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(54) **BUILDING MODULE**

(57) A building module for use as a part of a moveable work- and/or living space is provided. The building module comprises a roof frame. The roof frame comprises at least one roof profile. The module comprises at least one roof element connected to the roof profile, which roof profile has at least a first and a second flank together forming a corner being inwards oriented to the roof profile. The first flank is substantially parallel to the top surface of the at least one roof element, the endpoint of the second flank oriented away from the corner extends, in a direction perpendicular to the first flank, less or equally far from the first flank as the lower surface of the at least one roof element.

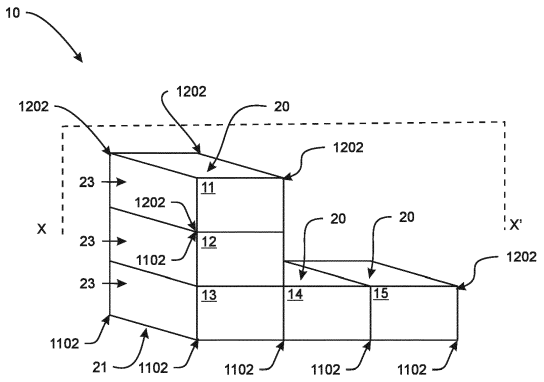

Fig. 1a

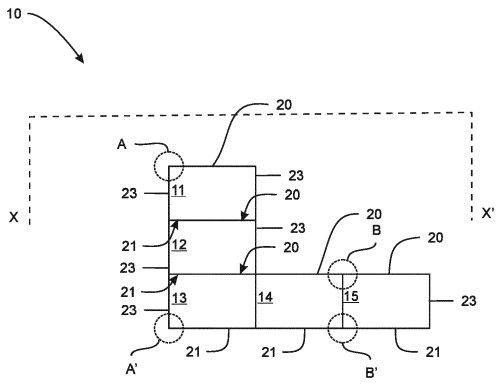

Fig. 1b

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Description

Field of the Invention

[0001] The present invention generally relates to building modules for use as a part of a moveable work- and/or living space.

Background of the Invention

[0002] Building modules for use as a part of a moveable work- and/or living space are known. Such modules are mounted one adjacent and/or on top of the other in order to provide a moveable work- and/or living space, e.g. for temporarily housing, as temporarily offices at construction sites, an many more uses.

[0003] An example of such building module is given in DE202009002015U1.

[0004] The safety and environmental requirements for such temporarily work- and/or living space, such as Belgian EPB-legislation, required R(EI) values by local legislation, etcetera, become more and more difficult, if not impossible, to be met. Users also have more and more specific requirements, like substantially planar floors and roofs along a plurality of adjacent modules.

[0005] Also during mounting of the modules, safety requirements for workmen installing the modules, are raised. Nowadays, safely mounting moveable work- and/or living spaces are time consuming.

Summary of the Invention

[0006] It is an object of the present invention to provide building modules for use as a part of a moveable work- and/or living space which overcome one or more drawbacks of the building modules presently known. It is an object of some embodiments of the invention to provide building modules which can be installed more easily with less interventions of workmen on the roof tops of the modules to be mounted. It is an object of some embodiments of the invention to provide building modules which can meet the present safety and environmental requirements.

[0007] According to a first aspect a building module for use as a part of a moveable work- and/or living space is provided. The building module comprises a roof frame. The roof frame comprises at least one roof profile. The module comprises at least one roof element connected to the roof profile, which roof profile has at least a first and a second flank together forming a corner being inwards oriented to the roof profile. The first flank is substantially parallel to the top surface of the at least one roof element, the endpoint of the second flank oriented away from the corner extends, in a direction perpendicular to the first flank, less or equally far from the first flank as the lower surface of the at least one roof element.

[0008] The distance from the endpoint of the second flank oriented away from the corner extends and the lower surface of the at least one roof element, in a direction perpendicular to the first flank, is preferably in the range of 15 to 150 mm.

[0009] As such, the roof element may be coupled to the roof profile, while avoiding a cold bridge between the outer ambient of the work- and/or living space, and the inner of the module, hence the inner space of the work- and/or living space.

[0010] A profile, such as a steel profile, is a product which have been shaped, like plied, rolled, drawn, extruded or pressed, into a shape which is of the same cross-section over its entire length. A profile has a central axis which is perpendicular to the plane forming the cross-section.

[0011] The profile may be a polymeric or metal profile, preferably being a steel profile. The metal profile may be an extruded, hot or cold rolled metal profile, most preferably a cold rolled steel profile. Hence the profile may have a cross-section in radial direction, which cross-section is a solid profile, or a filled profile, filled with material. The metal profile may be an extruded, hot or cold rolled metal profile, most preferably a cold rolled steel profile, whose internal void is partially or completely filled with thermally and/or flame retarding material.

[0012] The profile may be a tubular profile. Hence the profile may be an unfilled profile, i.e. having a cross-section in radial direction, which cross-section has a perimeter encompassing a void. The filled or unfilled profile may be a closed profile, i.e. the cross -section is free of openings or interruptions along its perimeter, or may be an open profile, i.e. the cross -section is having an opening or interruption along its perimeter.

[0013] Preferably, the profile is a cold rolled steel profile, provided from a steel sheet having a thickness in the range of 1 to 6 mm, such as in the range of 2 to 5 mm. The steel alloy used is preferably construction steel alloys. The outer surfaces of the profile, or even all surfaces of the profile, may be coated with a corrosion retarding or preventing coating. The outer surfaces of the profile, or even all surfaces of the profile, optionally on top of the corrosion retarding or preventing coating, may be provided with any other coating, like a decorative coating.

[0014] The roof frame preferably has a polygonal, more preferably a square or rectangular circumference. The length of the sides of the circumference may be in the range of 1 to 12 m, such as in the range of 1 to 5 m for the small side of the rectangular circumference and 3 to 12 m for the long side of the rectangular circumference.

[0015] Preferably all profiles from the roof frame are identical.

[0016] The module may comprise a floor frame. The roof frame and the floor frame may have the same planar projection, i.e. the same projection of the floor frame or roof frame to a plane parallel to the floor of the module.

[0017] At the point where two profiles of a roof frame connect, the connection or joint between the two profiles may be provided as a mitre joint, i.e. a joint made between two profiles at a defined angle, such as an angle of 90°,

such that the line of junction bisects this angle. Alternatively, a joining means may be used to connect the two outer ends of the two profiles on to the other. Such joining means may e.g. be a corner, like a steel corner, e.g. an ISO1161 corner castings.

[0018] The first flank of the profile is substantially parallel to the top surface of the at least one roof element. Substantially parallel means that the plane of the flank and the plane of the top surface are parallel within normal tolerances during construction. Though the angle between these planes is aimed to be 0°, an angle of plus or minus 2° is understood as substantially parallel.

[0019] The roof frame and the roof element or elements together provide a roof to the module. Possibly more than one roof element is provided and coupled to the roof frame. The plurality of roof elements may be mount side by side while being coplanar. The side of a first roof element may be contacting the side of a second roof element. The length of the sides of the circumference of a single roof element may be in the range of 0.5 to 12 m, such as in the range of 1 to 10 m.

[0020] In some embodiments, the top surface of the at least one roof element may be fixed to the first flank.

[0021] In some embodiments, at least a part of the side of the at least one roof element may be fixed to the second flank.

[0022] The top surface of the at least one roof element may be coupled to the first flank, such as being mechanically and/or chemically connected one to the other. This coupling may be realized by using an adhesive, like a permanent adhesive, such as modified silane polymer kits, or my means of mechanical fastening means like bolts, screws, or rivets. Possibly the head of the mechanical fastening means are sunken in the lower surface of the at least one roof element. The void between the head of the sunken mechanical fastening means and the lower surface of the at least one roof element may be filled with filling material, optionally having thermally insulating and/or flame retardant and/or fire resistant properties. The top surface of the at least one roof element may cover the whole surface of the first flank, or may only cover a section of the surface of the first flank, preferably being a section comprising the outer point of the first flank, i.e. the endpoint of the first flank oriented away from the corner it makes with the second flank.

[0023] A part or the whole side of the at least one roof element may be coupled to the second flank, such as being mechanically and/or chemically connected one to the other. This coupling may be realized by using an adhesive, like a permanent adhesive, such as modified silane polymer kits, or my means of mechanical fastening means like bolts, screws, or rivets. Possibly the head of the mechanical fastening means are sunken in the lower surface of the at least one roof element. The void between the head of the sunken mechanical fastening means and the lower surface of the at least one roof element may be filled with filling material, optionally having thermally insulating and/or flame retardant and/or fire resistant properties. The side of the at least one roof element may cover the whole surface of the second flank or may only cover a section of the surface of the second flank, preferably being a section comprising the outer point of the second flank, i.e. the endpoint of the second flank oriented away from the corner it makes with the first flank.

[0024] Possibly the top surface of the at least one roof element may contact, even be coupled to the first flank and the part or the whole side of the at least one roof element may contact, even be coupled to the second flank. As such the roof element fills the corner provided by the first and second flank.

[0025] The roof profile may be free from flanks extending under the lower surface of the roof element.

[0026] The endpoint of the second flank oriented away from the corner may provide the lowermost point of the roof profile.

[0027] This further facilitates the provision of a work- and/or living space by means of modules, where cold bridges between the inner space of the work- and/or living space and the outer ambient are avoided when several modules are mounted adjacent to each other, and having sides contacting each other, thereby forming a work- and/or living space comprising an inner space being the combination of the inner spaces of the two or more adjacent modules. Where two profiles of two adjacent roof frames meet, the lower side of both profiles will be less far remote from the respective first flanks of the profiles, as compared to the lower surface of the roof elements. Both lower surface of the roof elements will extend lower than the profiles. The area between the sides of the roof elements, the area being situated under the two profiles, may be filled with a thermally insulating and/or flame retardant and/or fire resistant material, like a tape or plate of such material. By filling this area, a substantially planar roof plane at the whole inner side of the work- and/or living space may be provided, which substantially planar roof plane is free from cold bridges with the ambient outside the work- and/or living space.

[0028] The at least one roof element may comprise flame retardant and/or fire resistant, and thermally insulating material.

[0029] The at least one roof element may comprise flame retardant and/or fire resistant, and/or thermally insulating material. "Flame retardant" means material which does not ignite readily or propagate flames under small to moderate fire exposures. Fire resistant means non-combustible. "Thermally insulating material means" having a lambda value of less than or equal to 0,100 W/mK.

[0030] Preferably the one roof element comprises flame retardant and/or fire resistant, and thermally insulating material, such as mineral wool, polyurethane material (PUR), polyisocyanurate material (PIR), specialty hard foams and alike and combinations thereof. Optionally the roof element comprises a plurality of layers one on top of the other. The various layers may be identical or different in individual thickness and may be of identical

or different material.

[0031] The at least one roof element preferably has a total thickness in the range of 50 to 300 mm, such as in the range of 60 to 200 mm.

[0032] On the outer top side of the module, the module may comprise a watertight layer or watertight layers, which cover the joining of the roof element and the roof frame at the outer side of the module. As an example, a PVC (polyvinylchloride) or an EPDM (Ethylene-Propylene-Diene-Monomer) based membrane or film may be used. Alternatively, rolled roofing, asphalt based roofing, TPO (thermoplastic Olefin bases polymer) may be used. Water, like rain or snow or alike, which may fall on the roof of the module, may be guided to a drain being provided to roof of the module, preferably on the side of the roof of the module. The module may be provided with a water drainage along the side of the module. The water drainage may be provided such that the water drainage from a first module may connect to the water drainage of a second module located under the first module. The water drainage may be provided such that the water drainage from a first module connect to the water drainage of a second module located under the first module by stacking the modules one on the other.

[0033] According to some embodiments, the roof profile may have a tubular cross section. The tubular cross-section may be open or closed.

[0034] A third flank may provide the upper side of the roof profile, a fourth side providing the outer side of the profile.

[0035] The at least one roof profile may have an L-shaped cross section.

[0036] The first and second flank are the flanks making the inner corner of the L-shaped cross-section. The L-shape may have two legs of equal length, however an L-shape with a long leg and a short leg is preferred. More preferably the first flank is part of the short leg, the second flank is part of the long leg. The thickness of the legs may be equal or different one from the other. More preferred, an L-shape with a long leg and a short leg, the first flank is part of the short leg, the second flank is part of the long leg, and the short leg having a larger thickness as compared to the long leg, is preferred.

[0037] Preferably the L-shaped cross-section is a tubular L-shaped cross-section, i.e. the inner volume delimited by the flanks of the L-shape is unfilled. The L-shape may be delimited by, in sequential order end in counter-clockwise direction round the axis of the profile, said first flank providing the downwards oriented lower side of the L-shape, a first outer flank defining the end of the first leg of the L-shape, a third flank provides the upper side of the roof profile, a fourth side providing the outer side of the profile and a second outer flank defining the end of the second leg of the L-shape and said second flank. Between each pair of consecutive flanks, a corner is provided, for which the smallest angle between the consecutive flanks being all in the range of 60 to 120°, like in the range of 80 to 100° and most preferably are all about 90°.

[0038] Possibly the L-shaped profile is a cold rolled profile, made from a metal, like steel, plate. The plate may be rolled in such a way that the outer borders of the plate are meeting and may be welded to each other at one of the corners of the L-shape. Most preferably this welding is provided in the corner defined by the first outer flank defining the end of the first leg of the L-shape and the third flank providing the upper side of the roof profile, or in the corner defined by the fourth side providing the outer side of the profile and the second outer flank defining the end of the second leg of the L-shape. As such a closed tubular cross-section may be provided.

[0039] Alternatively profile is a cold rolled profile, made from a metal, like steel, plate. Possibly the profile is an L-shaped profile. The plate may be rolled in such a way that the outer borders of the plate provide the endpoints of the first and second flank, these endpoints being oriented towards the corner these two flanks make. The endpoints of the first and second flank may be meeting and may be welded to each other. As such a closed tubular cross-section may be provided. Alternatively these endpoints may be spaced apart and not interconnected, as such providing an open tubular cross section.

[0040] Hence the first and second flank may not be interconnected, hence free of connection or unconnected along the corner they form.

[0041] The floor frame may comprise at least one floor profile, the floor profile being similar to the roof profile. The at least one floor profile and the at least one roof profile may differ in shape and/or dimensions and/or way of being produced and/or material being used, and alike. The various properties of the floor profiles may be similar to the ones set out for the roof profiles as used in the context of the present invention.

[0042] The roof frame and floor frame may be interconnected to each other by one or more supporting means, to keep the roof frame and the floor frame, and hence the roof and the floor from the module spaced apart. Thereby an inner volume of the module is provided. These supporting means carry the weight of amongst others the roof frame and roof element or elements. Possibly the supporting means carry the weight of modules placed on top of the module of which the supporting means are part of.

