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(72) Inventor: **DELFELD, Marc**
1300 Wavre (BE)

(74) Representative: **Pronovem**
Office Van Malderen
Avenue Josse Goffin 158
1082 Bruxelles (BE)

(71) Applicant: **Keep Silence Sprl**
1300 Limal (BE)

(54) **A CONSTRUCTION ASSEMBLY FOR WOODEN BUILDINGS**

(57) A construction assembly according to the invention comprises an I-joist or a U-joist comprising a mid section and two lateral beams, fixed at a right angle to a planar surface, wherein the right angle connection is realized by mounting two metal connection elements side by side, each connection element comprising a central first plate portion and a second plate portion at a right angle to the first, and wherein laterally placed upstanding and level strip-shaped plate portions define a profile that comprises two upward steps leading away from the cen-

tral plate portion. An auxiliary piece is placed between the connection elements and the mid-section of the I or U-joist, the auxiliary piece comprising a central portion having a higher thickness and two side portions having a lower thickness, wherein the dimensions of the auxiliary piece are chosen so that the auxiliary piece fits between the beams of the I or U joist, and so that the profiles of the metal connection pieces fit into the valleys defined by the side portions of the auxiliary piece, the beams of the joist and the central portion of the auxiliary piece.

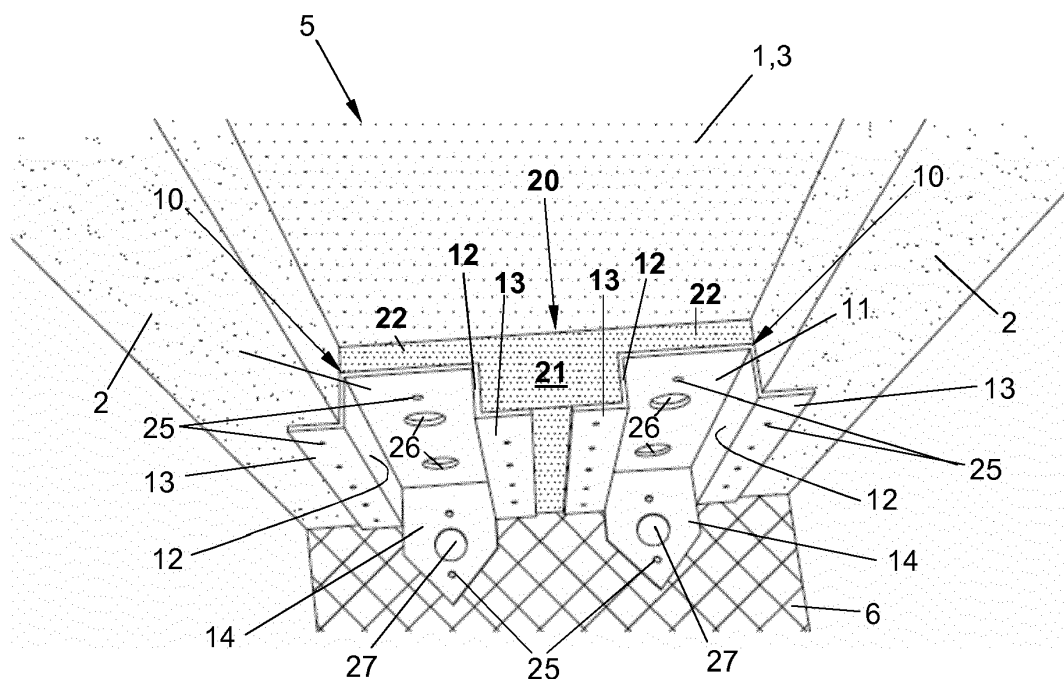


FIG. 2

Description

Field of the Invention

[0001] The present invention is related to wooden building constructions, in particular to the realization of a right-angle connection between a wooden I-joist or U-joist and a planar surface.

State of the art.

[0002] A wooden I-joist or U-joist comprises a mid section in the form of a long rectangular wooden plate and lateral beams of rectangular cross-section extending in the longitudinal direction of the joist. The lateral beams are elevated relative to one or both of the planar surfaces of the mid section.

[0003] Document WO2017/020098 describes a metal connection piece for realizing a right-angle connection between an I-joist or U-joist and a flat beam or plate. The metal piece comprises plate portions fixated to the I-joist or U-joist and to a perpendicular surface, and lateral upstanding plate portions. The upstanding portions are fitted against the sides of the lateral beams of the I-joist or U-joist. One embodiment shows a connection realized by placing two of the metal elements side by side and bridging the gap between the elements by a locally placed short wooden beam element glued or bolted on the mid section of the I- or U joist, centrally between the lateral beams of the I- or U joist.

[0004] While the connection including the two adjacent metal elements is capable of realizing a right angle connection of high quality and strength, it still has a number of drawbacks. One problem is the fact that it requires the careful positioning of the short wooden beam element in the centre between the two lateral beams of the I or U joist, which is a time-consuming operation. Furthermore, using fixed dimensions of the metal connection elements is often incompatible with the various dimensions of the I or U joists, which makes it necessary to provide metal connection pieces of various sizes, as a function of the dimensions of the I or U joists. Finally, fixating the upstanding plate portions of the metal connection elements to the sides of the lateral beams of the I or U joists and to the sides of the centrally placed beam element is awkward as these upstanding plate portions are not easily accessible when the metal connection elements are in place.

