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(54) **GUIDE ASSEMBLY FOR POSITIONING BUILDING UNITS**

(57) A guide assembly (5) and method for positioning a generally cuboid building unit (6) at a construction site, the guide assembly (5) comprising a lower guide member (1) for attachment to a top surface of a construction element or foundation, the lower guide member (1) comprising a first guide surface (2); and an upper guide member (3) for attachment to a bottom of said building unit (6), the upper guide member (3) comprising a second guide surface (4) for engaging the first guide surface (2); wherein the first guide surface (2) and the second guide surface (4) are shaped for slidably guiding the upper guide member (3) along an oblique guide path (7) when lowered onto the lower guide member (1), the guide path (7) having an average inclination (8) smaller than 45 degrees with respect to the horizontal pane.

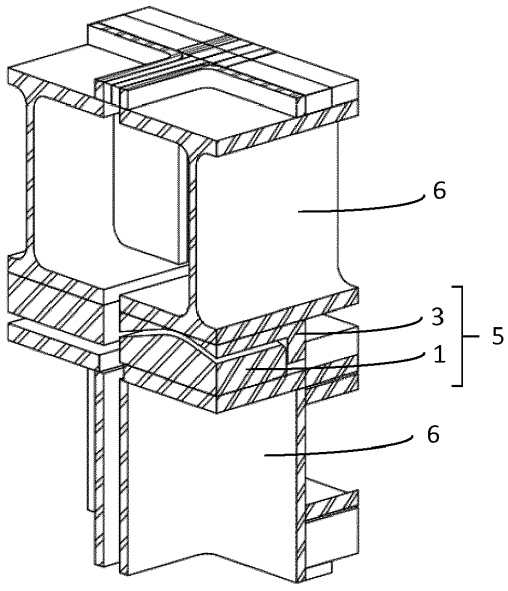

FIG. 4

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Description

TECHNICAL FIELD

[0001] The disclosure relates to the construction of buildings using prefabricated building units, more specifically to a guide assembly and method for positioning such a building unit during construction of a building, in particular in relation to the already built portion of the building.

BACKGROUND

[0002] Modular construction of buildings from prefabricated building units has been used for many years for reducing construction time and expense. Modular construction has the advantages that the units can be prefabricated at some remote place such as a factory and subsequently transported to the building site where the units can be assembled into a building. The prefabrication of the units can differ depending on the building method. In some cases, substantially flat panels are prefabricated and transported to a site for assembly into a building. The transport of the panels in this case is reasonably straightforward but the assembly on site involves a considerable amount of labor, resulting in increased expenses. In other cases, the entire building is prefabricated and transported to a final location but the transportation in this case, if possible at all, can present significant difficulties and costs. For these reasons, it is advantageous to assemble a building from several prefabricated three-dimensional building units that still can be transported without considerable difficulty and can then be assembled on site without requiring extensive labor and time.

[0003] In known solutions for prefabricating three-dimensional building units each modular unit is preformed/fabricated at a factory for final assembly at a building site, the modular units being stackable in various arrays to form a completed building. The interiors of such units can also be prepared at the factory to a different degree. Various plumbing and electrical conduits, as well as heating and air circulating ducts, can be formed in the units and interconnected when such units are stacked to form the completed building. However, due to risks of damage to the outer walls when assembling the units on site, more particularly damages caused by shock or sliding contact between adjacent side walls when the units are vertically lowered into place, it is generally avoided that any material that is sensitive to external forces, such as relatively soft joint sealings (insulation or fire sealings), is exposed on the outer walls of the units.

[0004] This results in additional manual labour and time required when assembling the building, as such necessary sealings between the units need to be added on site when the units are placed in their final position.

SUMMARY

[0005] It is an object to provide a guide assembly that overcomes or at least reduces the problem mentioned above.

[0006] The foregoing and other objects are achieved by the features of the independent claims. Further implementation forms are apparent from the dependent claims, the description and the figures.

[0007] According to a first aspect, there is provided a guide assembly for positioning a generally cuboid building unit at a construction site, the guide assembly comprising a lower guide member for attachment to a top surface of a construction element or foundation, the lower guide member comprising a first guide surface, and an upper guide member for attachment to a bottom of the building unit, the upper guide member comprising a second guide surface for engaging the first guide surface, wherein the first guide surface and the second guide surface are shaped for slidably guiding the upper guide member along an oblique guide path when lowered onto the lower guide member, and wherein the guide path has an average inclination smaller than 45 degrees with respect to the horizontal pane. Providing an oblique guide path with such a shallow angle of inclination upon lowering the building unit ensures that there is reduced sliding contact between adjacent units, thus reducing the risk of any possible damage to the outer surface of the units, such as a dislocation or tear of joint sealings (insulation or fire sealing). The prefabricated building unit can be lowered while keeping a safe distance to neighboring walls or parts of the already constructed building with the sideways movement towards these neighboring walls or parts being performed in a controllable manner guided by the guide members.

[0008] In a possible implementation form of the first aspect the average inclination is smaller than 30 degrees with respect to the horizontal pane. An angle of less than 30° ensures a rather small vertical movement thereby reducing the risk of damage.

[0009] In a possible implementation form of the first aspect the average inclination is approximately 16 degrees with respect to the horizontal pane. An angle of less than 16° ensures an even lesser vertical movement and thereby further reduces the risk of damage.

[0010] In a possible implementation form of the first aspect the guide path slopes down towards an edge of the lower guide member.