[0043] The floor frame may be provided with forklift pockets or means to allow the module to be lifted by forklifts.

[0044] The module may comprise a floor frame, the roof frame and floor frame being interconnected by supporting pillars.

[0045] Such supporting pillars may angle profiles, like cold or hot rolled steel angle profiles. These profiles preferably are right angle profiles.

[0046] The use of supporting pillars, preferably at least in each corner of the roof frame towards the corresponding corner of the floor frame, has the advantage that between the roof frame and floor frame, no further load car-

rying means are to be provided. The open area delimited by the supporting pillars, the roof and floor frame may be left open, and allow two modules to be positioned side by side, thereby providing an inner volume to a work- and/or living space being larger than the volume of one module. Alternatively the areas oriented towards the ambient of the work- and/or living space, and optionally also areas within the volume of the work- and/or living space, may be closed by wall elements which are not to support any load in a direction parallel to the plane of the wall element, except their own weight.

[0047] In general the building modules according to the invention may have dimensions conform ruling building legislation. The height of the building module may be in the range of 2.5 to 4 m, such as in the range of 2.6 to 3.6 m. The building module preferably has a rectangular cuboid volume. The long side of the planar projection of the rectangular cuboid volume (i.e. projection parallel to the height of the building module) may be in the range of 3 to 12 m, such as in the range of 4 to 10 m. The short side of the planar projection of the rectangular cuboid volume may be in the range of 1 to 5 m, such as in the range of 2 to 4 m.

[0048] The module may comprise a floor frame, the floor frame comprising at least one floor profile, the floor profile being identical to the roof profile.

[0049] The use of identical profiles for roof profiles and floor profiles, has the advantage that the production of the modules is facilitated less complex, and requires less logistics, as only one type of profile is to be provided for providing both the floor and roof frame during manufacturing of the modules.

[0050] The module may comprise a floor frame, the module comprises at least one floor element connected to the floor profile, said floor profile having at least a first and a second flank together forming corner being inwards oriented to the floor profile, said first flank of the floor profile is substantially parallel to the bottom surface of the at least one floor element, the endpoint of the second flank of the floor profile oriented away from the corner extends, in a direction perpendicular to the first flank of the floor profile, less far from the first flank of the floor profile at the upper side of the at least one floor element.

[0051] This provision avoids the existence of cold bridges between the inner space of the module and the ambient to a large extent, if not completely.

[0052] The at least one floor element may comprise flame retardant and/or fire resistant, and/or thermally insulating material. Alternatively the floor element may comprise wooden plates or elements, concrete plates steel construction elements thermal insulation material, flooring material and surfaces, metal - like steel - plates or sheets, and alike and combinations thereof.

[0053] Optionally the floor element comprises a plurality of layers one on top of the other. The various layers may be identical or different in individual thickness and may be of identical or different material.

[0054] The at least one floor element preferably has a total thickness in the range of 50 to 300 mm, such as in the range of 70 to 250 mm.

[0055] The first flank of the floor profile is substantially parallel to the bottom surface of the at least one floor element. Substantially parallel means that the plane of the flank and the plane of the bottom surface are parallel within normal tolerances during construction. Though the angle between these planes is aimed to be 0°, an angle of plus or minus 2° is understood as substantially parallel.

[0056] The floor frame and the floor element or elements together provide a floor to the module. Possibly more than one floor element is provided and coupled to the floor frame. The plurality of floor elements may be mount side by side while being coplanar. The side of a first floor element may be contacting the side of a second floor element. The length of the sides of the circumference of a single floor element may be in the range of 0.5 to 12 m, such as in the range of 1 to 10 m.

[0057] The bottom surface of the at least one floor element may be coupled to the first flank, such as being mechanically and/or chemically connected one to the other. This coupling may be realized by using an adhesive, like a permanent adhesive, such as modified silane polymer kits, or my means of mechanical fastening means like bolts, screws, or rivets. Possibly the head of the mechanical fastening means are sunken in the upper surface of the at least one floor element. The void between the head of the sunken mechanical fastening means and the upper surface of the at least one floor element may be filled with filling material. The bottom surface of the at least one floor element may cover the whole surface of the first flank, or may only cover a section of the surface of the first flank, preferably being a section comprising the outer point of the first flank, i.e. the endpoint of the first flank oriented away from the corner it makes with the second flank.

[0058] A part or the whole side of the at least one floor element may be coupled to the second flank, such as being mechanically and/or chemically connected one to the other. This coupling may be realized by using an adhesive, like a permanent adhesive, such as modified silane polymer kits, or my means of mechanical fastening means like bolts, screws, or rivets. Possibly the head of the mechanical fastening means are sunken in the upper surface of the at least one floor element. The void between the head of the sunken mechanical fastening means and the upper surface of the at least one floor element may be filled with filling material. The side of the at least one floor element may cover the whole surface of the second flank or may only cover a section of the surface of the second flank, preferably being a section comprising the outer point of the second flank, i.e. the endpoint of the second flank oriented away from the corner it makes with the first flank.

[0059] Possibly the lower surface of the at least one floor element may contact, even be coupled to the first flank and the part or the whole side of the at least one floor element may contact, even be coupled to the second

flank. As such the floor element fills the corner provided by the first and second flank.

[0060] Possibly the roof profile may be free from flanks extending under the lower surface of the roof element. Possibly the endpoint of the second flank may be oriented away from the corner provides the lowermost point of the roof profile.

[0061] This further facilitates the provision of a work- and/or living space by means of modules, where cold bridges between the inner space of the work- and/or living space and the outer ambient are avoided when several modules are mounted adjacent to each other, and having sides contacting each other, thereby forming a work- and/or living space comprising an inner space being the combination of the inner spaces of the two or more adjacent modules. Where two profiles of two adjacent floor frames meet, the upper side of both floor profiles will be less far remote from the respective first flanks of the floor profiles, as compared to the upper surface of the floor elements. Both upper surface of the floor elements will extend above the floor profiles. The area between the sides of the floor elements, the area being situated above the two profiles, may be filled with a suitable material, like a tape or plate of material. By filling this area, a substantially planar floor plane along the whole inner side of the work- and/or living space may be provided, which substantially planar floor plane is free from cold bridges with the ambient outside the work- and/or living space.

[0062] According to some embodiments, one or more wall elements may be provided, the upper side of the wall element contacting the lower surface of the roof element. Additionally or alternatively, in case these is an open space provided between the side of the at least one roof element and the second flank of the roof profile, the upper side of the wall element may be provided in the open space provided between the side of the at least one roof element and the second flank of the roof profile, filling partially or completely this open space.

[0063] Similarly for the floor side of the module, according to some embodiments, one or more wall elements may be provided, the lower side of the wall element contacting the upper surface of the floor element. Additionally or alternatively, in case these is an open space provided between the side of the at least one floor element and the second flank of the floor profile, the lower side of the wall element may be provided in the open space provided between the side of the at least one floor element and the second flank of the floor profile, filling partially or completely this open space.

[0064] The at least one wall element may comprise flame retardant and/or fire resistant, and/or thermally insulating material.

[0065] Preferably the one wall element comprises flame retardant and/or fire resistant, and thermally insulating material, such as polyurethane material (PUR), polyisocyanurate material (PIR), specialty hard foams and alike and combinations thereof. Optionally the wall element comprises a plurality of layers one on top of the other. The various layers may be identical or different in individual thickness and may be of identical or different material.

[0066] The at least one wall element preferably has a total thickness in the range of 50 to 300 mm, such as in the range of 60 to 200 mm.

[0067] Wall elements may be provided with doors, windows, openings and alike. The inner surfaces of the wall elements may be provided with sound attenuating material.

[0068] Cold bridges between the ambient and the inner space of the work- and/or living space at the top and the foot of the wall element may be avoided.

[0069] The module may comprise at least a first wall element, the upper side of the wall element contacting the lower surface of the roof element, the outer surface of said wall element being connected an upper side profile, which upper side profile is connected to the roof profile.

[0070] The module may comprise a floor frame comprising at least one floor profile and a floor element, said module comprises at least a first wall element, the upper side of the wall element contacting the upper surface of the floor element, the outer surface of said wall element being connected a lower side profile, which lower side profile is connected to the floor profile.

[0071] The outer surface of a wall element is the surface oriented away from the inner volume of the module it is part of. The provision of an upper and/or lower side profile to contact the outer surface of the wall element, and connecting this upper and/or lower profile to the roof respectively the floor profile, has the advantage that this upper and/or lower profile may bridge the part of the side of the roof element respectively the floor element over which the roof element or floor element extends beyond the roof respectively the floor profile. As such the will element or elements can be firmly fixed to the roof and/or floor profile, while no cold bridges are provided, nor parts from the roof or floor profile needs to be provided to couple the wall element to. In the meantime, if no wall element is provided between two adjacent profiles of two adjacent modules providing a work- and/or living space, the lower side of both roof profiles will be less far remote from the respective first flanks of the roof profiles, as compared to the lower surface of the roof elements. Both lower surface of the roof elements will extend lower than the profiles. The area between the sides of the roof elements, the area being situated under the two profiles, may be filled with a thermally insulating and/or flame retardant and/or fire resistant material, like a tape or plate of such material. By filling this area, a substantially planar roof plane at the whole inner side of the work- and/or living space may be provided, which substantially planar roof plane is free from cold bridges with the ambient outside the work- and/or living space. Similarly, the upper side of both floor profiles will be less far remote from the respective first flanks of the floor profiles, as compared to the upper surface of the floor elements. Both lower sur-

face of the floor elements will extend above the floor profiles. The area between the sides of the floor elements, the area being situated above the two profiles, may be filled with a floor material, like a tape or plate of suitable material. By filling this area, a substantially planar floor plane at the whole inner side of the work- and/or living space may be provided, which substantially planar floor plane is free from cold bridges with the ambient outside the work- and/or living space.

[0072] According to a second aspect, a building module for use as a part of a moveable work- and/or living space is provided. The module comprises a floor frame and a roof frame, the roof frame comprising at least one roof profile. The module comprises at least one roof element connected to the roof profile, the roof profile having at least a first and a second flank together forming a corner being inwards oriented to the roof profile. The first flank is substantially parallel to the top surface of the at least one roof element. The top surface of the at least one roof element is fixed to the first flank, possibly along a part or even along the whole length of the first flank. This fixing can be by means of a mechanical fixing and/or a chemical fixing.

[0073] It is clear that the features of the first aspect of the invention may be combined with features of the second aspect of the invention.

[0074] According to a further, third, independent aspect of the invention, a building module for use as a part of a moveable work- and/or living space is provided. The module comprises a floor frame and a roof frame. The floor frame comprises at least three support points adapted to support the module on a roof frame of an identical module when two identical modules are mounted one on top of the other. The roof frame is adapted to support an identical module mounted on top of the module of which the roof frame is part of.

[0075] Identical modules are to be understood as two modules having the same roof and floor frame, and roof and floor elements. The identical modules hence may differ from each other in the number and type of wall elements being provided.

[0076] The module comprises at least one, and possibly a plurality, of floor elements being supported on the floor frame. Under the floor element or elements, a void space is defined by the floor frame, the lower surface of the floor element or elements, and the at least three support points on the floor frame.

[0077] The roof frame may be provided with a lifting means, adapted to receive a hook of a lifting device for lifting the building module.

[0078] The lifting means protrudes above the roof frame. The void space at the floor frame of said module is adapted to receive the lifting means of an identical module mounted under the module the floor frame is part of.

[0079] The module may comprise a floor frame and a roof frame, both having an identical polygonal contour. The at least one lifting means is preferably provided in at least one of its corners of its contour. Optionally at least three lifting means are provided, and preferably in three corners of its contour. The void space at the floor frame of said module is adapted to receive all lifting means of an identical module mounted under the module the floor frame is part of.

[0080] The floor and roof frame may define a rectangular contour. four lifting means may be provided in the four corners of its contour. The void space at the floor frame of said module is adapted to receive said four lifting means of an identical module mounted under the module the floor frame is part of.

[0081] The lifting means may be located at the inner side of the roof frame.

[0082] The lifting means may be provided as a hook of a bar, like a hook provided by a metal, like steel, bar. Alternatively, the lifting means may be a plate, like a metal, e.g. steel plate, in which at least one, like one opening, an eye, is provided. The lifting means may be provided as a fin extending above the roof frame, the plane of the fin being about perpendicular, e.g. perpendicular to the roof upper surface. The lifting means may be provided as a fin extending above the roof frame, the fin bisecting the angle of the roof frame it is connected to.

[0083] The upper side of the fin may be provided as a guiding curve, adapted to guide the floor frame, e.g. a corner of the floor frame, to the corresponding position on the roof frame, where said roof frame is to support this floor frame. The guiding curve may be a continuous line, continuously decreasing in height from the top point of the lifting means towards the roof frame the loading means is connected to. This facilitates the mounting of identical or similar modules in a stacked configuration. The lifting means of the lower module, which themselves were used to lift this lower module, will receive the floor frame of the adjacent upper module, and guide the floor frame, hence the module, to the stacking position of this second upper module on the lower module, and this without interference of a workman. Once the modules are stacked, the lifting means will contribute to the stability of the stack of modules.

[0084] Each of the lifting means may be provided with a flexible lifting means, like a cable, chain or rope or similar means, coupled to the lifting means at one end, the other end being connected to a central hoisting device, like a hoisting ring or hoisting eye. By lifting the hoisting device, the module can be lifted. Preferably the hoisting device is a metal device, like a steel device, e.g. a steel ring or eye. This metal device can be attracted by a hoisting hook being provided with an activatable magnetic means, like an electromagnet. By bringing the hook with the activatable magnetic means near the hoisting means, and activating the magnetic means, the metal hoisting device will be attracted to the magnetic device, thereby orientating the opening of the metal hoisting device such that the hook can connect to the metal hoisting device.

[0085] As such, no workmen need to get onto the roof of the module in order to couple the hook to the hoisting

device.

[0086] While modules are stacked one to the other, the lifting means, the flexible lifting means like a cable, chain or rope or similar means, and the central hoisting device may remain in place during use of the stacked modules. In this case the void space at the floor frame of the upper module is adapted to receive the lifting means, the flexible lifting means like a cable, chain or rope or similar means, and the central hoisting device.

[0087] As such, no workman needs to get onto the roof of the module in order to decouple the flexible lifting means, like the cable, chain or rope or similar means, and the central hoisting device from the lifting means each time a further module is stacked onto another module.

[0088] It is clear that the features of the first, second, and/or third aspect of the invention may be combined with each other.

[0089] It is clear that the building modules of the first, second, and/or third aspect of the invention may be used to provide a moveable work- and/or living space.

