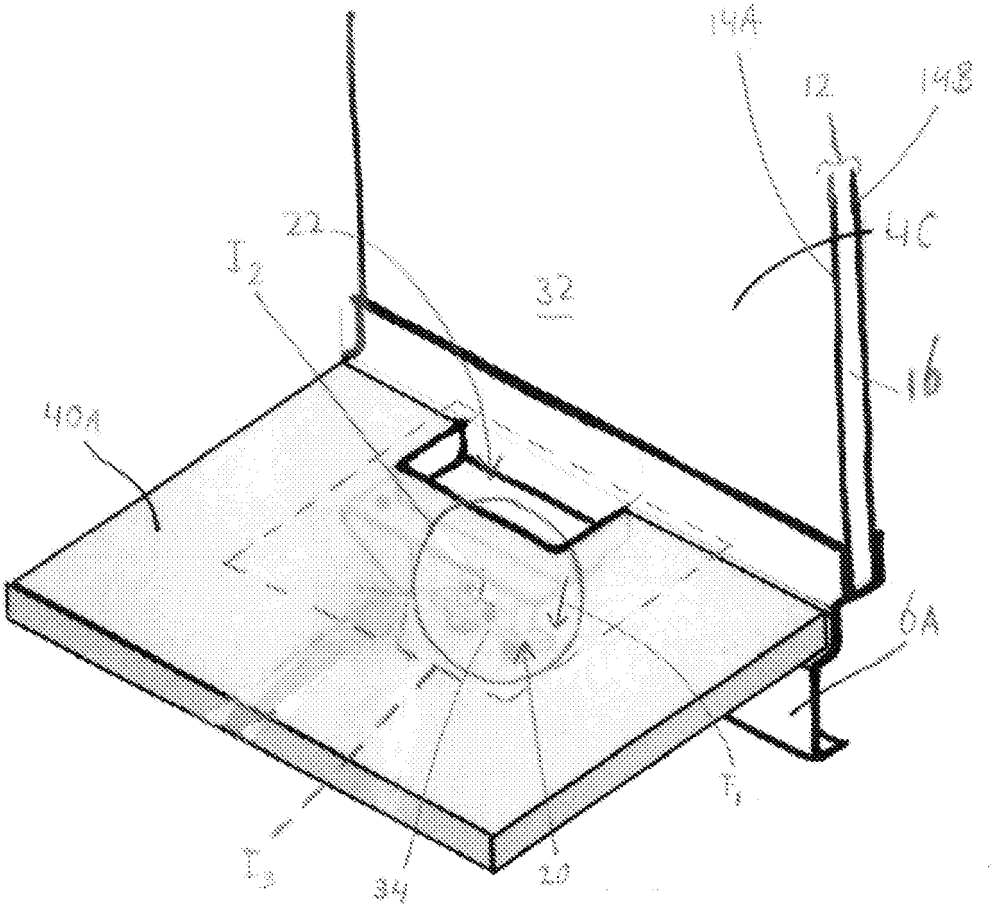


FIG 2B/15

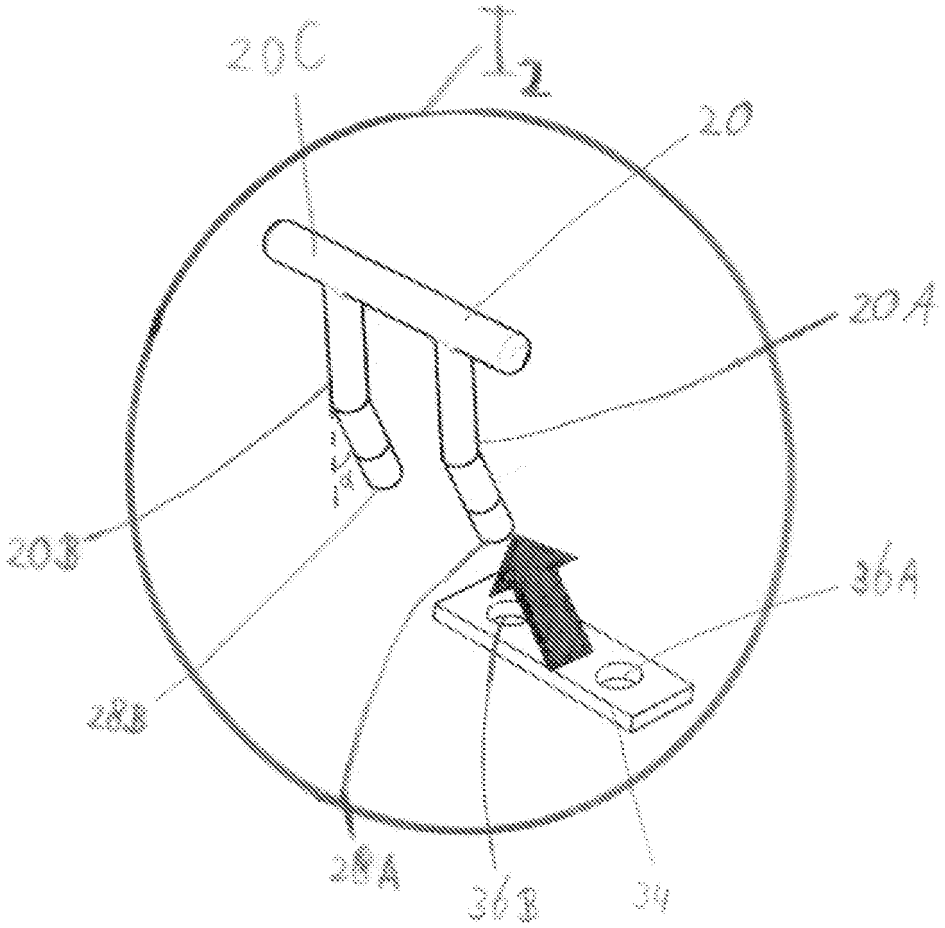


FIG 2C/15

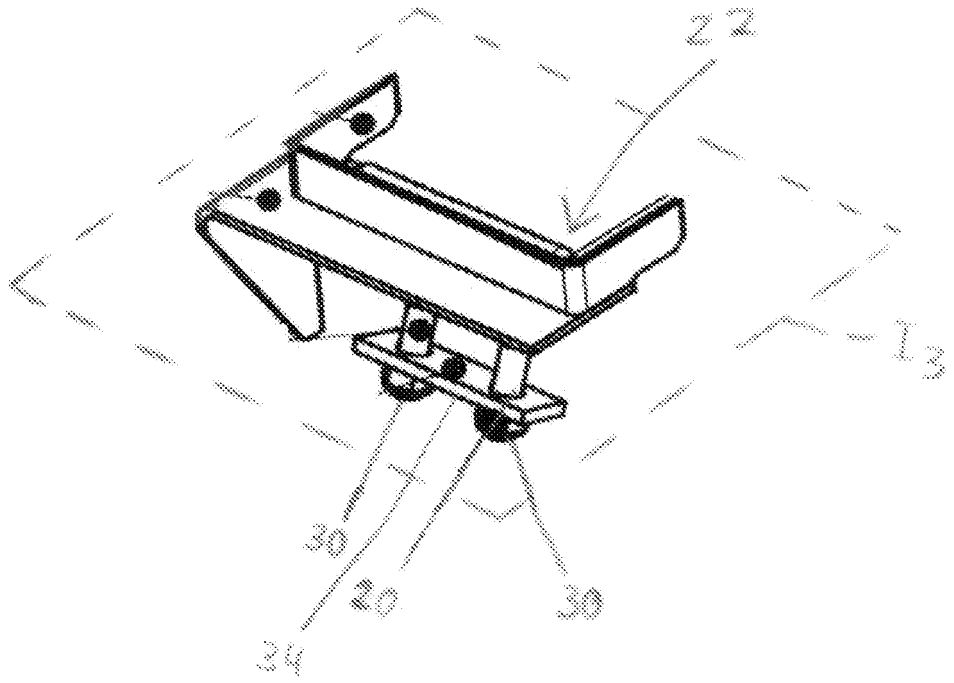


FIG 2D/15

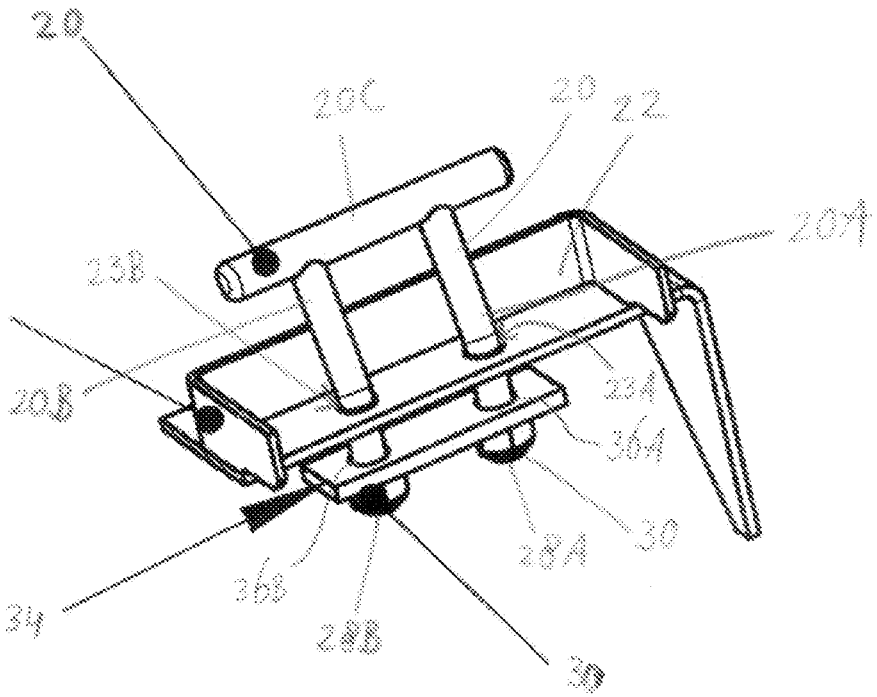


FIG 3A/15

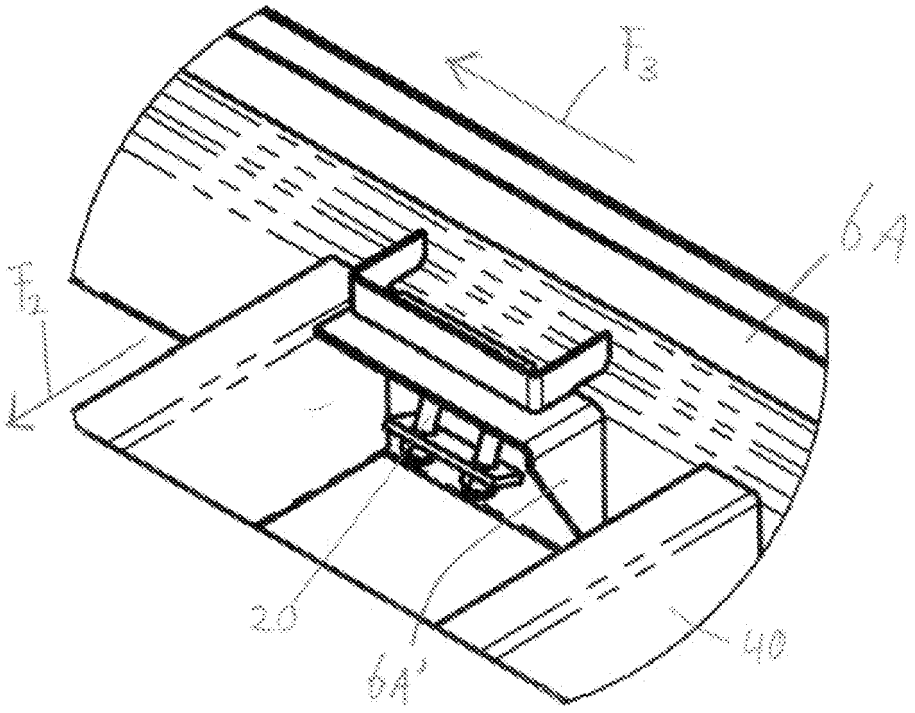


FIG 3B/15