[0011] In a possible implementation form of the first aspect the first guide surface comprises a slope corresponding to the inclination.

[0012] In a possible implementation form of the first aspect the first guide surface comprises two slopes, at least one of the slopes corresponding to the inclination.

[0013] In a possible implementation form of the first aspect the two slopes define an upper part of the lower guide member shaped as an inverted V. Thus, two opposing guide services are created that allow exact posi-

tioning of the building element.

[0014] In a possible implementation form of the first aspect both slopes correspond to the inclination, thus defining an upper part of the lower guide member with an upper surface shaped as an inverted V with two equal sides.

[0015] In a possible implementation form of the first aspect the two slopes are connected by a curved surface to create a smooth engagement surface for engaging the second guide surface.

[0016] In a possible implementation form of the first aspect the second guide surface of the upper guide member corresponds to the first guide surface of the lower guide member.

[0017] According to a second aspect, there is provided a generally cuboid building unit for positioning at a construction site, the building unit comprising at least one upper guide member of a guide assembly according to any one of the possible implementation forms of the first aspect attached to a bottom surface of the building unit, wherein the upper guide member is arranged to slidably engage with a corresponding lower guide member when the building unit is lowered into place, thereby guiding the building unit to its place along the guide path of the guide assembly with the inclination.

[0018] In a possible implementation form of the second aspect the building unit comprises at least two of the upper guide members, preferably arranged diagonally at or near opposite lower corners of the building unit, and at least two of the corresponding lower guide members of the guide assembly arranged at or near the corresponding upper corners the building unit, so that when one of the building units is lowered onto another one of the building units the corresponding guide members engage slidably, thereby guiding the lowered building unit to its place along the guide path of the guide assembly.

[0019] In a possible implementation form of the second aspect, at least one side wall of the cuboid building unit is at least partially covered by a layer of relatively soft insulation material.

[0020] According to a third aspect, there is provided a method of positioning a building unit at a construction site, the method comprising:

providing at least one building unit according to any one of the possible implementation forms of the second aspect,

arranging at least one lower guide member corresponding to the at least one upper guide member of the building unit to a top surface of a construction element or foundation in a position corresponding to a desired final position of the building unit,

lifting and moving the building unit to a first position, wherein the at least one upper guide member is located above but off-axis with respect to the at least one lower guide member,

lowering the building unit vertically without any sideways movement into a second position where the at least one upper guide member and the at least one lower guide member engage,

further lowering the building unit while the upper guide member slidably engages the lower guide member and guides the building unit along the guide path of the guide assembly to its final position.

[0021] In a possible implementation form of the third aspect, wherein the building unit is to be placed to a final position adjacent to a side wall of a construction element or another one of the building units, the method comprises:

lifting and moving the building unit to a first position with a first side wall of the building unit in close parallel proximity to a second side wall of the construction element or building unit, wherein the at least one upper guide member is located above but off-axis with respect to the at least one lower guide member,

lowering the building unit vertically without any sideways movement into a second position where the at least one upper guide member and the at least one lower guide member engage,

further lowering the building unit while the upper guide member slidably engages the lower guide member and guides the building unit along the guide path of the guide assembly to its final position, whilst the sideways movement towards the second side wall is limited by the guide path to thereby minimize sliding contact between the first side wall and the second side wall,

wherein at least one of the first side wall and the second side wall is at least partially covered by a layer of relatively soft insulation material.

[0022] These and other aspects will be apparent from the embodiments described below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] In the following detailed portion of the present disclosure, the aspects, embodiments and implementations will be explained in more detail with reference to the example embodiments shown in the drawings, in which:

Figs. 1A to 1F show front views of different possible embodiments of the lower guide member of the guide assembly,
Figs. 1G to 1I show front views of different possible embodiments of the guide assembly,
Fig. 2A shows a front view of an embodiment of the

lower guide member of the guide assembly,
Fig. 2B shows a side view of an embodiment of the lower guide member of the guide assembly,
Fig. 2C shows a front view of an embodiment of the upper guide member of the guide assembly,
Fig. 2D shows a side view of an embodiment of the upper guide member of the guide,
Fig. 3 shows a perspective view of the embodiment of the lower guide member shown in Figs. 2A to 2B,
Fig. 4 shows a cut-off perspective view of the embodiment of the guide assembly shown in Figs. 2A to 2D attached to the top and bottom surfaces of respective building units, while engaging the building units in their final position,
Fig. 5 shows a perspective view of the embodiment of the lower guide member shown in Fig. 3, provided at an upper corner of a building unit,
Fig. 6 shows a schematic perspective view of a cuboid building unit, with locations for the lower and upper guide members indicated at the respective upper and lower corners,
Figs. 7A to 7D each show a schematic elevated view of a group of building units, illustrating the steps of the method of positioning a building,
Figs. 8A to 8B show an enlarged view of the engagement area of the group of building units in Figs. 7A to 7D, illustrating the final steps of positioning a building unit and some features in greater detail.

DETAILED DESCRIPTION

[0024] Guide assemblies for positioning building units at a construction site are generally known. These assemblies usually comprise engaging upper and lower guide members that help centering a unit when it is lowered onto a foundation, or onto another building unit. These guide members may comprise tapered blocks and matching recesses with side surfaces sloping at a steep angle.