[0090] According to a fourth aspect of the invention, a moveable work- and/or living space is provided, the moveable work- and/or living space comprising at least a first and a second building module according to the first aspect of thein invention. The building modules may be mounted adjacent one to the other in vertical direction, i.e. one on top of the other, wherein the roof profile of a first building module contacts the floor profile of a second building module.

[0091] Possibly, even preferably, the floor profile of the first building module contacts the floor profile of the second building module.

[0092] According to some embodiments, a plurality of modules according to the first, second or third aspect of the invention, with same or similar outer dimensions, may be mounted adjacent one to the other together forming a work- and/or living space. Some or all sides of the modules which contact an other side of another module, may be free from wall elements, while the respective floor profiles contacts each other and the respective roof profiles contacts each other. A substantially planar floor and/or roof plane may be provided to the work- and/or living space, by filling the areas above adjacent floor frames and areas under adjacent roof frames with appropriate materials. The planar floor and/or roof plane are coplanar with the upper side of the floor elements, respectively the lower side of the roof elements. And all this while avoiding the creation of cold bridges with the ambient of the work- and/or living space.

[0093] According to some embodiments, a plurality of modules according to the first, second or third aspect of the invention, may be mounted one on top of the other. As such a work- and/or living space with two, three, for, five or even more levels and two, three, for, five or even more open spaces may be provided.

[0094] The work- and/or living spaces according to the invention may meet the fire safety requirements, like the requirements stipulated in the royal decree of July 7, 1994, changed on December 19, 1997 and April 4, 2003. An R(EI) of 60 can be obtained, measured according to live fire tests according to NBN EN 1363-1:2020 and NBN 1365-2:2014. The work- and/or living spaces according to the invention may meet the energy requirements for buildings, like being almost energy neutral. An E-level of E55 or less, even E40 or less can be reached.

[0095] The work- and/or living spaces according to the invention may be used in moveable classrooms, installations for childcare, hospitals, student rooms, sanitary facilities, offices, home offices, kangaroo houses, private houses, overnight spaces in holiday parks, as offices, sanitary rooms and/or workplaces and storage places on construction sites, and many more.

[0096] In the context of this invention, when references are made to ranges, these ranges include the end points of the range, unless explicitly stated differently.

Brief Description of the Drawings

[0097]

Figure 1a schematically shows a moveable work- and/or living space. Figure 1b schematically shows a cross section according to a vertical plane of the building modules of the moveable work- and/or living space of figure 1a.

Figures 2a and 2b schematically show a detail A or A' of the cross section of the building modules of figure 1b. Figures 2a and 2b schematically show roof and floor profiles as used in the embodiment of the building module illustrated in figures 2a and 2b.

Figures 3a and 3b schematically show a detail A or A' of the cross section of alternative embodiments of the building modules of figure 1b. Figures 3a and 3b schematically show roof and floor profiles as used in the embodiment of the building module illustrated in figures 3a and 3b.

Figures 4a and 4b schematically show a detail A or A' of the cross section of another alternative embodiments of the building modules of figure 1b, and using the same roof and floor profiles as shown in figures 3c and 3d.

Figures 5a and 5b schematically show a detail B or B' of the cross section of the embodiments of the building modules of figure 1b, of which other details are shown in figures 2a to 2d and 3a to 3d.

Figures 6a and 6b schematically show a detail B or B' of the cross section of the embodiments of the building modules of figure 1b, of which other details are shown in figures 4a to 4d.

Figure 7 shows schematically a roof top of a building module used in figures 1a and 1b.

In figure 8 shows two building modules as shown in figures 4a, 4b, 6a and 6b, which modules are positioned one adjacent the other in horizontal direction. Further details of these two building modules are shown in figures 8a to 8e.

In figure 9 shows two building modules as shown in figures 4a, 4b, 6a and 6b, which modules are positioned one adjacent the other in vertical direction. Further details of these two building modules are shown in figures 9a to 9c.

[0098] The same reference signs refer to the same, similar or identical features in the different figures.

Detailed Description of Embodiment(s)

[0099] A moveable work- and/or living space 10 is schematically shown in figure 1a and figure 1b. figure 1b is a cross section of the moveable work- and/or living space 10 of figure 1a according to the plane XX'. The moveable work- and/or living space 10 comprises five building modules 11, 12, 13, 14 and 15 according to the present invention. All modules are provided with a roof 20 and a floor 21. The roofs comprise a roof frame and roof elements positioned in the roof frame. The floors comprise a floor frame and floor elements positioned in the floor frame. Modules 11, 12 and 13 are stacked one on top of the other, thereby providing a moveable work- and/or living space 10 of three floors high. The floor frame of an upper of two stacked modules in positioned on top of the roof frame of the lower of two stacked modules. Modules 11 and 12 are provided at the four sides with walls, each time together with the roof and floor defining an inner volume.

[0100] Modules 13, 14 and 15 are positioned one adjacent to the other. Between adjacent modules, the mutually facing sides of the module are free of any wall, hence are open. All other outwards facing sides are provided with walls 23. As such, in combination with the roofs and floors, one larger inner volume is defined, having the volume of three modules according to the invention. Except for the present or absence of walls, all modules 11, 12, 13, 14 and 15 are identical.

[0101] Details A, A', B or B' of some embodiments of modules according to the invention are schematically shown in figures 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6a or 6b.

[0102] Turning to figure 2a and 2b, details of the cross-sections A and A' of embodiments of modules 11 respectively 13 are shown. Figures 2c and 2d provide and show a detail of the roof profile 1201 and the floor profile 1101, which are identical one to the other.

[0103] The building modules 11 and 13 comprises a floor frame 110 and a roof frame 120. The roof frame 120 comprises four roof profiles 1201. The roof further comprises a roof element 121 connected to the roof profiles 1201. The four roof profiles 1201 are connected and providing a rectangular roof frame 120. At the corners 1202 of the rectangular roof frame 120, the connecting roof profiles 1201 are linked using a miter joint. In this embodiment, one roof element 121 is provided, which extends over the whole surface of the roof frame 120. It is understood that several roof elements, positioned one adjacent the other, may be used to provide the roof 20 of the module, like module 11.

[0104] The building modules 11 and 13 comprises a floor frame 110 having the same planar projection as the roof frame 120, i.e. the same projection of the floor frame or roof frame to a plane parallel to the floor of the module. The long sides of the frames are in the range of about 4 to 10 m and the short sides of the frames are in the range of about 2 to 4 m. The floor frame 110 comprises four floor profiles 1101. The floor 21 further comprises a floor element 111 connected to the floor profiles 1101. The four floor profiles 1101 are connected and providing a rectangular floor frame 110. At the corners 1102 of the rectangular floor frame 110, the connecting floor profiles 1101 are linked using a miter joint. In this embodiment, one floor element 111 is provided, which extends over the whole surface of the floor frame 110. It is understood that several floor elements, positioned one adjacent the other, may be used to provide the floor 21 of the module 13. The floor profiles 1101 and roof profiles 1201 are identical. The floor profiles 1101 and roof profiles 1201 are cold rolled steel profiles, forming in this embodiment a closed tubular profile having an L-shaped cross section. The steel plate used to roll the profile, is a 2 to 5 mm thick steel plate. The plate is rolled in such a way that the outer borders of the plate are meeting and are welded to each other at one of the corners of the L-shape. The inner volume delimited by the flanks of the L-shape is unfilled.

[0105] As shown in figure 2c, the roof profile 1201 has a first 1203 and a second 1204 flank together forming a corner 1205 being inwards oriented to the roof profile 1201. More in detail as shown in figure 2c for the roof profile 1201, the L-shape is delimited by, in sequential order and in figure 2d in counter-clockwise direction round the axis of the profile 1201, this first flank 1203 (end to end about 1 to 20 cm) providing the downwards oriented lower side of the L-shape, a first outer flank 1206 (end to end about 1 to 20 cm) defining the end of the first leg of the L-shape, a third flank 1207 (end to end about 1 to 20 cm) providing the upper side of the roof profile, a fourth side 1208 (end to end about 1 to 20 cm) providing the outer side of the profile, a second outer flank 1209 (end to end about 1 to 20 cm) defining the end of the second leg of the L-shape and finally the second flank 1204 (end to end about 1 to 20 cm). Between each pair of consecutive flanks, a corner is provided, for which the smallest angle between the consecutive flanks being all about 90°. Between the first and second flank 1203 and 1204, the inwards the profile oriented corner 1205 is defined, where the first and second flank are connected one

to the other. The outer end of the outer flank 1206 is provided with a small lip, being bended parallel to the first flank 1203. The outer flank 1206 and the first flank are welded to each other at one of the corners of the L-shape.

[0106] The first flank 1203 is substantially parallel to the top surface 1221 of the roof element 122. The endpoint 1210 of the second flank 1204 oriented away from the corner 1205 extends, in a direction perpendicular to the first flank 1203, less far from the first flank 1203 as the lower surface 1222 of the roof element 122. Or in other words, the thickness of the roof element 122 is larger than the distance between corner 1205 and end point 1210. The roof element 122 may extend beyond the end point 1210 in a direction perpendicular to the first flank 1203 over 50 to 150 mm.

[0107] The roof element 122 is connected to the first flank 1203 by means of e.g. screws 1401 or bolts or rivets or alike. The head of the screw 1301 or bolt or rivet may be sunken in the lower surface 1222 of the roof element 122. The recess so obtained may be filled, e.g. with thermally insulating material.

[0108] The roof element 122 is preferably a thermally insulating and flame retardation plate, e.g. provided from mineral wool, polyurethane material (PUR), polyisocyanurate material (PIR), specialty hard foams and alike and combinations thereof. It may have a thickness in the range of 60 to 200 mm. On the upper surface 1221 of this plate, a watertight layer, e.g. an EPDM layer may be provided to seal the roof of the module.

[0109] The roof element 122 is connected to the first flank 1203. In the embodiment shown in figure 2a, between the side 1223 of the roof element 122 and the second flank 1204, a space is left, in which a wall element 130 can be inserted. This wall element 130 may have a thickness filling the space. The wall element 130 may be connected by its outer side 1331 to the second flank 1204 by means of e.g. screws 1402 or bolts or rivets.

[0110] The way the floor element 111 is connected to the floor profile 1101 is substantially identical as the way the roof element 120 is connected to the roof profiles 1201. The roof profile 1201 and the floor profile 1101 are identical. The flanks have the same length end to end.

[0111] More in detail as shown in figure 2d for the floor profile 1101, the L-shape is delimited by, in sequential order end in figure 2d in clockwise direction round the axis of the profile 1101, this first flank 1103 providing the downwards oriented lower side of the L-shape, a first outer flank 1106 defining the end of the first leg of the L-shape, a third flank 1107 provides the upper side of the roof profile, a fourth side 1108 providing the outer side of the profile, a second outer flank 1109 defining the end of the second leg of the L-shape and finally the second flank 1104. Between each pair of consecutive flanks, a corner is provided, for which the smallest angle between the consecutive flanks being all about 90°. Between the first and second flank 1103 and 1104, the inwards the profile oriented corner 1105 is defined, where the first and second flank are connected one to the other. The outer end of the outer flank 1106 is provided with a small lip, being bended parallel to the first flank 103. The outer flank 1106 and the first flank are welded to each other at one of the corners of the L-shape.

[0112] The first flank 1103 of the floor profile 1101 is substantially parallel to the bottom surface 1112 of the floor element 111. The endpoint 1110 of the second flank 1104 of the floor profile 1101 oriented away from the corner 1105 extends, in a direction perpendicular to the first flank 1103, less far from the first flank 1103 as the upper surface 1111 of the floor element 111. Or in other words, the thickness of the floor element 111 is larger than the distance between corner 1105 and end point 1110. The floor element 111 may extend beyond the end point 1110 in a direction perpendicular to the first flank 1103 over 20 to 150 mm.

[0113] The floor element 111 is connected to the first flank 1103 of the floor profile 1101 by means of e.g. screws 1403 or bolts or rivets or alike.

[0114] The floor element 111 is preferably a thermally insulating and flame retardation plate, e.g. provided from comprise wooden plates or elements, concrete plates steel construction elements thermal insulation material, flooring material and surfaces, metal - like steel - plates or sheets, and alike and combinations thereof. It may have a thickness in the range of 70 to 250 mm. On the upper surface 1111 of this plate, a floor surface being resistant to wear may be provided, e.g. a vinyl layer or alike.

[0115] The floor element 111 is connected to the first flank 1103 of the floor profile 1101. In the embodiment shown in figure 2b, between the side 1113 of the floor element 111 and the second flank 1104 of the floor profile 1101, a space is left, in which a wall element 130 can be inserted. This wall element 130 may have a thickness filling the space. The wall element 130 may be connected by its outer side 1331 to the second flank 1104 of the floor profile 1101 by means of e.g. screws 1404 or bolts or rivets. The wall element 130 may be provided from polyurethane material (PUR), polyisocyanurate material (PIR), specialty hard foams and alike and combinations thereof, and have a thickness in the range of 60 to 200. The height of the wall element, may be in the range of 2,6 to 3,6 m.

[0116] Turning to figure 3a and 3b, details of the cross-sections A and A' of an alternative embodiment of modules 11 and 13 is shown. Figures 3c and 3d provide and show a detail of the roof profile 1291 and the floor profile 1191, which are identical one to the other. The references to flanks of the L-shaped profile of roof profile 1291 and the floor profile 1191 refer to the corresponding flanks of the L-shaped profile of roof profile 1201 and the floor profile 1101.

[0117] The roof profiles 1291 and the floor profiles 1191 are identical in material, dimensions, have an L-shaped cross section which is an open profile. The same references refer to the same points or flanks as is the

case for the roof profiles 1201 and the floor profiles 1101 of figures 2a to 2d. The profiles are a cold rolled profiles, made from a steel plate. The plate is rolled in such a way that the outer borders of the plate provide the endpoints of the first and second flank, these endpoints being oriented towards the corner 1205 respectively 1105 these two flanks make. The first 1203 and second 1204 flank may remain separated at the corner 1205 and not interconnected, as such providing an open tubular cross section. The dimensions of the flanks of the L-shaped profile are identical to the profile shown in figures 2a and 2b. The floor elements and roof elements are identical to the ones shown in figures 2a and 2b.

[0118] The first flank 1203 is substantially parallel to the top surface 1221 of the roof element 122. The endpoint 1210 of the second flank 1204 oriented away from the corner 1205 extends, in a direction perpendicular to the first flank 1203, less far from the first flank 1203 as the lower surface 1222 of the roof element 122. Or in other words, the thickness of the roof element 122 is larger than the distance between corner 1205 and end point 1210. The roof element 122 may extend beyond the end point 1210 in a direction perpendicular to the first flank 1203 over 50to 150 mm.