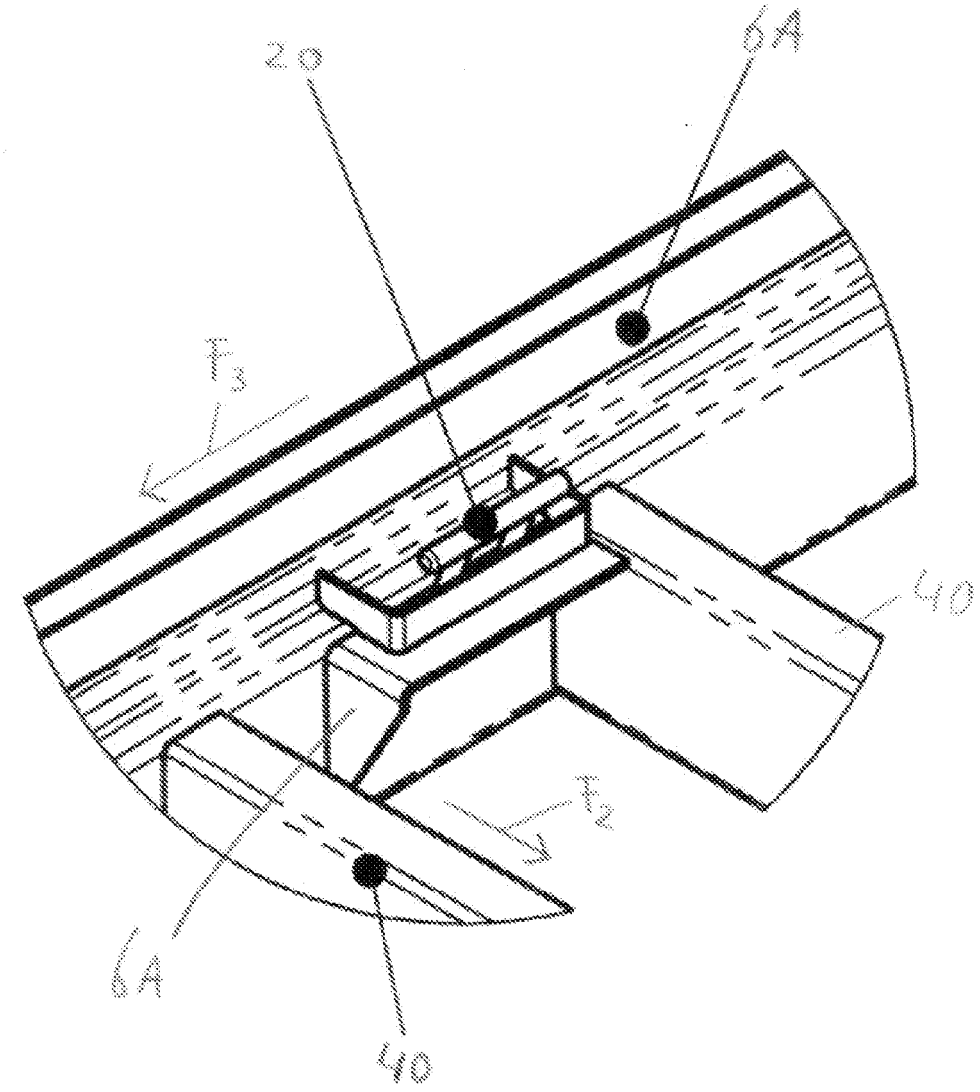


FIG 4A/15

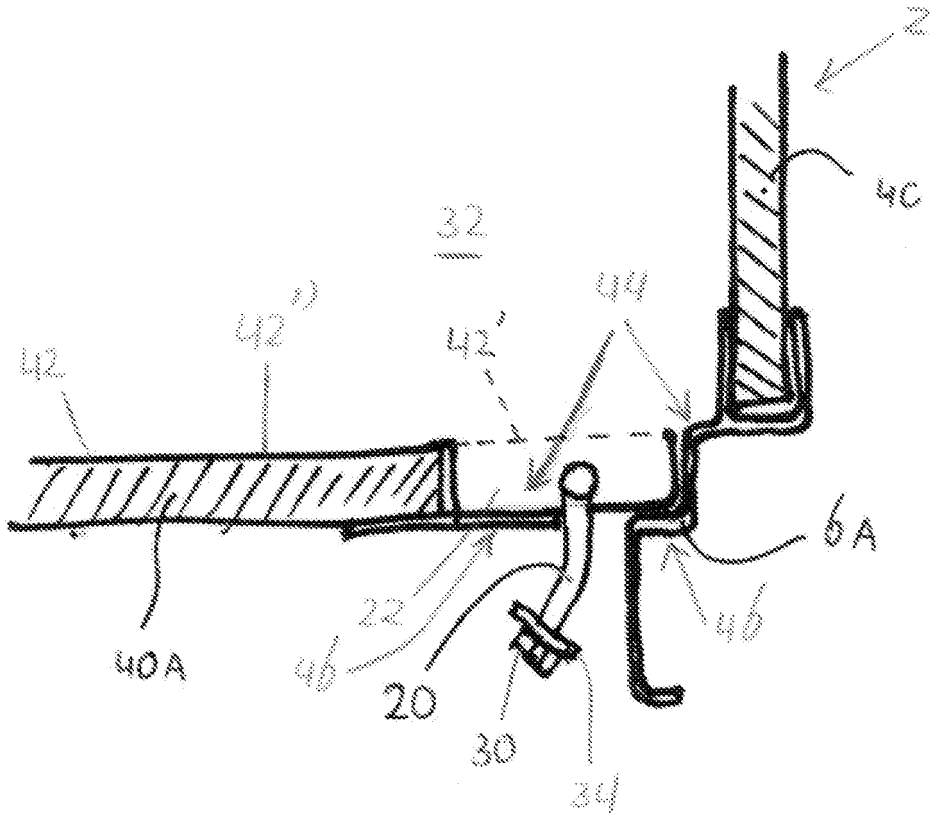


FIG 4B/15

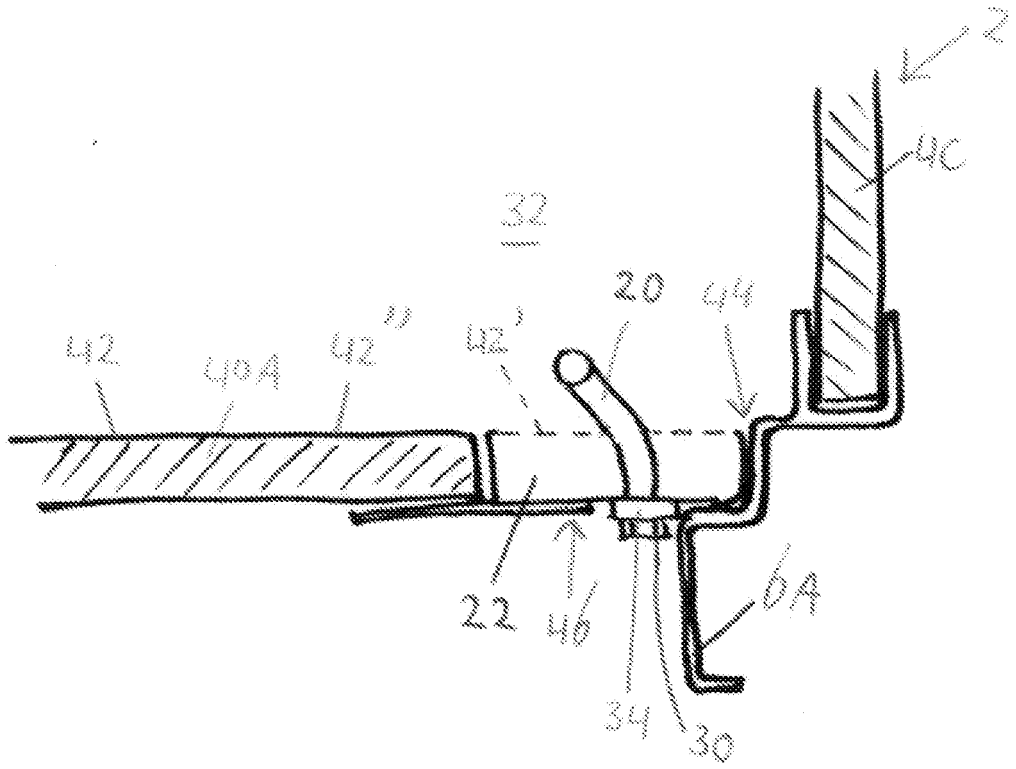


FIG 5A/15

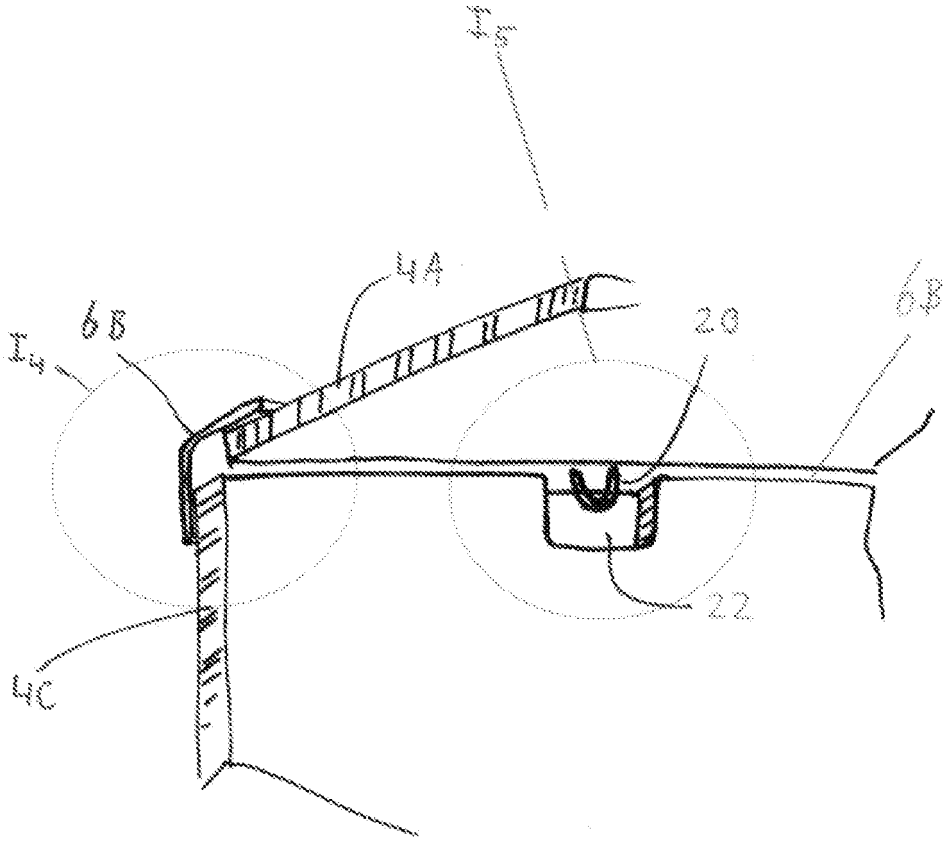


FIG 5B/15

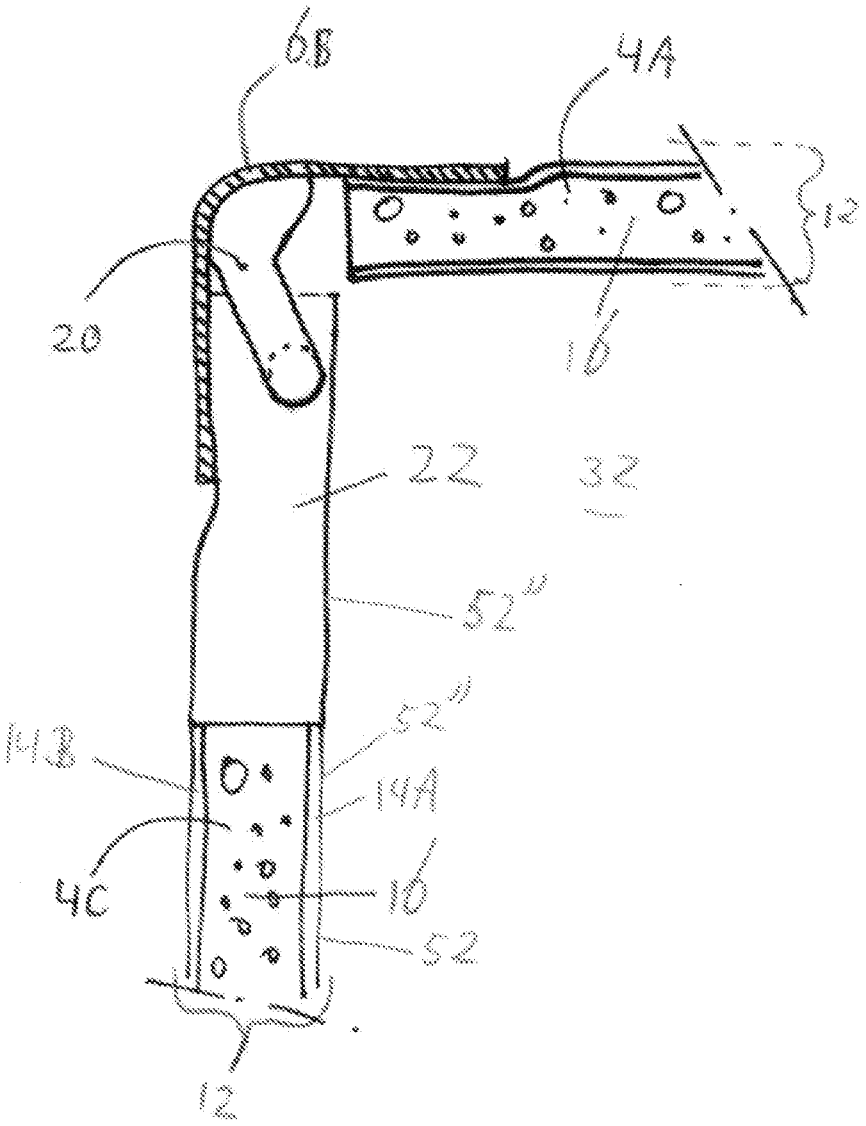


FIG 5C/15

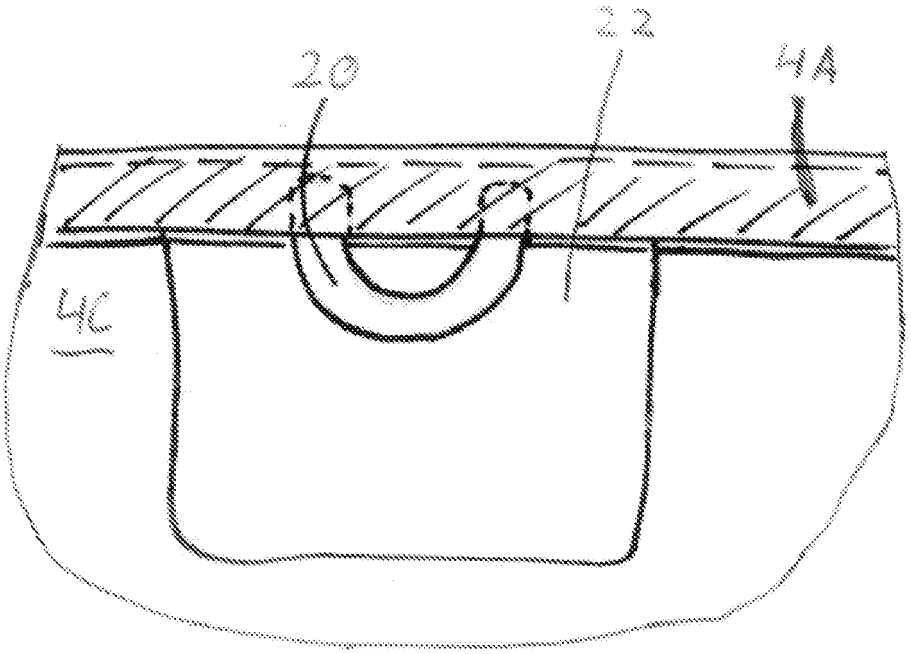