[0025] These kind of guide assemblies work well when the units are vertically lowered into their final position, which is the common situation when assembling prefabricated steel or concrete units to form a multistory building.

[0026] However, in case of building units with side walls comprising exposed elements such as e.g. soft insulation or fire sealing, lowering the units vertically presents a danger of damaging these exposed elements upon sliding contact between adjacent units.

[0027] These above-mentioned disadvantages are overcome by means of the embodiments of the present disclosure.

[0028] Figs. 1A to 1C illustrate different possible embodiments of the lower guide member 1 of the guide assembly 5, wherein a first guide surface 2 of the guide member 1 is shaped to provide an oblique guide path for an upper guide member with an average inclination 8 smaller than 45 degrees with respect to the horizontal pane. This average inclination can be achieved in several ways including, but not limited to providing a linear surface 2 as shown of Fig. 1A, as well as by providing an inwards curved (concave) surface 2 as shown on Fig. 1B, or an outwards curved (convex) surface 2 as shown on Fig. 1C.

[0029] Figs. 1D to 1F illustrate further possible embodiments of the lower guide member 1, wherein the guide member 1 may comprise a generally cuboid lower part, and an upper part comprising a sloping guide surface 2, which sloping surface may correspond to a desired average inclination 8. As shown on Fig. 1E, the upper part may comprise two slopes, thereby defining an upper part with a recess shaped as a V. The slopes may also slope down towards the edges of the guide member 1 as shown on Fig. 1F, thereby defining an upper part shaped as an inverted V. The two slopes may even have the same inclination, thereby defining an upper surface shaped as an inverted V with two equal sides.

[0030] Figs. 1G to 1I illustrate different possible embodiments of the guide assembly 5, comprising a lower guide member 1 according to the embodiment shown on Fig. 1F, and an upper guide member 3, the guide members arranged to slidably engage along an oblique guide path 7. As shown on Fig. 1G, the upper guide member 3 may comprise a curved second guide surface 4.

[0031] In a different embodiment, the upper guide member 3 may comprise a linear second guide surface 4, as shown on Fig. 1H. In a further alternative embodiment shown on Fig. 1I, the second guide surface 4 of the upper guide member 3 may correspond to the first guide surface 2 of the lower guide member 1.

[0032] Figs. 2A, 2B, and Fig. 3 illustrate an example embodiment of the lower guide member 1 of the guide assembly 5. In this embodiment, as shown in the front view of Fig. 2A, two slopes of the first guide surface 2 are connected by a curved surface 2A to create a smooth engagement surface for engaging a second guide surface 4. The radius R of the curvature is selected to ensure that the transition between the linear and curved portions of the guide surface 2 is seamless, with no noticeable bump or visible edge in between. For example, when the desired angle of inclination 8 is approx. 16 degrees, and the curved surface 2A has a width W of approx. 20 cm, the radius is selected to be in the region of 50 to 90 cm, more preferably 60 to 80 cm, more preferably approx. 70 cm.

[0033] In further possible embodiments, one or both of the edges connecting the first guide surface 2 and the front and rear faces of the lower guide member 1 respectively may be cut off as shown in the side view Fig. 2B to provide a better engagement surface for an upper guide member 3. For example, the edges may be cut off to an extent of 5-5 cm both vertically and horizontally, thus resulting in a sloping top front and rear edge with an inclination of 45 degrees.

[0034] Figs. 2C and 2D illustrate an embodiment of the upper guide member 3 of the guide assembly 5. In this

embodiment, as shown in the front view of Fig. 2C, two slopes of the second guide surface 4 are connected in the middle by a curved surface. The inclination of the slopes and the radius R of the curvature of the curved surface in between are selected to approximately correspond to the parameters of the first guide surface 2 of the lower guide member 1 shown on Fig. 2A, thereby resulting in approximately corresponding guide surfaces. This ensures that there is minimal clearance between the guide members once they reach their final position.

[0035] In further possible embodiments, one or both of a front guide wall 12 and a rear guide wall 13 may be added to the front and rear side of the upper guide member 3 respectively, as shown in Fig. 2D, thereby resulting in an upper guide member 3 with a shape of an inverted U when viewed from the side. These guide walls ensure an enhanced positioning effect when the upper guide member 3 is lowered onto the lower guide member 1. This embodiment of the upper guide member 3 comprising guide walls 12,13 provides a further enhanced positioning effect when used together with a lower guide member 1 according to the embodiment illustrated on Fig. 2B, as the cut-off edges of the lower guide member 1 ensure increased tolerance for misalignment of the guide members, as well as better engagement with the guide walls 12,13.

[0036] Fig. 4 illustrates in a cut-off perspective view of how the upper guide member 3 and lower guide member 1 shown in Figs. 2A to 2D can engage as a guide assembly 5 when attached to the top and bottom surfaces of respective building units 6, thereby guiding the building units into their final position with respect to each other.

[0037] Figs. 5 and 6 show an embodiment of the building unit 6. The building unit may have a substantially rectangular cuboid shape. In some embodiments, the building unit may comprise a basic structure of interconnected steel beams arranged so that they define the edges of the rectangular cuboid shape. Fig. 5 shows how a lower guide member 1 may be arranged at an upper corner of the building unit. Fig. 6 illustrates the positioning of lower guide members 1 arranged diagonally at or near opposite upper corners of the building unit 6, while upper guide members 3 are arranged at or near the corresponding lower corners of the building unit 6. This arrangement ensures an optimal positioning effect when arranging building units 6 on top of each other, while keeping the number of necessary guide assemblies 5 low, and thus saving material costs. In other possible embodiments it may also be possible that the building unit 6 is arranged with fewer or more upper guide members 3 or lower guide members 1 attached to the bottom and top surface of the building unit 6, respectively.