Summary of the invention

[0005] The invention aims to provide a construction assembly comprising a wooden I or U joist connected at a right angle to a planar surface, that does not suffer from one or more of the above-described problems. This aim is achieved by a construction assembly as described in the appended claims.

[0006] A construction assembly according to the inven-

tion comprises an I-joist or a U-joist comprising a mid section and two lateral beams, fixed at a right angle to a planar surface, wherein the right angle connection is realized by mounting two metal connection elements side by side, each connection element comprising a central first plate portion and a second plate portion at a right angle to the first, and wherein laterally placed upstanding and level strip-shaped plate portions define a profile that comprises two upward steps leading away from the central plate portion. An auxiliary piece is placed between the connection elements and the mid-section of the I or U-joist, the auxiliary piece comprising a central portion having a higher thickness and two side portions having a lower thickness, wherein the dimensions of the auxiliary piece are chosen so that the auxiliary piece fits between the beams of the I or U joist, and so that the profiles of the metal connection pieces fit into the valleys defined by the side portions of the auxiliary piece, the beams of the joist and the central portion of the auxiliary piece.

[0007] The invention is in particular related to a construction assembly comprising a planar surface and a wooden I-joist or a wooden U-joist, oriented at a right angle to the planar surface, the joist comprising a planar mid-section and a pair of lateral beams of rectangular cross section at one side or both sides of the planar mid-section and elevated relative to the mid-section, the assembly further comprising :

- a pair of metal connection elements placed side by side, each connection element comprising the following components which together form a uniform metal piece :
 - a central plate portion having two opposite and mutually parallel longer sides, and at least one shorter side perpendicular to the longer sides,
 - two lateral upstanding strip-shaped plate portions fixed to the two opposite parallel longer sides and forming right angles with the central plate portion, so that the edges of the upstanding portions are parallel to and elevated from the central plate portion,
 - two level strip-shaped plate portions fixed to the edges of the upstanding portions, forming right angles with said upstanding portions and being oriented away from the central plate portion, thereby defining a profile formed of two upward steps on either side of the central plate portion,
 - a second plate portion fixed to the shorter side of the central plate portion and at a right angle to the central plate portion,
- an auxiliary piece having a flat back side lying against the mid-section of the joist, and a width that corresponds to the distance between the lateral beams of the joist, so that the auxiliary piece closely fits between said lateral beams, and wherein the auxiliary

piece comprises at its front side a central elevated portion of constant width W1, extending in the length direction of the piece, so that the auxiliary piece has a first thickness T1 in the central portion, and a second thickness T2 in two lateral portions of the piece, on either side of the central elevated portion, the thickness T2 being lower than T1 and lower than the height of the lateral beams (2) relative to the mid-section of the joist, so that two valleys are formed between the lateral beams of the joist and the central portion of the auxiliary piece,

wherein for each of the two connection elements :

- the central plate portion is secured to the lateral portions of the auxiliary piece and to the mid-section of the joist,
- the second plate portion is secured to the planar surface,

wherein the width W1 of the central portion of the auxiliary piece and the thicknesses T1 and T2 are adapted to the dimensions of the joist and to the dimensions of the metal connection elements so that:

- the profiles of the connection elements closely fit into the valleys between the lateral beams of the joist and the central portion of the auxiliary piece,
- for each of the two connection elements, one level strip-shaped plate portion of the metal elements is in contact with the upper surface of a lateral beam of the joist and the other level strip-shaped portion is in contact with the central portion of the auxiliary piece.

[0008] According to an embodiment, the level strip-shaped strip portions of the metal connection elements are screwed onto the beams of the joist and onto the central portion of the auxiliary piece by screws passing through through-holes provided in the level strip-shaped portions.

[0009] According to an embodiment, the central plate portion and the second plate portion comprise bolt holes and wherein the central plate portion and the second plate portion are secured respectively to the mid-section of the joist and to the planar surface, by bolts passing through the holes and secured by nuts.

[0010] According to an embodiment, the upward steps of the profiles of both metal connection elements are the mirror-image of each other relative to the longitudinal center lines of the central plate portions of the connection elements.

[0011] According to an embodiment, the upward steps of the profiles of both metal connection elements are higher on the side of the central portion of the auxiliary piece than on the side of the beams of the joist. The auxiliary piece may be a wooden piece.

[0012] The assembly may further comprise a further

structure adjacent to the joist, wherein the securing of the central plate portions of the metal connection elements to the mid-section of the joist also secures the joist to the further structure.

[0013] According to an embodiment, the further structure is a further joist placed parallel to the first joist and also equipped with a pair of metal connection elements, placed back to back with the first pair of connection elements.