[0119] The roof element 122 is connected to the first flank 1203 of the roof profile 1291 by means of e.g. screws 1401 or bolts or rivets or alike. The head of the screw 1401 or bolt or rivet may be sunken in the lower surface 1222 of the roof element 122. The recess so obtained may be filled, e.g. with thermally insulating material. In the embodiment shown in figure 3a, between the side 1223 of the roof element 122 and the second flank 1204, a space 1520 is left, in which a wall element 130 can be inserted. This wall element 130 has a thinner 1332 section at the upper 1334 and lower 1335 side of the wall element 130, the thickness of this thinner section filling the space 1520. A part 1333 of the upper side 1334 of the wall element 130 is in contact with the lower side 1222 of the roof element 111. This part 1333 may cover the location where the roof element 120 is connected to the first flank 1203. The wall element 130 may be connected to the second flank by means of e.g. screws or bolts or rivets at this thinner section. Alternatively, as shown in figure 3a, an additional upper side profile 1500 is provided, connected to the lower flank 1209 of the roof profile 1201, e.g. by screwing, bolting, welding, adhesive or alike. The outer surface 1331 of the wall element 130 is connected to the upper side profile 1500, e.g. by means of rivets, bolts, or screws 1402.

[0120] The way the floor element 111 is connected to the floor profile 1191 is substantially identical as the way the roof element 122 is connected to the roof profiles 1291. The roof profile 1291 and the floor profile 1191 are identical. The flanks have the same length end to end.

[0121] As shown in figure 3b, an additional lower side profile 1510 is provided, connected to the upper flank 1109 of the floor profile 1191 e.g. by screwing, bolting, welding, adhesive or alike. The outer surface 1331 of the wall element 130 is connected to the lower side profile 1510, e.g. by means of rivets, bolts, or screws 1404. This additional lower side profile 1510 is identical to the additional upper side profile 1500. The profiles 1500 and 1510 may be tubular cold or hot rolled steel tubes or an extruded metal profiles.

[0122] The floor element 111 is connected to the first flank 1103 of the floor profile 1191 by means of e.g. screws 1403 or bolts or rivets or alike. In the embodiment shown in figure 3b, between the side 1113 of the floor element 111 and the second flank 1104, a space 1530 is left, in which a wall element 130 can be inserted. This wall element 130 has a thinner 1332 section at the lower side 1335 of the wall element 130, the thickness of this thinner section 1335 filling the space 1530. A part 1333 of the lower side 1335 of the wall element 130 is in contact with the upper side 1111 of the floor element 111. This part 1333 may cover the location where the floor element 111 is connected to the first flank 1103. The wall element 130 may be connected to the second flank 1104 by means of e.g. screws or bolts or rivets at this thinner section. Alternatively, as shown in figure 3b, an additional lower side profile 1510 is provided, connected to the upper flank 1109 of the floor profile 1101. The outer surface 1331 of the wall element 130 is connected to the lower side profile 1510, e.g. by means of rivets, bolts, or screws 1404.

[0123] Turning to figure 4a and 4b, details of the cross-sections A and A' of another alternative embodiment of modules 11 and 13 is shown. The roof profile 1291 and the floor profiles 1191 are identical to the profiles shown in figure 3a and figure 3b. The floor elements 111 and roof elements 120 are identical to the ones shown in figures 2a and 3a, and 2b and 3b.

[0124] The roof element 122 is connected to the first flank 1203 by means of e.g. screws 1401 or bolts or rivets or alike. The head of the screw 1401 or bolt or rivet may be sunken in the lower surface 1222 of the roof element 122. The recess so obtained may be filled, e.g. with thermally insulating material. In the embodiment shown in figure 4a, the side 1223 of the roof element 122 and the second flank 1204 are in contact with each other. Optionally the roof element and the second flank are connected. The upper side 1334 of the wall element 130 is in contact with the lower side 1222 of the floor element 122. The upper side 1334 of the wall element 130 may cover the location where the roof element 122 is connected to the first flank 1203. An additional upper side profile 1500 is provided, connected to the lower flank 1209 of the roof profile 1291. The outer surface 1331 of the wall element 130 is connected to the upper side profile 1500, e.g. by means of rivets, bolts, or screws 1402.

[0125] The way the floor element is connected to the floor profile is substantially identical as the way the roof element is connected to the roof profiles.

[0126] As shown in figure 4b, an additional lower side profile 1510 is provided, connected to the upper flank 1109 of the floor profile 1191. The outer surface 1331 of

the wall element 130 is connected to the lower side profile 1510, e.g. by means of rivets, bolts, or screws 1404.

[0127] The floor element 111 is connected to the first flank 1103 by means of e.g. screws 1403 or bolts or rivets or alike. In the embodiment shown in figure 4b, the side 1113 of the floor element 111 and the second flank 1104, are in contact with each other, and optionally connected one to the other. A part of the lower side 1335 of the wall element 130 is in contact with the upper side 1111 of the floor element 111. This part may cover the location where the floor element 111 is connected to the first flank 1103. As shown in figure 4b, an additional lower side profile 1510 is provided, connected to the upper flank 1109 of the floor profile 1191. The outer surface 1331 of the wall element 130 is connected to the lower side profile 1510, e.g. by means of rivets, bolts, or screws 1404.

[0128] In figure 5a and figure 5b, the connection between two horizontally adjacent modules 14 and 15 (or modules 13 and 14) is schematically shown, and this at the roof level (figure 5a) and floor level (figure 5b). These sections are indicated in figure 1a as detail B and B'. In these embodiments in figure 5a and figure 5b, the modules 14 and 15 are modules as schematically shown in figures 3a to 3d. In an identical way, two modules as shown in figures 2a to 2d may be used.

[0129] When two modules 14 and 15 are places one adjacent the other and the and the outer flanks 1208 or 1108 of the roof profiles 1201 or floor profiles 1101 in contact with each other, a void space 2000 is provided between the sides 1223 or 1113 of the two roof elements 120 or the two floor elements 111. This void space 2000 can be filled at the roof elements 120 by means of a U-profiled filling means 2001, snuggly fitting with its legs 2002 into the space 1520 between the second flank 1204 of the roof profile 1291 and the adjacent side 1223 of the roof element 120. The intermediate part 2003 of the U-profile has a thickness which fills the distance between the outer points 1210 of the roof profiles 1291 and the lower side 1222 of the roof elements 120. The U-profiled filling means 2001 may be attached to the roof profiles 1291 by means of connection means 2005 like screws, bolts rivets and alike. As such a flat, continuous sealing may be provided to the inner volume of the moveable work- and/or living space.

[0130] In a similar way, the void space 3000 above and aside the two adjacent floor profiles 111 can be filled by means of a U-profiled filling means 3001, snuggly fitting with its legs 3002 into the space 1520 between the second flank 1104 of the floor profile 1191 and the adjacent side 1113 of the floor element 111. The intermediate part 3003 of the U-profile has a thickness which fills the distance between the outer point 1110 of the floor profiles 1191 and the upper side 1111 of the floor elements 111. The U-profiled filling means 3001 may be attached to the floor profiles 1191 by means of connection means 3005 like screws, bolts rivets and alike. As such a flat, continuous floor surface may be provided to the inner volume of the moveable work- and/or living space.

[0131] It is clear that the material of the U-profiled filling means 2001 and 3001 may be chosen from material similar or identical to the material from which the adjacent roof or floor elements are made.

[0132] In figure 6a and figure 6b, the connection between two horizontally adjacent modules 14 and 15 (or modules 13 and 14) is schematically shown, and this at the roof level (figure 6a) and floor level (figure 6b) for modules 14 and 15 being modules as schematically shown in figures 4a and 4b. When two modules 14 and 15 are places one adjacent the other and the outer flanks 1208 of the roof profiles 1291 in contact with each other, a void space 4000 is provided between the sides 1223 or 1113 of the two roof elements 122 or the two floor elements 111. This void space 4000 can be filled at the roof elements 122 by means of a cuboid-like filling means 4001, snuggly fitting between the adjacent sides 1223 of the roof elements 122. The filling means 4003 of has a thickness which fills the distance between the outer point 1210 of the roof profiles 1291 and the lower side 1222 of the roof elements 122. The filling means 4001 may be attached to the roof profiles 1291 by means of connection means 4005 like screws, bolts rivets and alike. As such a flat, continuous sealing may be provided to the inner volume of the moveable work- and/or living space.

[0133] In a similar way, the void space 5000 above and aside the two adjacent floor profiles 1191 can be filled by means of a cuboid-like filling means 5001, snuggly fitting between the adjacent side 1113 of the floor element 111. The filling means 5003 has a thickness which fills the distance between the outer point 1110 of the roof profiles 1191 and the upper side 1111 of the floor elements 111. The filling means 5001 may be attached to the floor profiles 1191 by means of connection means 5005 like screws, bolts rivets and alike. As such a flat, continuous floor surface may be provided to the inner volume of the moveable work- and/or living space.

[0134] It is clear that the material of the filling means 4001 and 5001 may be chosen from material similar or identical to the material from which the adjacent roof or floor elements are made.

[0135] In figure 7, a top view of the outer side of the roof 20 of a module according to the invention, like modules 11, 12, 13, 14 and 15 in figure 1a, is shown. The roof frames 7100 have four corners 7000, provided by connecting four roof profiles 7111 one to the other at an angle of about 90°. The roof profiles 7111 may be roof profiles 1201 or 1291 as shown in the figures 2c or 3c. Preferably mitre joints are used. The lifting means 7001, adapted to receive a hook of a lifting device for lifting the building module 11, 12, 13, 14 or 15, is provided in each corner 7000. The lifting means 7001 in this embodiment is provided as a metal plate or fin in which an opening or eye, is provided. such lifting means are better shown in figures 8a, 9b and 9c. The metal lifting means 7001 is connected in each corner 7000 such the plate bisects the angle of the corner 7000. The lifting means extends above the upper side 7101 of the roof profile 7111, but

the extension is limited such that, when two building modules are placed one on top of the other, the lifting means does not touch the lower side 1112 of the floor elements 120 of the upper building module. Hence the height of the flank 1106 of the floor frames 1101 or 1191 is large enough to provide a void space 7200 under the floor elements 120, which is adapted to receive the lifting means 7001 of an identical or similar building module positioned under the building module it is part of.

[0136] This is in particularly shown in figure 9c. As shown in figure 7, a flexible element, like a chain, cable, or rope 7002, is provided to each of the lifting means 7001. The outer end of the chain, cable, or rope 7002 which is not in connection to the lifting means 7001, is connected to a central hoisting device 7004, like a hoisting ring or hoisting eye, like a steel ring. By lifting the hoisting device, the module can be lifted. This metal ring 7004 can be attracted by a hoisting hook being provided with an activatable magnetic means, like an electromagnet. By bringing the hook with the activatable magnetic means near the hoisting means, and activating the magnetic means, the metal hoisting device will be attracted to the magnetic device, thereby orientating the opening of the metal hoisting device such that the hook can connect to the metal hoisting device.

[0137] As best shown in figure 9c, where two modules 11 and 12 are positioned one module 11 above the other module 12, the upper side 7006 of the lifting means 7001 is provided as a guiding curve, adapted to guide the corner of the floor frame 7500, of the lifted module 11, to the corresponding position on the roof frame 7100 of the lower module 12 having an identical lifting means 7001 at its roof side. This floor frame 7500 is a floor frame 1191 as shown figures 3d and being part of the embodiment as shown in figures 4a and 4b, or a floor frame 1101 as shown figures 2d and being part of the embodiment as shown in figures 2a and 2b or 3a or 3b. The guiding curve is a continuous line, continuously decreasing in height from the top point 7007 of the lifting means 7001 towards the roof frame 7100. This facilitates the mounting of identical or similar modules in a stacked configuration.

[0138] While the modules 11 and 12 are stacked one to the other, the lifting means 7001, the chain, cable, or rope 7002, and the central hoisting ring 7004 of the lower module remain in place during use of the stacked modules 11 and 12. These elements stay stored in the void space 7200 delimited by the floor frame 7500 of the upper module 11 and the roof frame 7100 of the lower module 12.

[0139] Figure 8 shows of two building modules 14 and 15 as shown in figures 4a, 4b, 6a and 6b are provided, which modules are positioned one adjacent the other in horizontal direction. Further details 8a to 8e are shown in figures 8a to 8e. The same reference signs refer to the same elements as in figures 4a, 4b, 6a and 6b.

[0140] Figures 8a and 8b show a detail of the upper corners of the roof frames. In particular the lifting means 7001, adapted to receive a hook of a lifting device for lifting the building module is shown. The wall element 130 and roof element 122 are connected to each other, while a strip 7700 of thermally expandible material is inserted at their interface, as shown in figure 8a. The void between adjacent sides of the roof elements 120 is filled by a filling means 4001, comprising two strips of material one provided on top of the other, as shown in figure 8b.

[0141] Figure 8c shows schematically the supporting pillars 8001 which are used to keep the roof frame 7100 and the floor frame 7500, spaced apart. They define the height of the modules 14 and 15. These supporting pillars 8001 carry the weight of amongst others the roof frame 7100 and roof elements 120 of the module, as well as the weight of modules placed on top of the module of which the supporting means are part of. Hence the roof frame 7100 and floor frame 7500 are interconnected by supporting pillars 8001 being cold rolled steel right angle profiles. The sides 1339 of the wall elements 130 are connect using a rebate joint or butt joint. The legs of the supporting pillars 8001 can be provided with additional vertical profiles 8003, providing a larger support surface to the outer surfaces 1331 of the wall elements 130, avoiding wall elements 130 to bend outwards from the module. Such vertical profiles 8003 may be tubular profiles or cold rolled steel profiles, preferably having a rectangular cross-section.

[0142] The same elements are shown in figure 8e, where two supporting pillars 8001 of adjacent modules 14 and 15 contact one the other. The inner side 1338 of the wall elements 130 extend further from the first leg 8010 of the supporting pillar 8001 contacting the outer side 1331 of the wall element 130 as compared to the end points 8011 of the second leg 8012 of the supporting pillars 8001. The void space 8020 in front of the two end points 8011 of the two legs 8012 of the supporting pillars 8001, and further delimited by the plane of the inner surfaces 1338 of the wall elements 130, can be filled by means of a cuboid-like filling means 8025, snuggly fitting between the adjacent sides 1339 of the wall elements 130. The material this filling means 8025 may be similar or identical to the material the wall elements 130 are provided from. In this embodiment shown in figure 8e, the filling means 8025 comprises two strips one mounted on top of the other.