[0038] Figs. 7A to 7D illustrate the steps of a method of positioning a building unit 6. Fig. 7A shows three adjacent building units 6 in their final, assembled position, and a fourth, new building unit 6 to be positioned. The new building unit 6 comprises at least one upper guide member 3 indicated at its lower right corner, while there is also at least one lower guide member 1 provided at the corresponding upper corner of the building unit 6 where the new unit is to be lowered onto, the location of which lower guide member 1 corresponds to a desired final position P3 of the new unit 6.

[0039] In a first step, as shown on Fig. 7A, the new unit 6 is lifted and moved to a first position P1, wherein the upper guide member 3 is located above but off-axis with respect to the lower guide member 1. In this first position P1 the side wall of the new unit 6 is in close parallel proximity to the side wall of the adjacent unit it is to be positioned next to, in case there is one.

[0040] In a second step, as shown on Fig. 7B, the new unit 6 is lowered vertically without any sideways movement into a second position P2, where the upper guide member 3 and the lower guide member 1 engage. Avoiding any sideways movement in this step is important in order to reduce the risk of sliding contact between the first side wall 9 of the new unit and the second side wall 10 of the adjacent unit and thus to avoid damaging the potentially exposed elements on the side walls 9, 10 of the units 6.

[0041] In a third step, as shown on Fig. 7C, the new unit 6 is further lowered while the upper guide member 3 slidably engages the lower guide member 1 and guides the new building unit 6 along a guide path 7 to its final position P3. During this step, the sideways movement towards the second side wall 10 is limited by the guide path 7 to thereby minimize sliding contact between said first side wall 9 and said second side wall 10.

[0042] Figs. 8A to 8B illustrate the final steps of positioning the building unit 6 and some features in greater detail, in an enlarged view of the engagement area of the building units of Figs. 7A to 7D.

[0043] As shown on Fig. 8A, at least one of the first side wall 9 and said second side wall 10 is at least partially covered by a layer of relatively soft insulation material 11. The oblique guide path indicated by the thick arrow, with its shallow angle of inclination provided by the engaging guide surfaces of the upper guide member 3 and lower guide member 1 upon lowering the new building unit 6 ensures that there is reduced sliding contact between adjacent side walls 9 and 10 of the building units, thus reducing the risk of any possible damage to the outer surface of the units, such as a dislocation or tear of the insulation material 11.

[0044] As shown on Fig. 8B, when the new building unit is in its final position, the insulation material is fitted perfectly between the adjacent units 6, while the matching guide surfaces of the guide assembly 5 ensure that there is a minimal distance between the units 6.

[0045] The various aspects and implementations have been described in conjunction with various embodiments herein. However, other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed subject-matter, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does

not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

[0046] The reference signs used in the claims shall not be construed as limiting the scope.

Claims

1. A guide assembly (5) for positioning a generally cuboid building unit (6) at a construction site, said guide assembly (5) comprising:

   a lower guide member (1) for attachment to a top surface of a construction element or foundation, said lower guide member (1) comprising a first guide surface (2), and
   an upper guide member (3) for attachment to a bottom of said building unit (6), said upper guide member (3) comprising a second guide surface (4) for engaging said first guide surface (2), wherein
   said first guide surface (2) and said second guide surface (4) are shaped for slidably guiding said upper guide member (3) along an oblique guide path (7) when lowered onto the lower guide member (1), and wherein
   said guide path (7) has an average inclination (8) smaller than 45 degrees with respect to the horizontal pane.

2. A guide assembly (5) according to claim 1, wherein said average inclination (8) is smaller than 30 degrees with respect to the horizontal pane.

3. A guide assembly (5) according to claim 1, wherein said average inclination (8) is approximately 16 degrees with respect to the horizontal pane.

4. A guide assembly (5) according to any one of claims 1 to 3, wherein said guide path (7) slopes down towards an edge of said lower guide member (1).

5. A guide assembly (5) according to any one of claims 1 to 4, wherein said first guide surface (2) comprises a slope corresponding to said inclination (8).

6. A guide assembly (5) according to claim 5, wherein said first guide surface (2) comprises two slopes, at least one of said slopes corresponding to said inclination (8).

7. A guide assembly (5) according to claim 6, wherein said two slopes define an upper part of the lower guide member (1) shaped as an inverted V.

8. A guide assembly (5) according to claim 7, wherein both of said two slopes correspond to said inclination (8), thus defining an upper part of the lower guide member (1) with an upper surface shaped as an inverted V with two equal sides.

9. A guide assembly (5) according to any one of claims 6 to 8, wherein said two slopes are connected by a curved surface (2A) to create a smooth engagement surface for engaging said second guide surface (4).

10. A guide assembly (5) according to any one of claims 1 to 9, wherein the second guide surface (4) of the upper guide member (3) corresponds to the first guide surface (2) of the lower guide member (1).

11. A generally cuboid building unit (6) for positioning at a construction site, said building unit (6) comprising:

    at least one upper guide member (3) of a guide assembly (5) according to any one of claims 1 to 9, attached to a bottom surface of said building unit (6), wherein
    said upper guide member (3) is arranged to slidably engage with a corresponding lower guide member (1) when the building unit (6) is lowered into place,
    thereby guiding the building unit (6) to its place along the guide path (7) of said guide assembly (5) with said inclination (8).