FIG 6A/15

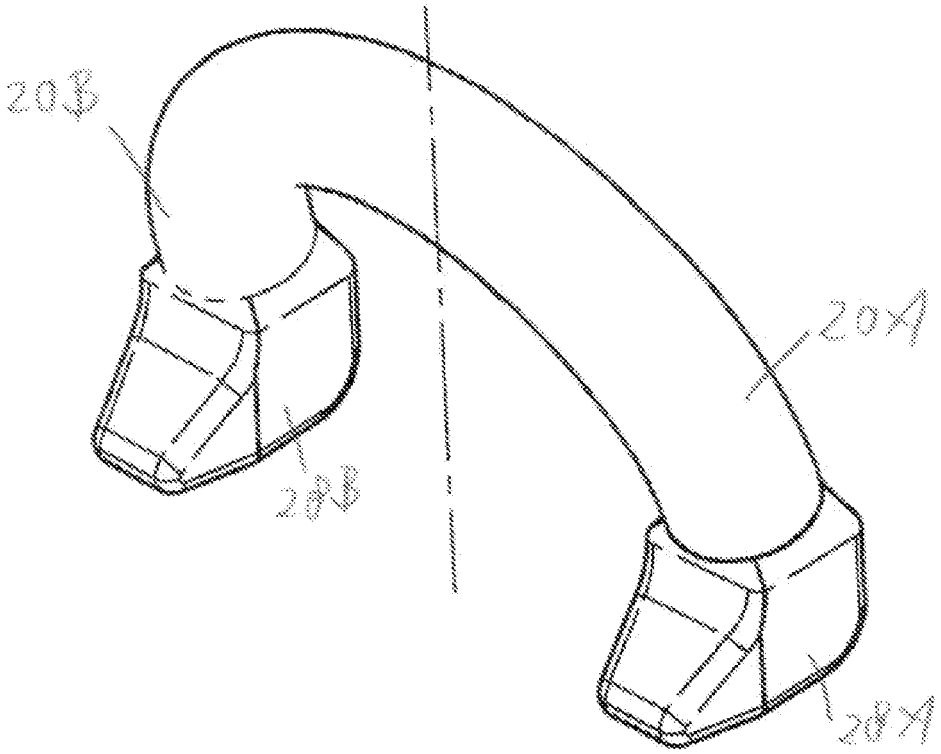


FIG 6B/15

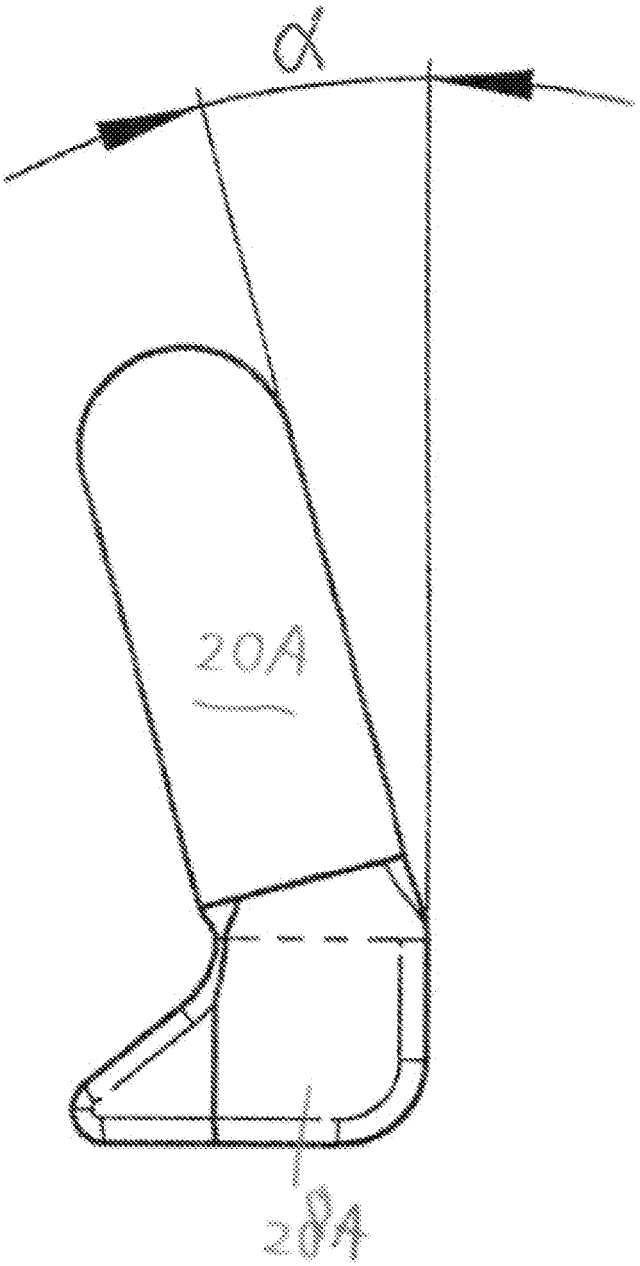
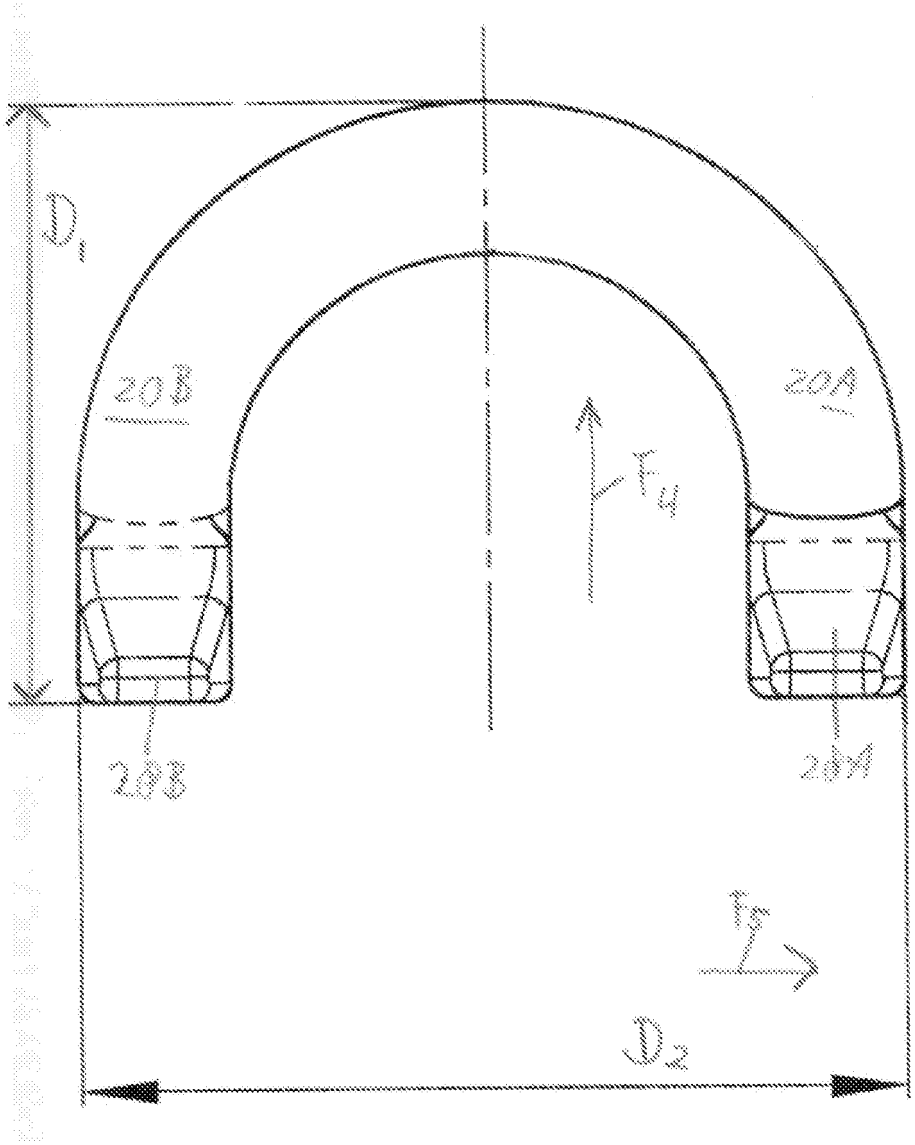


FIG 6C/15



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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 9826

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	WO 96/29232 A1 (STOUGHTON COMPOSITES INC [US]; SHAFFER BRENT G [US]; LIVINGSTON DOUGLA) 26 September 1996 (1996-09-26) * page 7, line 14 - page 20, line 17; figures 5,6 *	1-5,11, 18-20	INV. B65D90/00 B65D90/02 B65D90/08 ADD. B65D88/12
Y	WO 2010/094086 A1 (LOAD EASY INTERNAT PTY LTD [AU]; CROOK THOMAS JAMES [AU]) 26 August 2010 (2010-08-26) * page 13, paragraph 4 - page 16, paragraph 3; figures 2,4 *	1-5,11, 18-20	
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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	16 February 2012	Lämmel, Gunnar

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 11 16 9826

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

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

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

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

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-5, 11, 18-20

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 11 16 9826

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

1. claims: 1-4, 20

   details of the fiber-reinforced composite wall material

   ---

2. claims: 5, 11, 18, 19

   details of the cavity

   ---

3. claims: 6-10, 12-17

   movability of the lashing eye

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 16 9826

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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