[0143] The figure 8d shows schematically a detail of the floor 21 of the module, including the floor frame 7500 and the floor element 111. As shown the floor element 111 may be provided from two layers, the outer layer 1118 providing the support and strength of the floor element 111, the inner layer 1119 having a rather decorative aspect and serving to provide wear resistance to the floor surface. The outer layer 1118 is slightly extending beyond the end point 1110 of the second flank 1104 of the floor frame 7500. The wall element 130 is resting with its lower side 1334 on the outer layer 1118 of the floor element 111, the inner layer 1119 contacting the inner side 1338 of the wall element 130.

[0144] The floor frame 7500, preferably along the long

end of the floor frame, is provided with forklift pockets 8030 to allow the module to be lifted by forklifts. The module may be provided with windows 8040, external rain pipes 8050, doors, etc.

[0145] In figure 9, further details of two building modules 11 and 12 as shown in figures 4a, 4b, 6a and 6b are provided, which modules are positioned one adjacent the other in vertical direction. The same reference signs refer to the same elements as in figures 4a, 4b, 6a and 6b and figure 8.

[0146] Figure 9 shows of two building modules 14 and 15 as shown in figures 4a, 4b, 6a and 6b are provided, which modules are positioned one adjacent the other in vertical direction. Further details 9a to 9c are shown in figures 9a to 9+c. The same reference signs refer to the same elements as in figures 4a, 4b, 6a and 6b.

[0147] Figure 9a show a detail of the connection between two rain pipes 8050. Between the rain pipes 8050 a coupling piece 9010 is provided, allowing two vertically aligned rain pipes 8050 to be fluidly coupled, thereby allowing water from the upper module 11 to pass via the upper rain pipe in the rain pipe of the lower module 12.

[0148] In figure 9b, the upper side of the upper module 11 is shown, including the roof frame 7100, the mitre joint between two joined roof profiles 7100, and the lifting means 7001 extending above the roof profile 7100 and bisecting the angle of the corner 7000 at the inner side of the roof frame 7100 and corner 7000.

[0149] In figure 9c, a detail of a floor frame 7500 of the upper module 11 being in contact with a roof frame 7100 of a lower module is shown. Under the floor element 111 a void space 7200 is provided by the floor profiles 7501 and roof profiles 7111, being a void space in which the lifting means 7001 fits in.

[0150] The floor frames 7500, preferably along the long end of the floor frame, are provided with forklift pockets 8030 to allow the module to be lifted by forklifts.

[0151] Although the present invention has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. In other words, it is contemplated to cover any and all modifications, variations or equivalents that fall within the scope of the basic underlying principles and whose essential attributes are claimed in this patent application. It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the invention are capable of operating according to the present invention in other sequences, or in orientations different from the one(s) described or illustrated above.

Claims

1. A building module for use as a part of a moveable work- and/or living space, said module comprising a roof frame, the roof frame comprising at least one roof profile, the module comprising at least one roof element connected to the roof profile, said roof profile having at least a first and a second flank together forming a corner being inwards oriented to the roof profile, **characterized in that** said first flank is substantially parallel to the top surface of the at least one roof element, the endpoint of the second flank oriented away from the corner extends, in a direction perpendicular to the first flank, less or equally far from the first flank as the lower surface of the at least one roof element.

2. A building module according to claim 1, wherein the top surface of the at least one roof element is fixed to the first flank.

3. A building module according to any one of the claims 1 to 2, wherein at least a part of the side of the at least one roof element is fixed to the second flank.

4. A building module according to any one of the claims 1 to 3, wherein the roof profile is free from flanks extending under the lower surface of the roof element.

5. A building module according to any one of the claims 1 to 4 wherein the endpoint of the second flank oriented away from the corner provides the lowermost point of the roof profile.

6. A building module according to any one of the claims 1 to 5, wherein the at least one roof element comprises flame retardant and/or fire resistant, and thermally insulating material.

7. A building module according to any one of the claims 1 to 6, wherein a third flank provides the upper side of the roof profile, a fourth side providing the outer side of the profile.

8. A building module according to any one of the claims 1 to 7, wherein the at least one roof profile has an L-shaped cross section.

9. A building module according to any one of the claims 1 to 8, wherein the first and second flank are not interconnected along the corner they form.

10. A building module according to any one of the claims 1 to 9, wherein the module comprises a floor frame, said roof frame and floor frame are interconnected by supporting pillars.

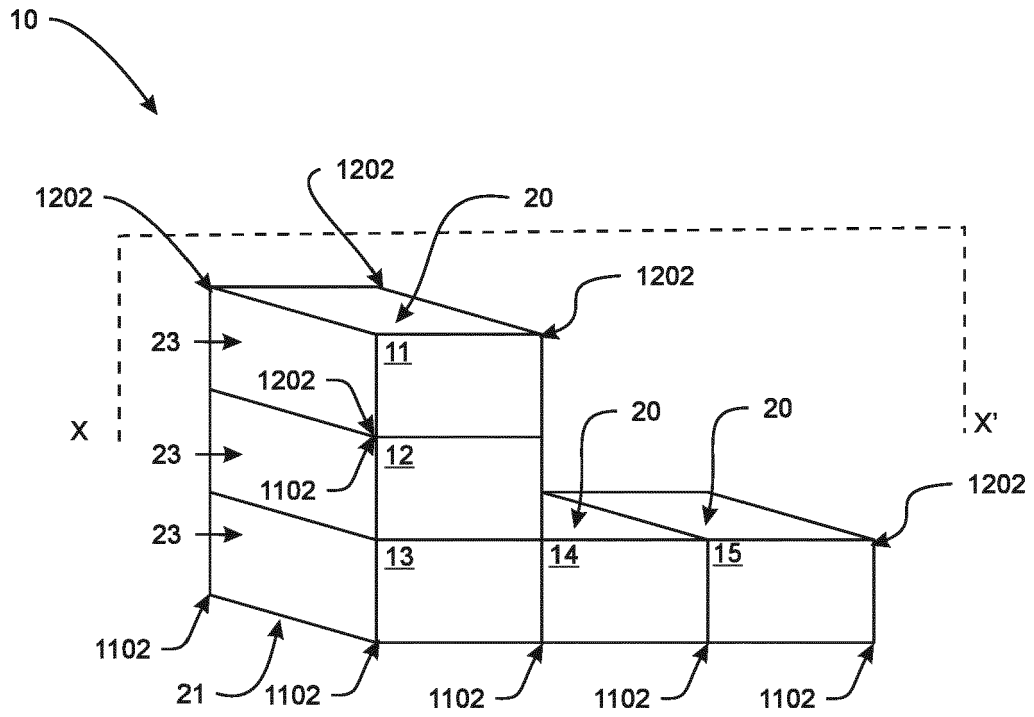
11. A building module according to any one of the claims 1 to 10, the module comprises a floor frame, wherein said floor frame comprising at least one floor profile, the floor profile being identical to the roof profile.

12. A building module any one of the claims 1 to 11, wherein the module comprises a floor frame, the module comprises at least one floor element connected to the floor profile, said floor profile having at least a first and a second flank together forming corner being inwards oriented to the floor profile, said first flank of the floor profile is substantially parallel to the bottom surface of the at least one floor element, the endpoint of the second flank of the floor profile oriented away from the corner extends, in a direction perpendicular to the first flank of the floor profile, less far from the first flank of the floor profile at the upper side of the at least one floor element.

13. A building module according to any one of the claims 1 to 12, wherein said module comprises at least a first wall element, the upper side of the wall element contacting the lower surface of the roof element, the outer surface of said wall element being connected an upper side profile, which upper side profile is connected to the roof profile.

14. A building module according to any one of the claims 1 to 13, wherein the module comprises a floor frame comprising at least one floor profile and a floor element, said module comprises at least a first wall element, the upper side of the wall element contacting the upper surface of the floor element, the outer surface of said wall element being connected a lower side profile, which lower side profile is connected to the floor profile.

15. A moveable work- and/or living space comprising at least a first and a second building module according to any one of the claims 1 to 14, said building modules being mounted adjacent one to the other in vertical direction, wherein the roof profile of the first building module contacts the floor profile of the second building module.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1202
20
1202
23
11
1202
X
20
20
X'
23
12
1102
1202
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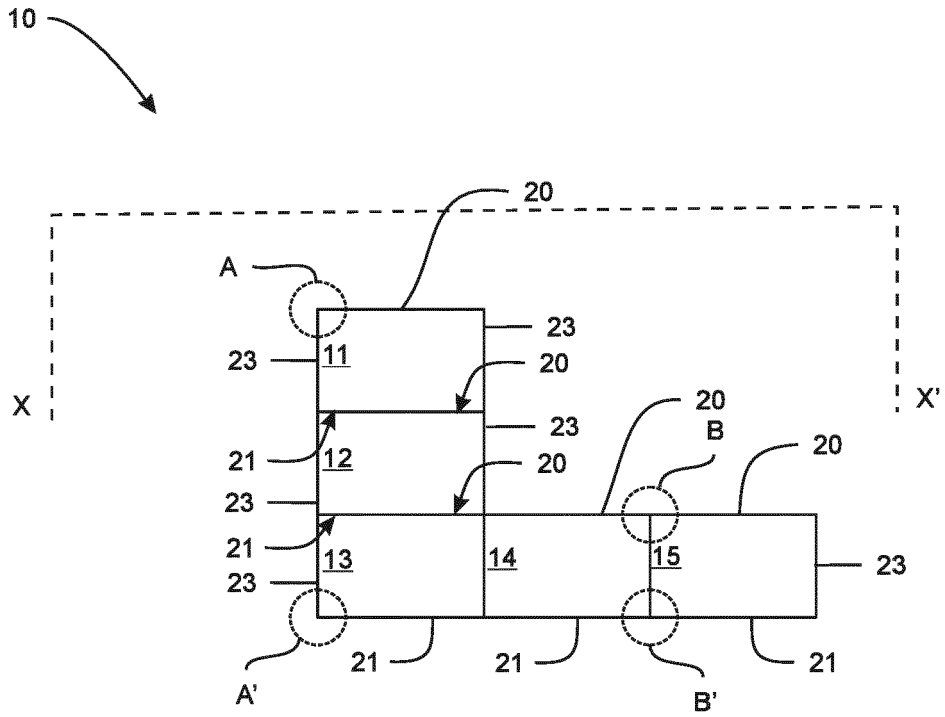
13
14
15
1102
21
1102
1102
1102
1102

Fig. 1a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B
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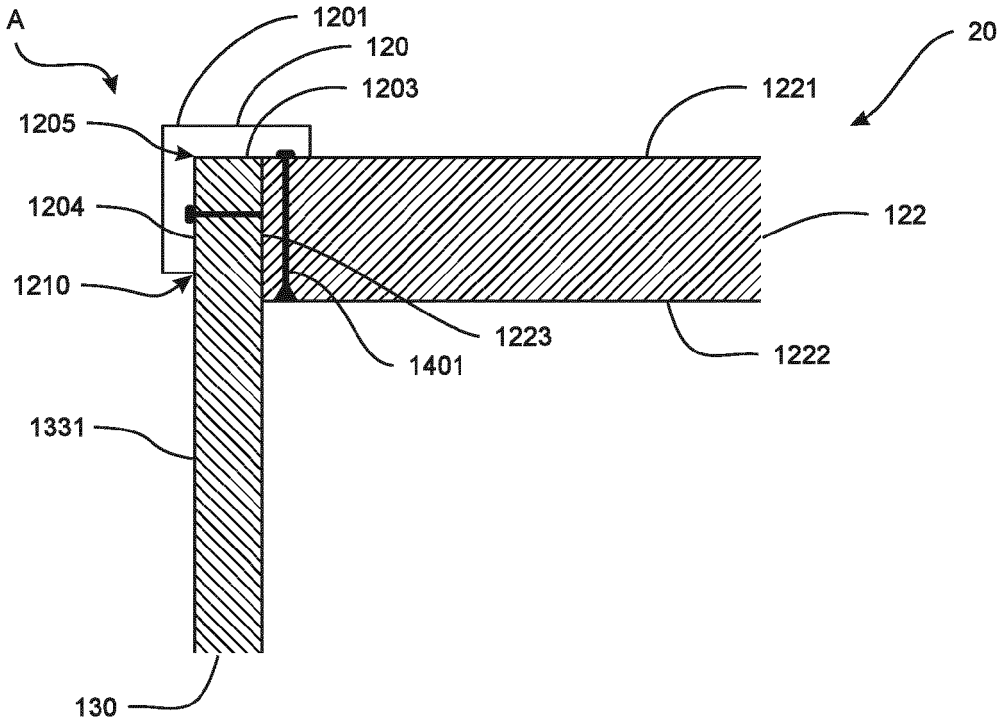
23
23
21
21
21
A'
B'

Fig. 1b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1401
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1331
130

Fig. 2a

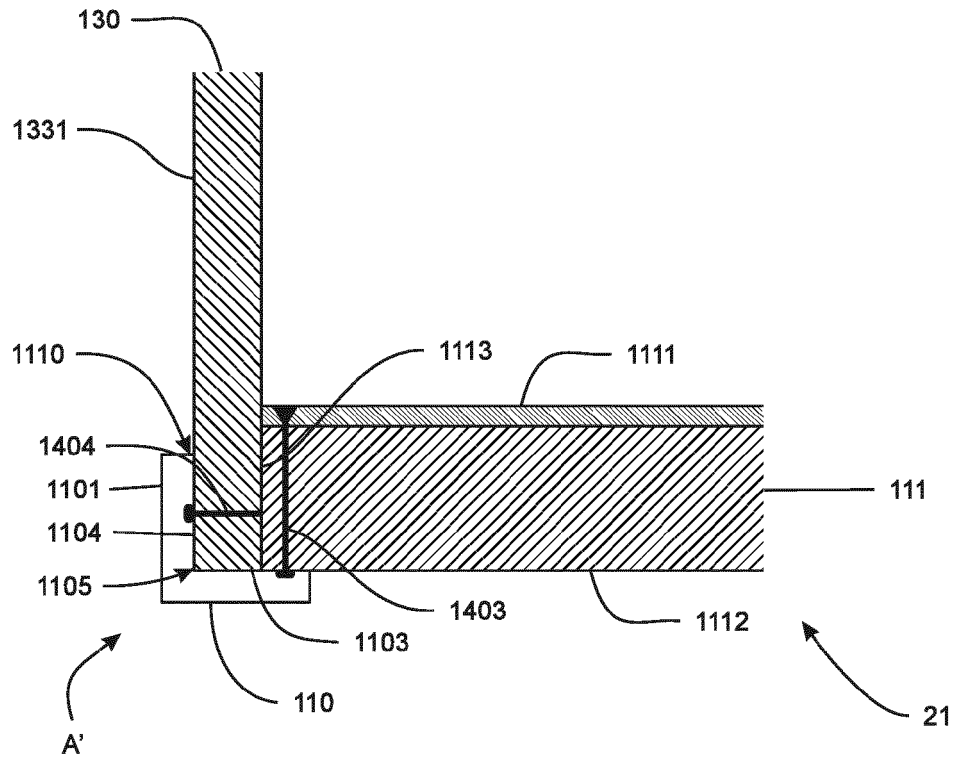
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Fig. 2b