12. A building unit (6) according to claim 11, wherein the building unit (6) comprises:

    at least two of said upper guide members (3), preferably arranged diagonally at or near opposite lower corners of the building unit (6), and
    at least two of the corresponding lower guide members (1) of said guide assembly (5) arranged at or near the corresponding upper corners the building unit (6),
    so that when one of said building units (6) is lowered onto another one of said building units (6) the corresponding guide members (1,3) engage slidably, thereby guiding the lowered building unit (6) to its place along the guide path (7) of said guide assembly (5).

13. A building unit (6) according to any of claims 11 or 12, wherein
    at least one side wall (9,10) of said cuboid building unit (6) is at least partially covered by a layer of relatively soft insulation material (11).

14. A method of positioning a building unit (6) at a construction site, the method comprising:

    providing at least one building unit (6) according

to any one of claims 11 to 13,
arranging at least one lower guide member (1) corresponding to the at least one upper guide member (3) of said building unit (6) to a top surface of a construction element or foundation in a position corresponding to a desired final position (P3) of said building unit (6),
lifting and moving said building unit (6) to a first position (PI), wherein said at least one upper guide member (3) is located above but off-axis with respect to said at least one lower guide member (1),
lowering said building unit (6) vertically without any sideways movement into a second position (P2) where said at least one upper guide member (3) and said at least one lower guide member (1) engage,
further lowering said building unit (6) while said upper guide member (3) slidably engages said lower guide member (1) and guides the building unit (6) along the guide path (7) of the guide assembly (5) to its final position (P3).

15. A method of positioning a building unit (6) at a construction site according to claim 14, wherein said building unit (6) is to be placed to a final position (P3) adjacent to a side wall (10) of a construction element or another one of said building units (6), the method comprising
lifting and moving said building unit (6) to a first position (PI) with a first side wall (9) of said building unit (6) in close parallel proximity to a second side wall (10) of said construction element or building unit (6), wherein said at least one upper guide member (3) is located above but off-axis with respect to said at least one lower guide member (1),
lowering said building unit (6) vertically without any sideways movement into a second position (P2) where said at least one upper guide member (3) and said at least one lower guide member (1) engage,
further lowering said building unit (6) while said upper guide member (3) slidably engages said lower guide member (1) and guides the building unit (6) along the guide path (7) of the guide assembly (5) to its final position (P3), whilst the sideways movement towards said second side wall (10) is limited by said guide path (7) to thereby minimize sliding contact between said first side wall (9) and said second side wall (10),
wherein at least one of said first side wall (9) and said second side wall (10) is at least partially covered by a layer of relatively soft insulation material (11).