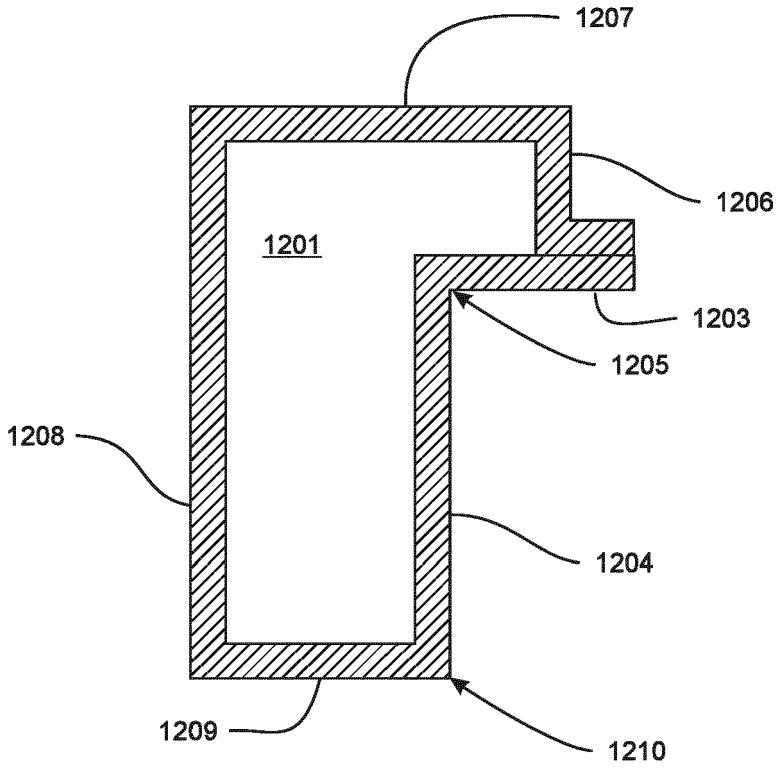
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Fig. 2c

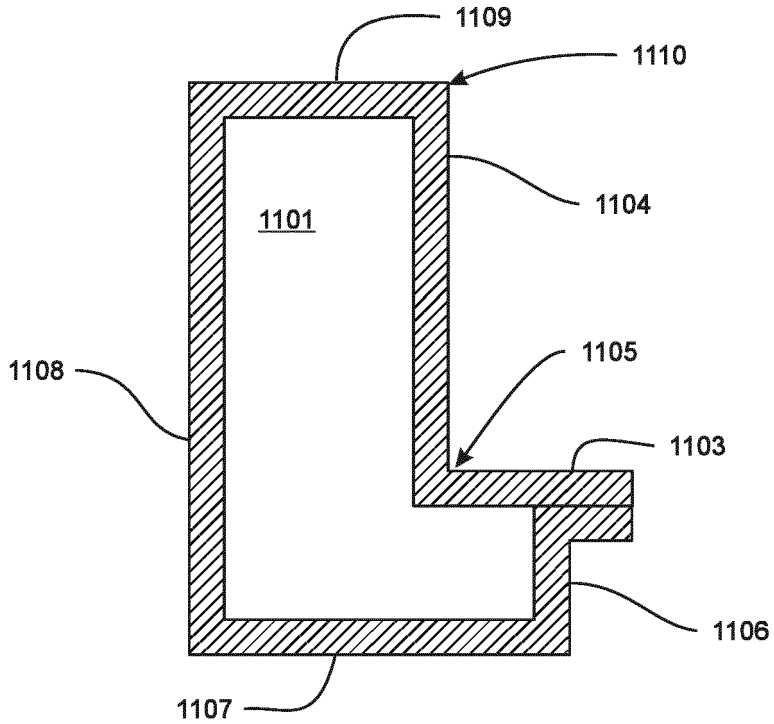
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Fig. 2d

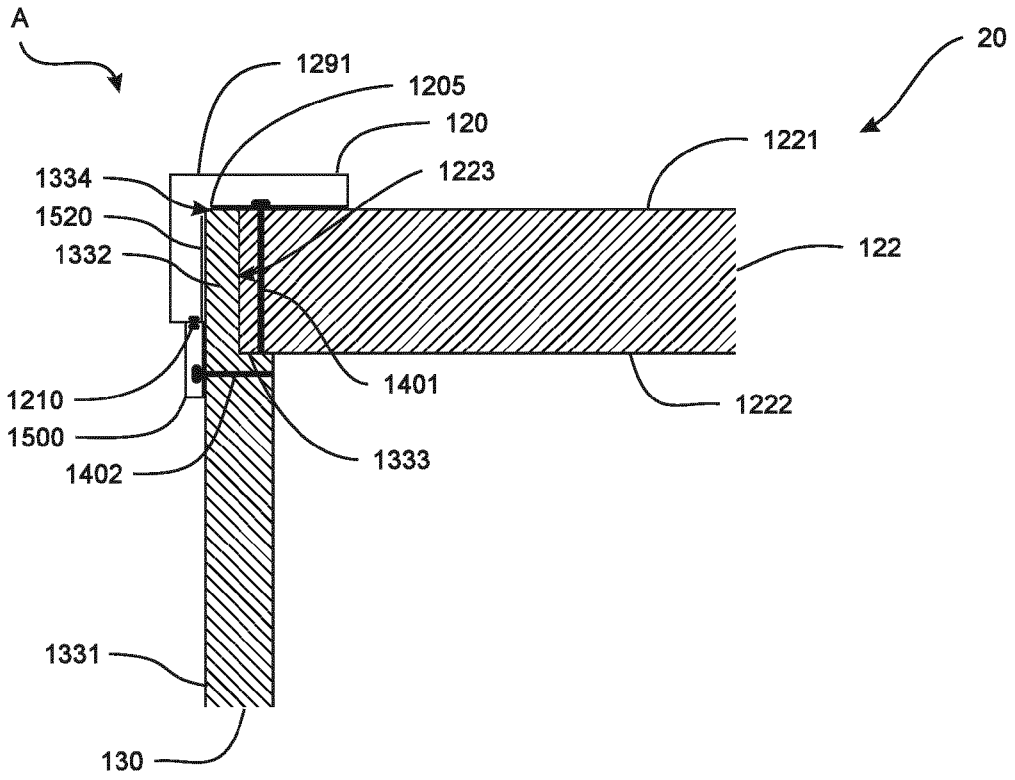
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Fig. 3a

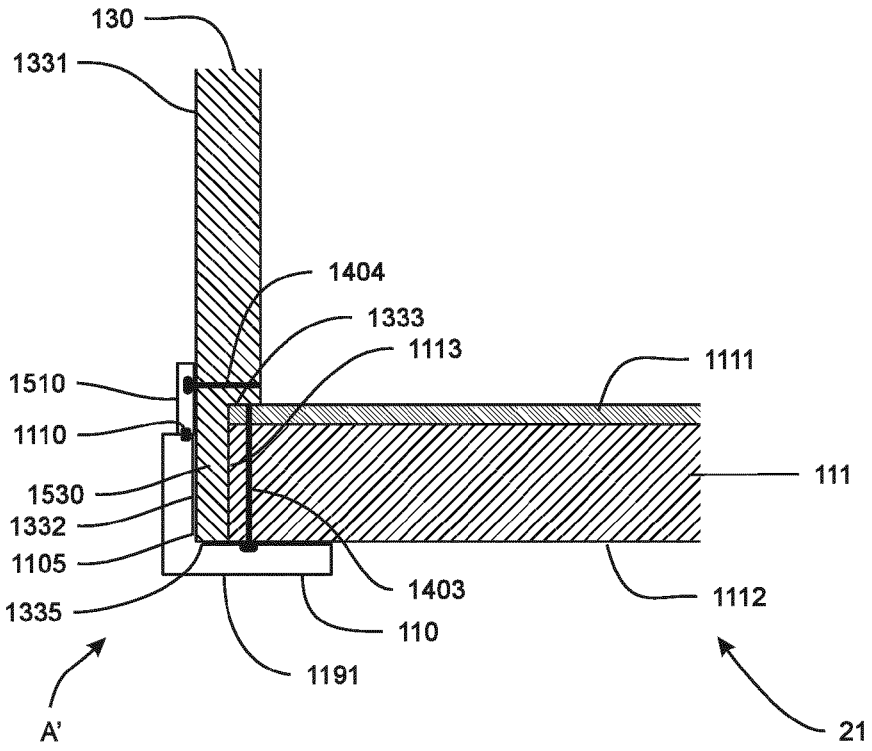
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Fig. 3b

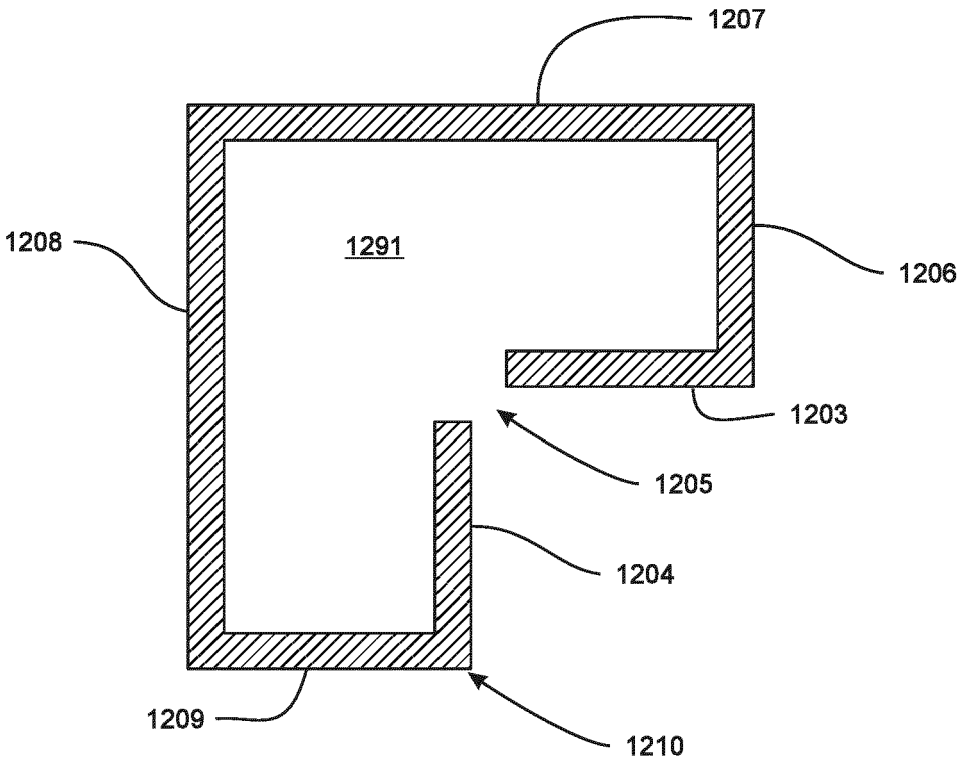
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Fig. 3c

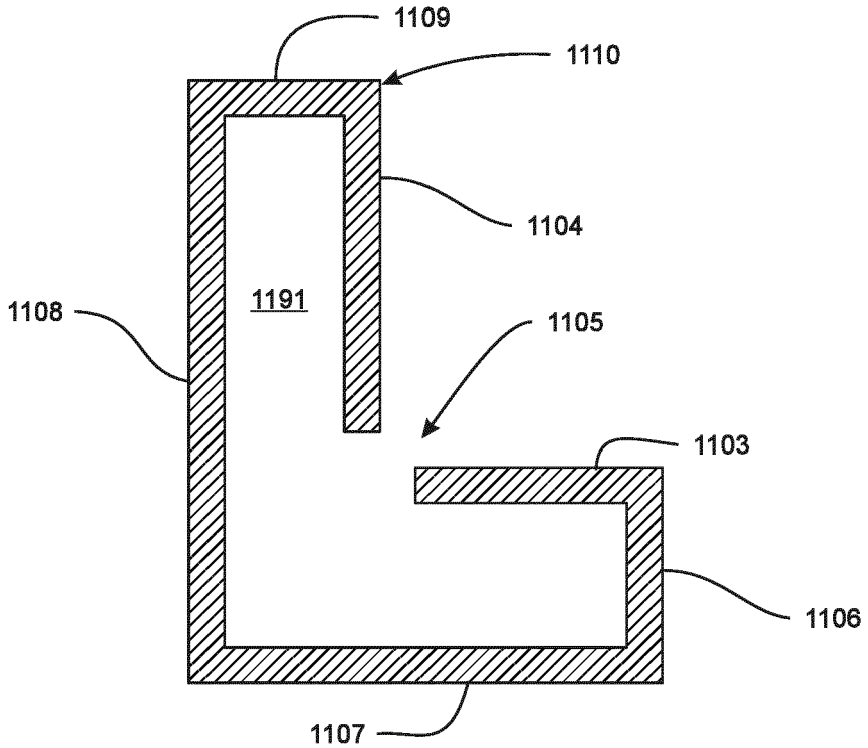
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Fig. 3d

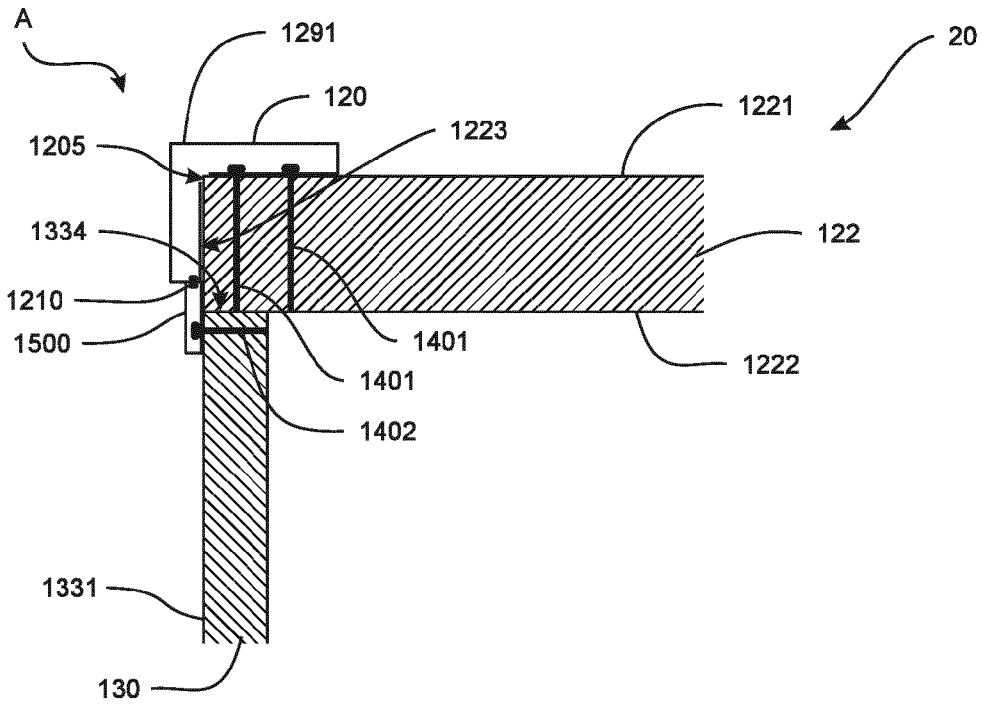
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Fig. 4a

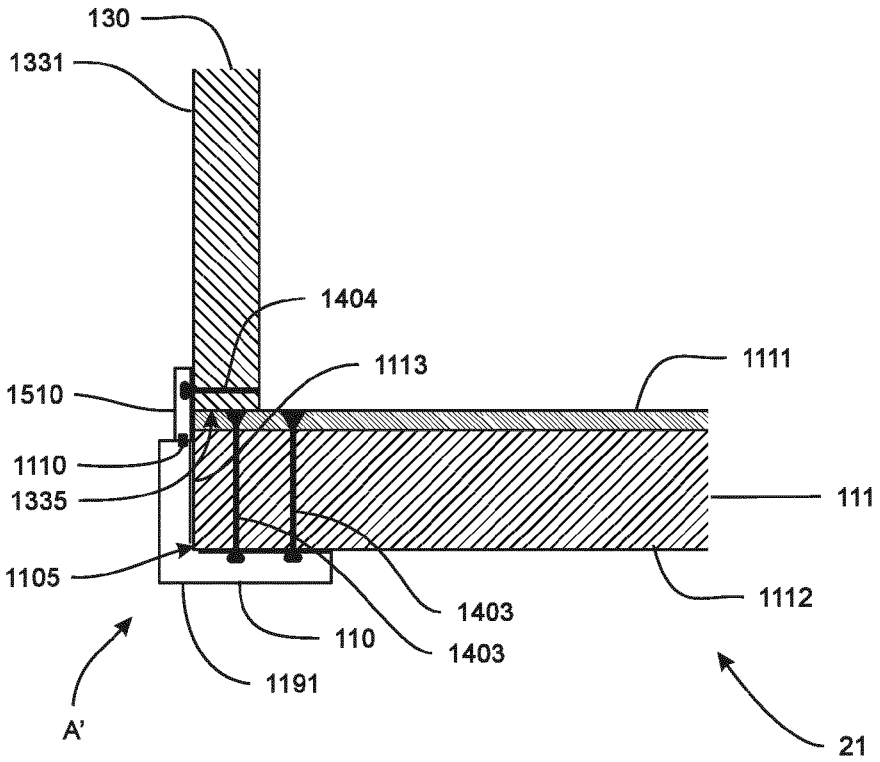
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Fig. 4b

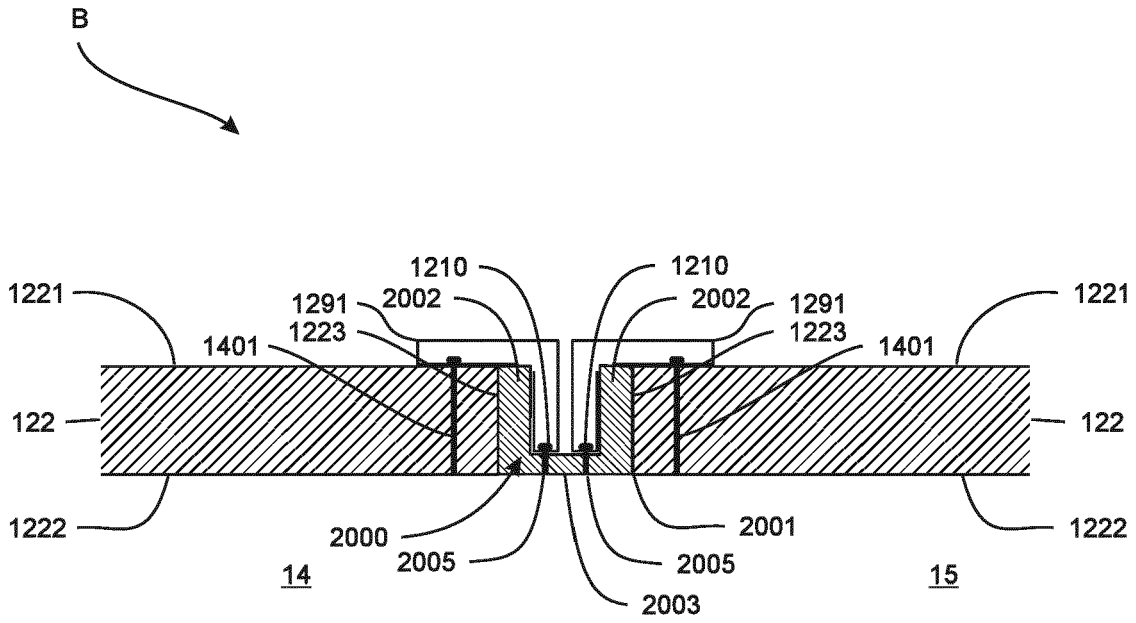
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Fig. 5a

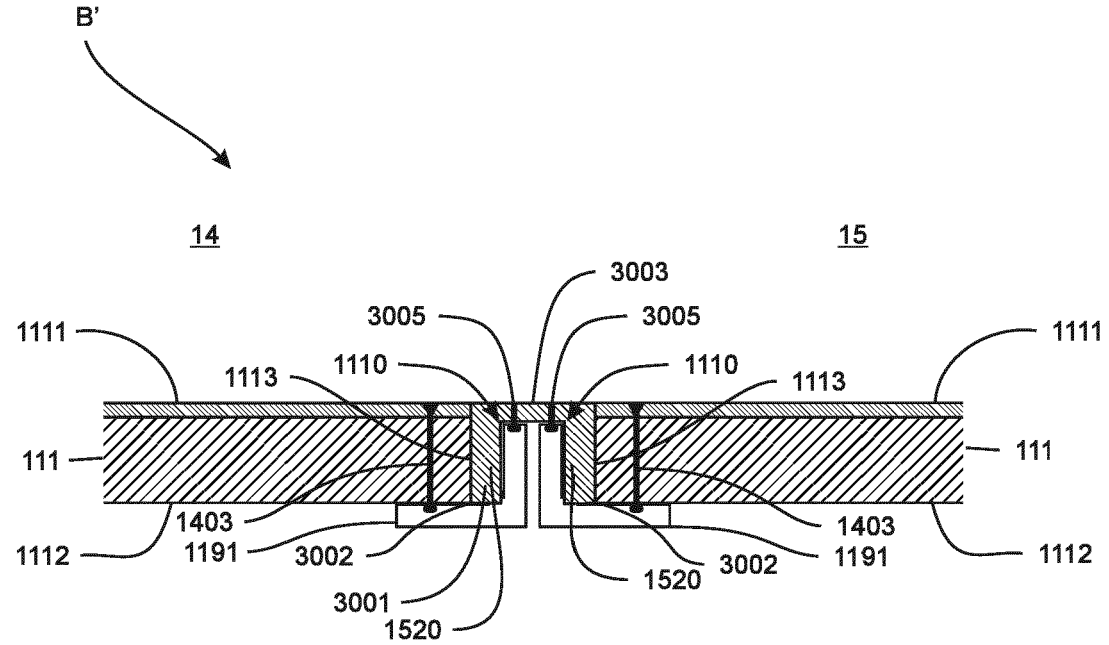
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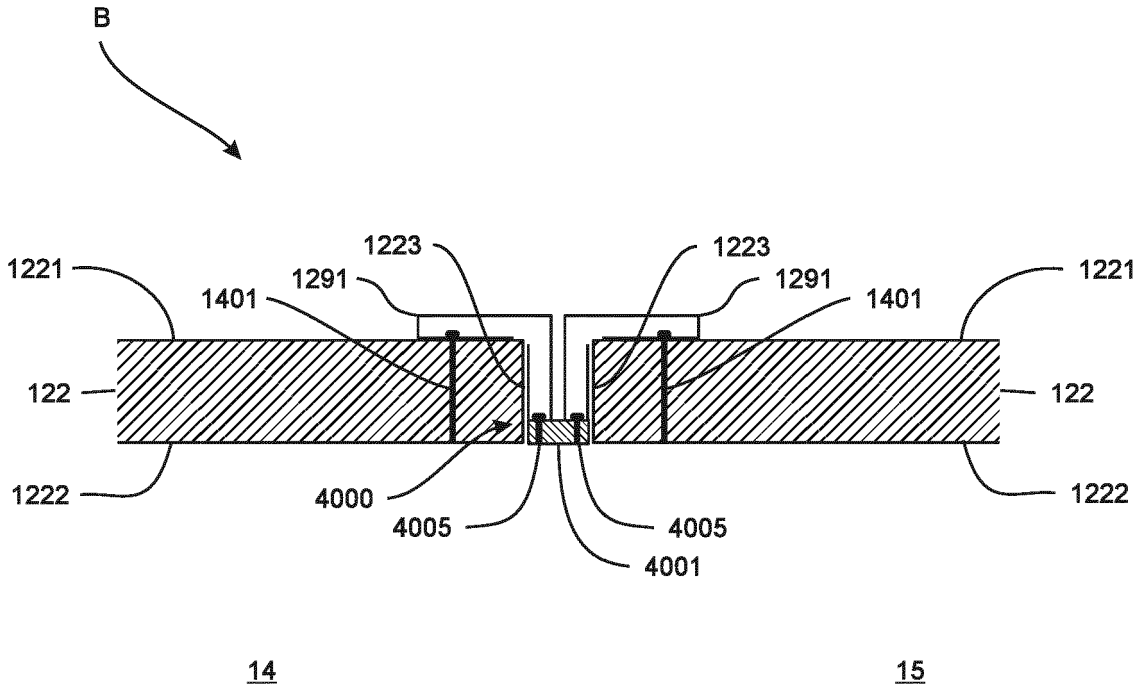
Fig. 5b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15

Fig. 6a

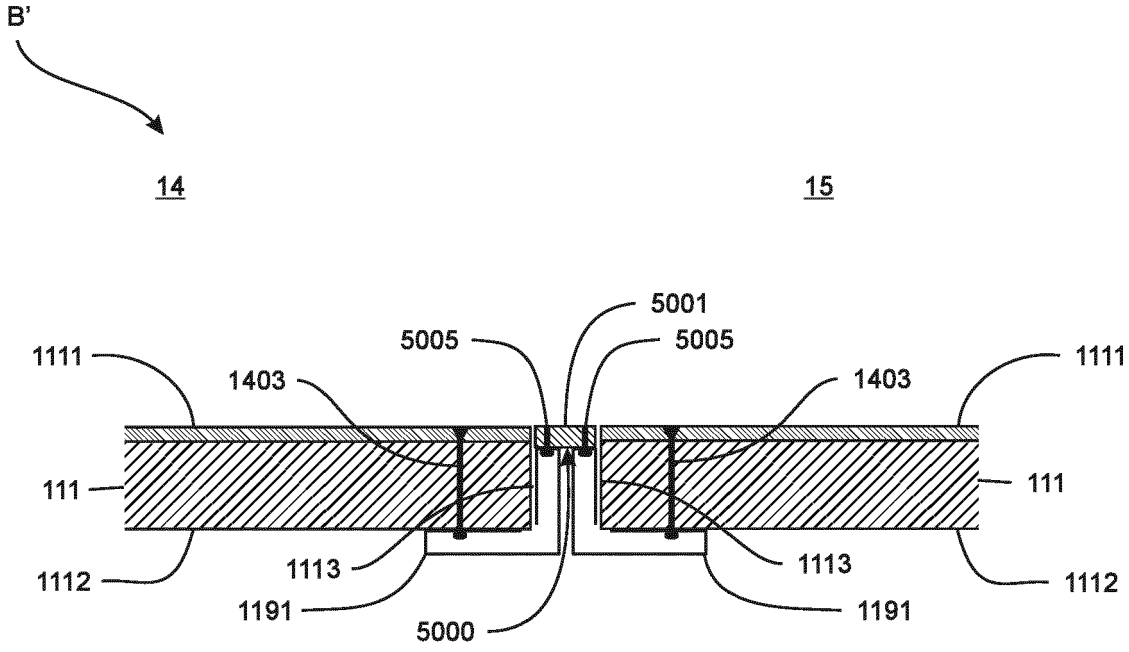
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Fig. 6b

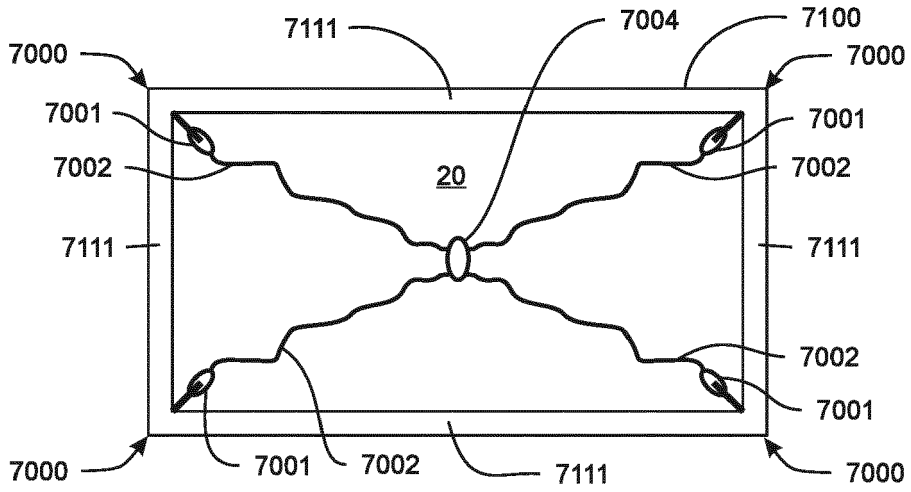
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Fig. 7