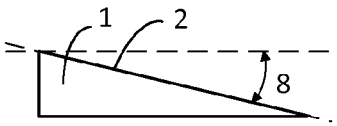

FIG. 1A

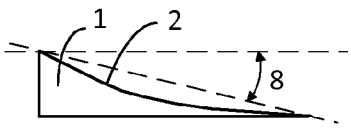

FIG. 1B

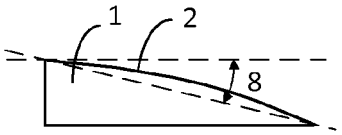

FIG. 1C

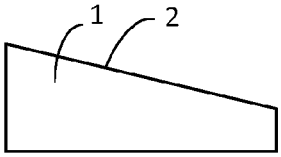

FIG. 1D

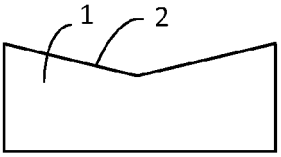

FIG. 1E

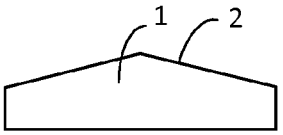

FIG. 1F

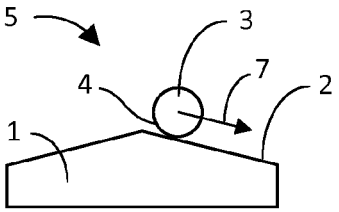

FIG. 1G

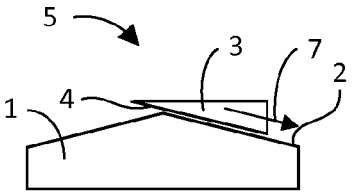

FIG. 1H

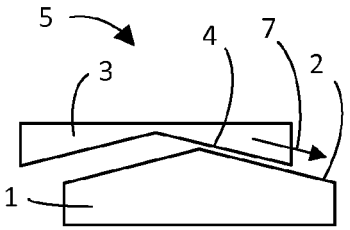

FIG. 1I

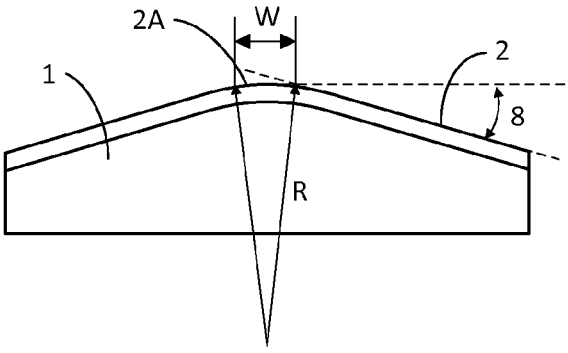

FIG. 2A

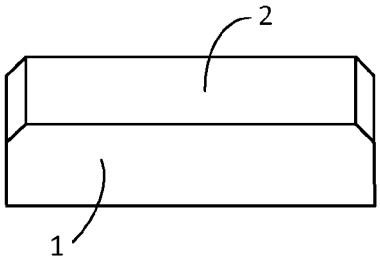

FIG. 2B

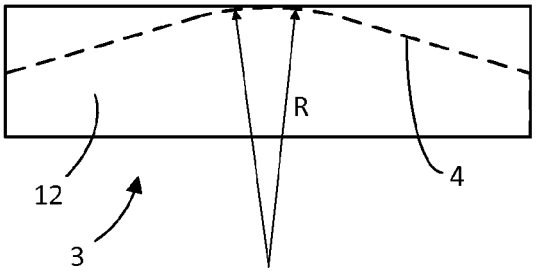

FIG. 2C

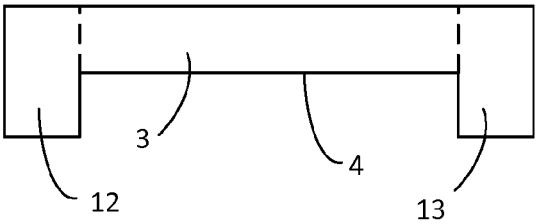

FIG. 2D

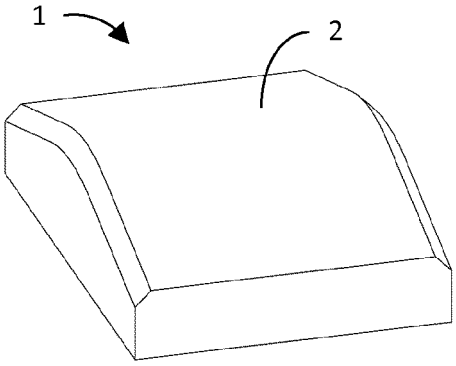

FIG. 3

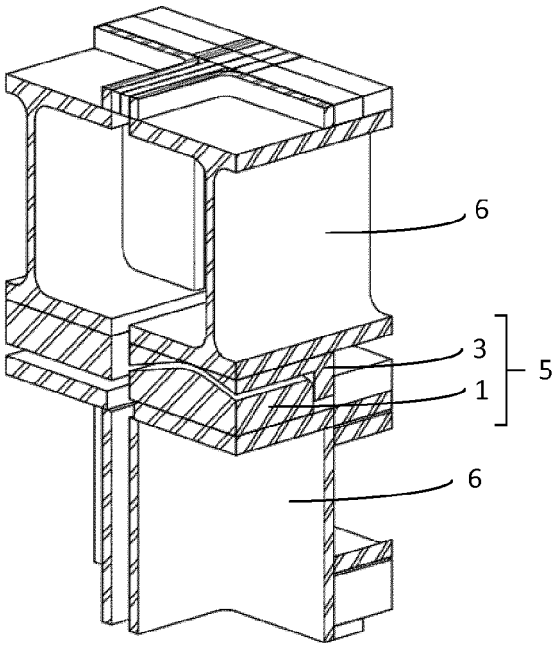

FIG. 4

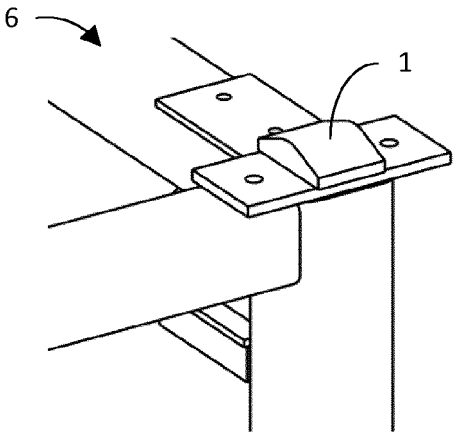