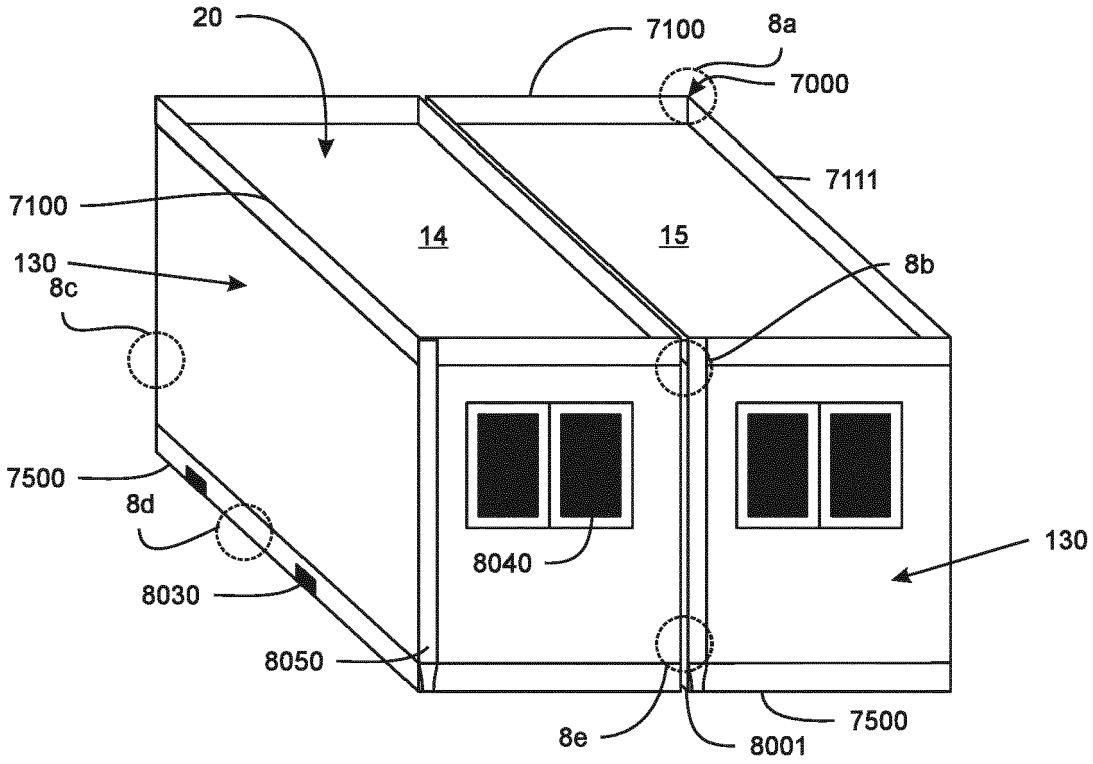
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Fig. 8

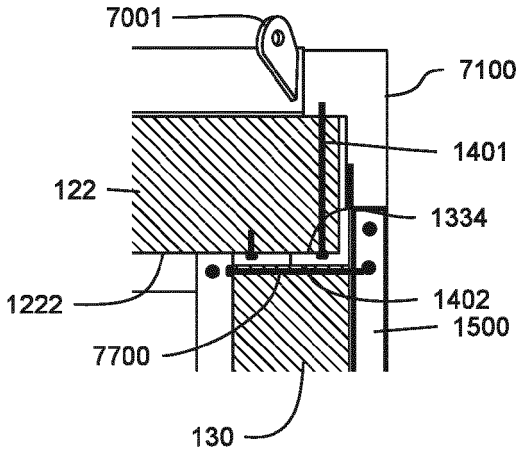


Fig. 8a

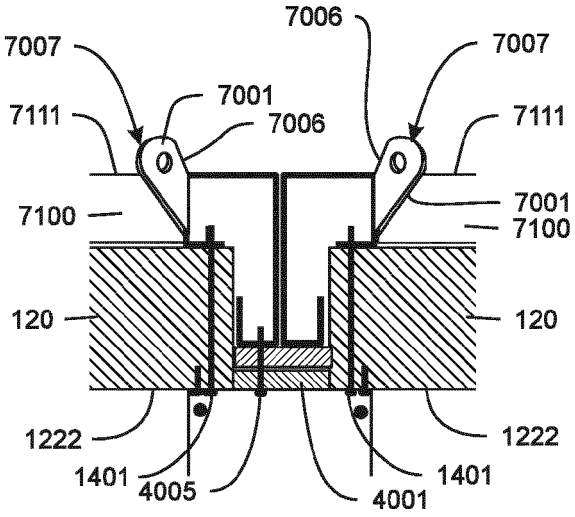


Fig. 8b

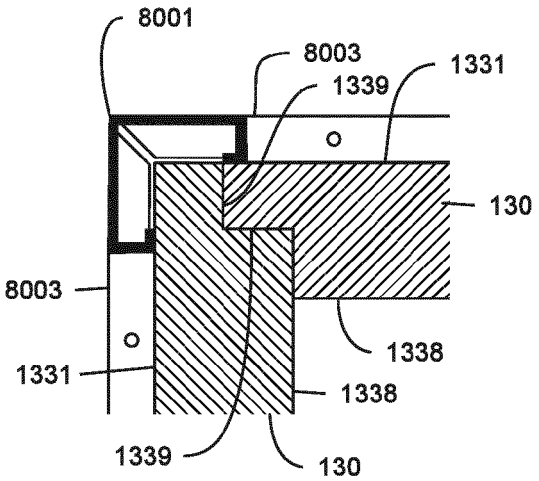


Fig. 8c

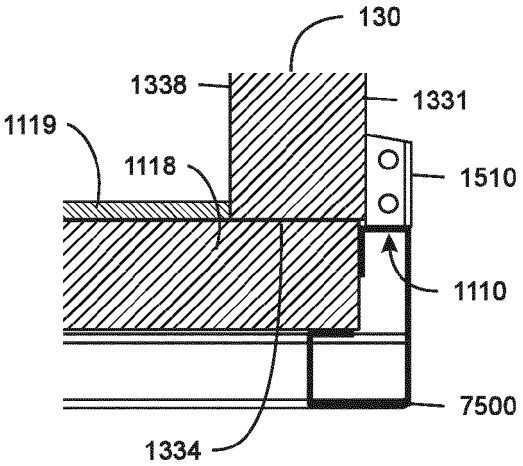


Fig. 8d

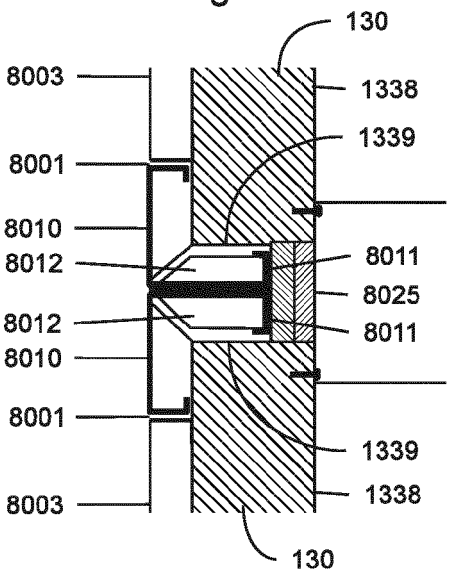
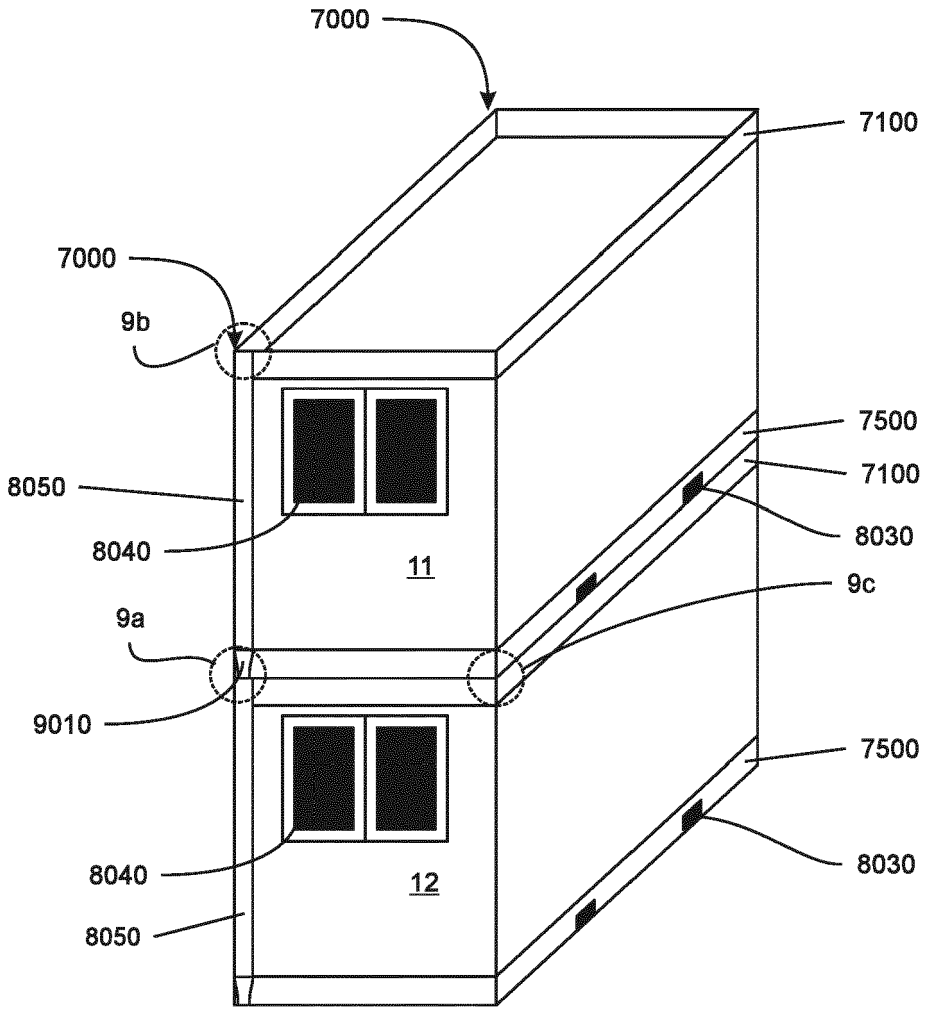


Fig. 8e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7000
9b
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8040
12
8050

Fig. 9

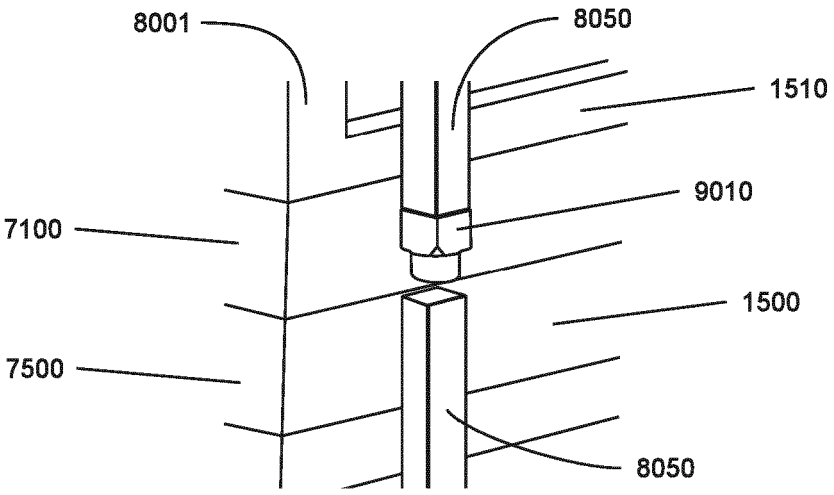

Fig. 9a

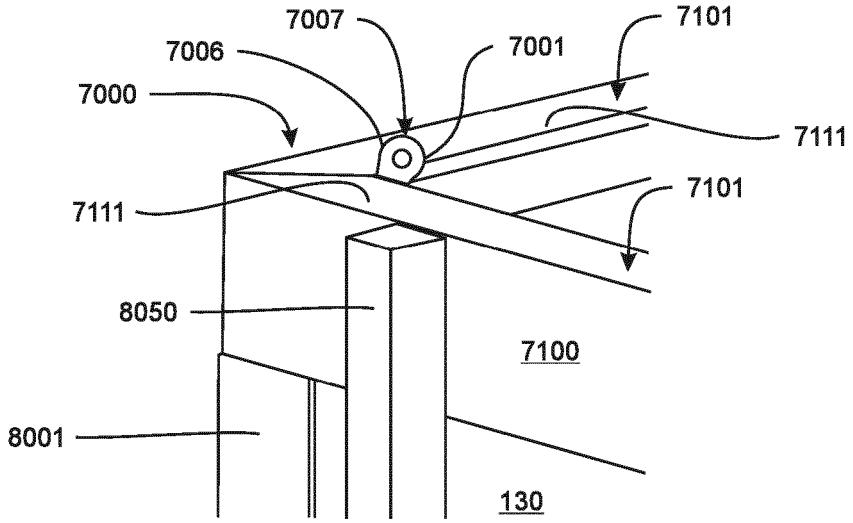

Fig. 9b

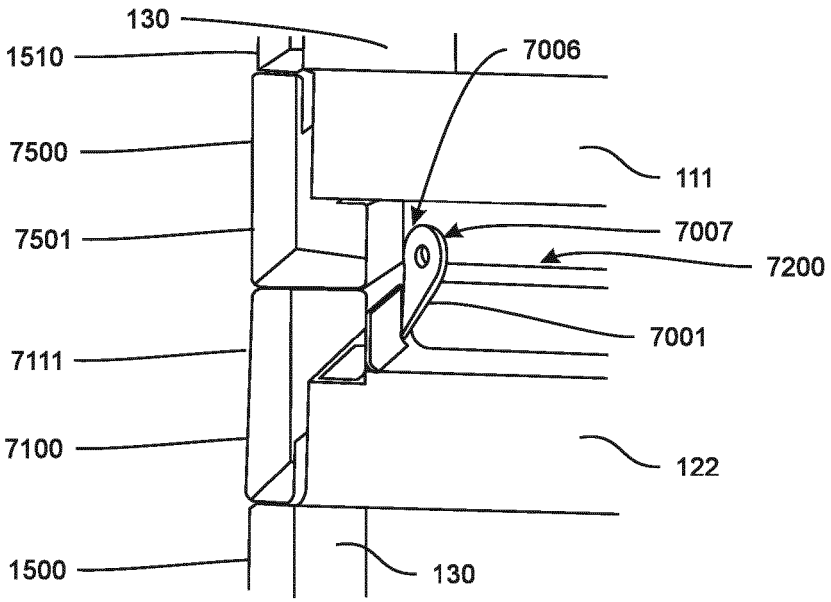

Fig. 9c

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 5110

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 926 115 A1 (PORTAKABIN LTD [GB]) 22 December 2021 (2021-12-22) * paragraph [0006] - paragraph [0135]; figures 1-5 *	1-15	INV. E04B1/348
X	US 2018/274254 A1 (FAN LI [CN]) 27 September 2018 (2018-09-27) * paragraph [0003] - paragraph [0092]; figures 1-8.3 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 November 2022	Dieterle, Sibille

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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