FIG. 5

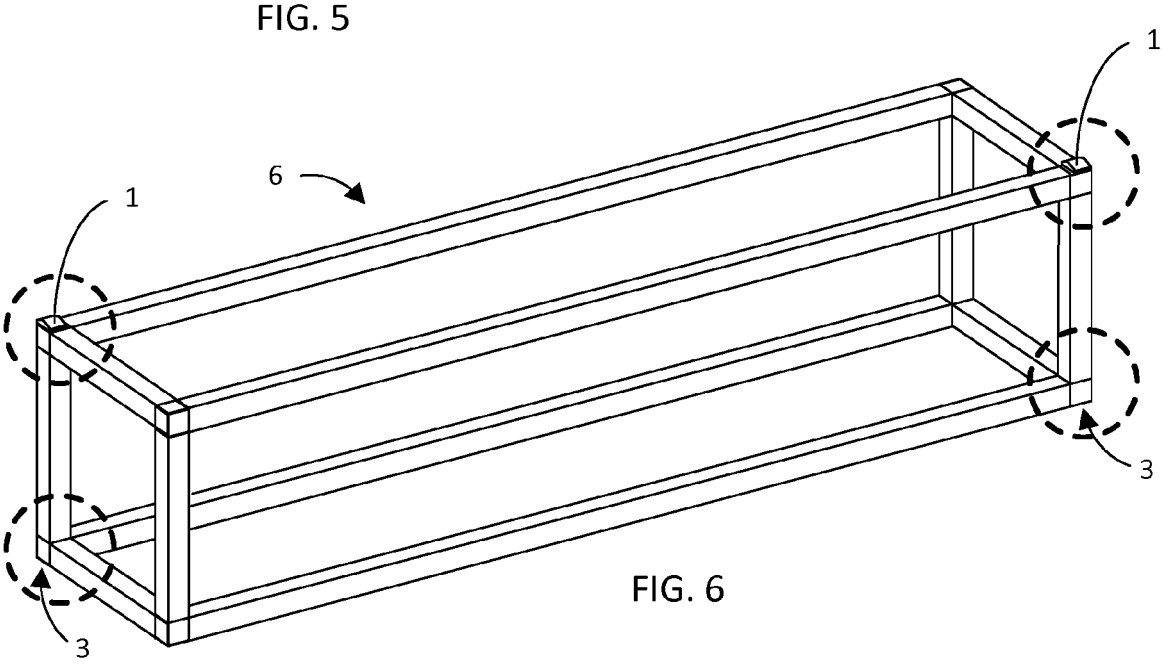

FIG. 6

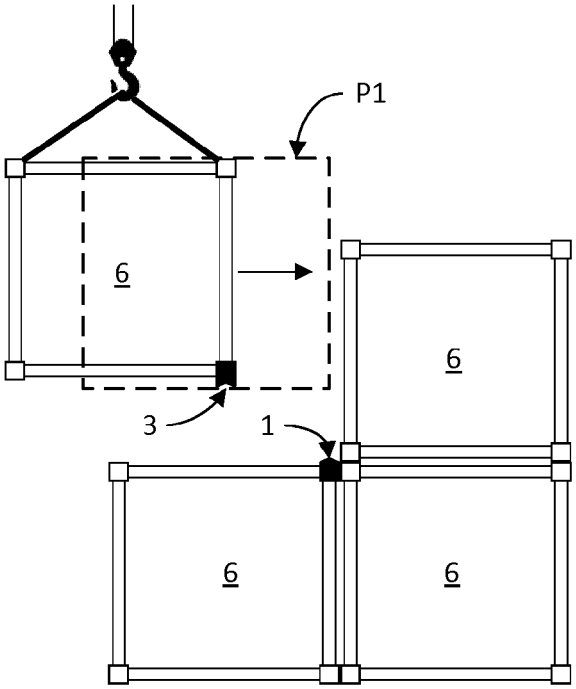

FIG. 7A

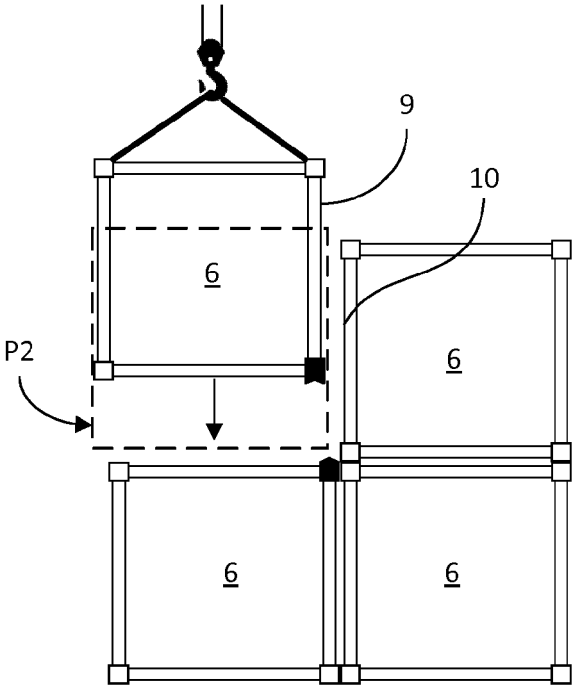

FIG. 7B

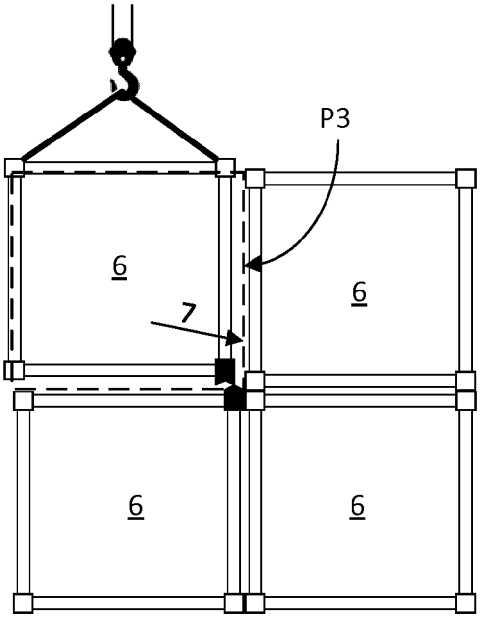

FIG. 7C

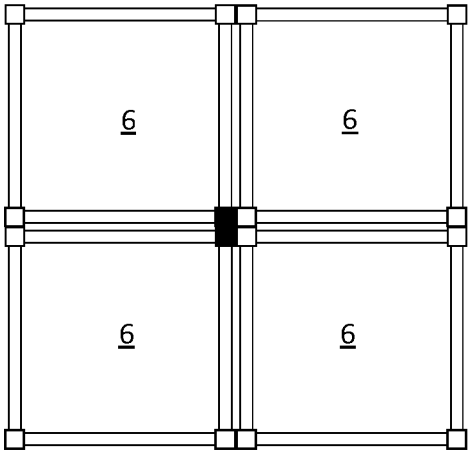

FIG. 7D

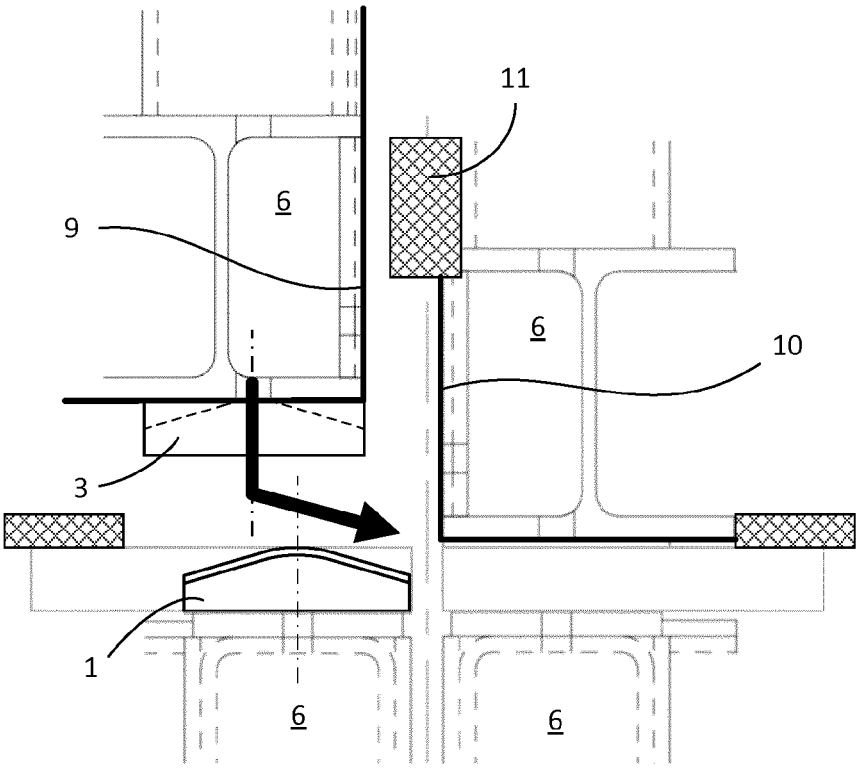

FIG. 8A

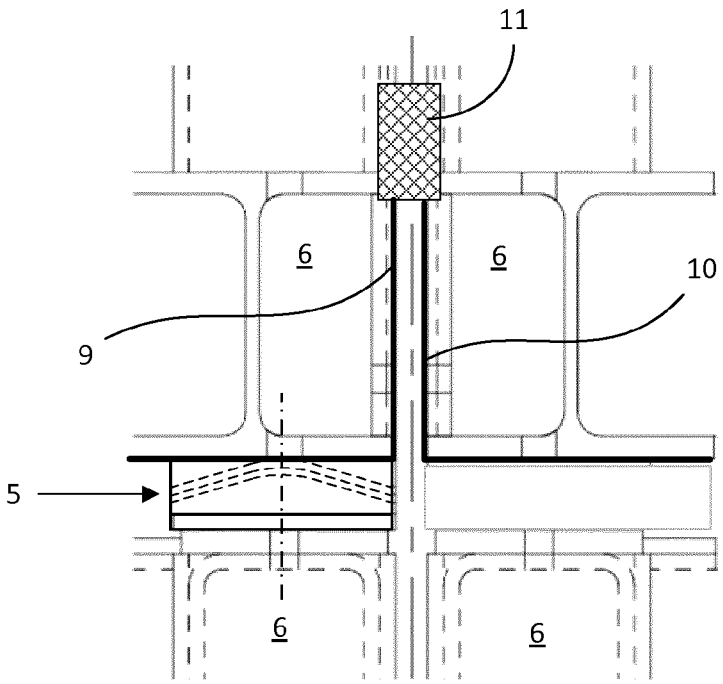

FIG. 8B

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EUROPEAN SEARCH REPORT

Application Number
EP 19 18 2189

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2011/198553 A1 (HOLTERMAN STEVEN W [US]) 18 August 2011 (2011-08-18) * paragraph [0016] - paragraph [0026]; figures *	1-5,10	INV. E04B1/348 ADD. B65D90/00
X	KR 2011 0076653 A (POSCO [KR]; RES INST IND SCIENCE & TECH [KR]) 6 July 2011 (2011-07-06) * abstract; figures *	1,6-9, 11-15	E04H12/22
A	KR 101 471 039 B1 (YEOP SEONG SIK [KR]) 9 December 2014 (2014-12-09) * abstract; figures *	1-15	
A	EP 2 871 298 A1 (GEN INNOVATION IND FRANCE [FR]) 13 May 2015 (2015-05-13) * paragraph [0036] - paragraph [0090]; figures *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

E04B
B65D
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 November 2019	López-García, G

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11-11-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011198553 A1	18-08-2011	NONE	
KR 20110076653 A	06-07-2011	NONE	
KR 101471039 B1	09-12-2014	NONE	
EP 2871298 A1	13-05-2015	EP 2871298 A1	13-05-2015
		FR 3012827 A1	08-05-2015

EPO FORM P0459

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