[0014] The invention is equally related to a kit of parts for realizing a right angle connection between an I joist or a U joist and a planar surface, the kit of parts comprising two metal connection elements and an auxiliary piece as described in any one of the above paragraphs and in the detailed description.

Brief description of the figures

[0015]

Figures 1a and 1b represent a section view of a standard I-joist and a standard U-joist as available commercially.

Figure 2 shows a right angle connection between a U-joist and a planar surface, in accordance with the invention.

Figure 3 is a side view of a U-joist with the auxiliary piece in place, indicating the relevant dimension of the piece.

Figures 4a and 4b represent a side and front view of a cross-wise assembly of two U-beams and two planar beams, in accordance with the invention.

Figure 5 illustrates an assembly of wall compartments assembled together in accordance with the invention.

Figure 6 shows an alternative embodiment of the right-angle connection, using metal connection pieces which are not symmetrical.

Detailed description of preferred embodiments of the invention

[0016] Figures 1a and 1b illustrate the cross-section of a wooden I-joist and U-joist respectively. Commercially available I-joists of this type are often referred to as TGI joists or TJI® joists, the latter being a brand name from US-based company Weyerhaeuser. These joists comprise a planar rectangular board 1, often of the OSB type (Oriented Strand Board), with lateral beams 2 extending along the edges of the board. The lateral beams 2 are often made of LVL (Laminated Veneer Lumber). The beams 2 have a rectangular cross-section and are elevated with respect to one of the planar surfaces of the board 1 in the case of the U-joist (Figure 1b), and with respect to both of the planar surfaces in the case of the I-joist (Figure 1a). The portion of the board that extends between the lateral beams 2 is defined as the mid-section 3 of the I or U joist.

[0017] These joists are extensively used in wooden constructions. A row of equally spaced TGI joists may be used for example as a basis for a floor of a building. Wall compartments formed of a row of parallel I or U joists mounted between two parallel planks are assembled together to form a wall. This type of assembly requires right angle connections between the outer joists of the compartments. The joists are available in a number of standard sizes in terms of the length of the joists and in terms of the dimensions indicated in the drawings : the width W of the board's mid-section 3, and the height H of the lateral beams 2 relative to the surface or surfaces of the mid-section 3.

[0018] Figure 2 illustrates a right angle connection between a U-joist 5 and a planar surface 6 in a construction assembly according to a preferred embodiment of the invention. The surface 6 could be the surface of a concrete floor or of a beam or plank formed of wood or any other suitable construction material.

[0019] The board 1 and the lateral beams 2 of the U-joist 5 are visible in the drawing. The right angle connection comprises two metal connection elements 10 and a centrally placed auxiliary piece 20. The auxiliary piece is preferably made of wood, for example LVL. The two metal elements 10 are identical to one another and both of these elements comprise a first rectangular central plate portion 11 having two long sides and two short sides. Two upstanding strip-shaped plate portions 12 are fixed to the long sides and form a right angle with the central plate portion 11. Two level strip-shaped plate portions 13 are fixed to the upper edges of the upstanding plate portions 12 and form right angles with the upstanding plate portions 12, while being oriented away from the central plate portion 11. Therefore, as seen in a cross-section in a plane perpendicular to the longitudinal direction of the central plate portion 11, the profile of the connection elements 10 is defined by symmetric upward steps formed by plate portions 12 and 13 on either side of the central plate portion 11.

[0020] A second plate portion 14 is fixed to one of the short sides of the central plate portion 11 and oriented at a right angle relative thereto. The second plate portion 14 has a rectangular part and a triangular part pointing away from the first plate portion 11.

[0021] The width W' of the auxiliary piece 20 is equal to or slightly smaller than the width W of the mid section 3 between the lateral beams 2 of the U-joist 5, so that the auxiliary piece 20 closely fits between these beams 2, as illustrated in Figure 3. The fit is preferably such that the auxiliary piece can be easily placed manually between the beams 2 until the flat back surface of the piece 20 is in contact with the mid-section 3 of the joist 5. Preferably the auxiliary piece 20 is glued to the mid section 3 and the sides of the beams 2.

[0022] With reference to both Figures 2 and 3, the auxiliary piece 20 comprises a central portion 21 extending in the length direction of the piece 20, and having a constant width W1 and constant thickness T1, and two side

portions 22 having equal width W2, with $W2 = (W' - W1)/2$, and having a thickness T2 lower than T1. The thicknesses T1 and T2 and the width W1 of the central portion 21 are chosen so that the above-described profile of the metal connection elements 10 closely fits into the valleys on either side of the central portion 21 of the auxiliary piece 20. To be more precise : the metal connection elements 10 can be manually fitted into the valleys, so that:

- the central plate portions 11 of the metal elements 10 are in contact with the side portions 22 of the auxiliary piece 20,
- the upstanding strip-shaped portions 12 are in contact with the sides of the beams 2 of the U-joist 5 and with the sides of the central portion 21 of the auxiliary piece 20,
- the level strip-shaped portions 13 are in contact with the upper surfaces of the beams 2 of the U-joist 5 and of the central portion 21 of the auxiliary piece 20.

[0023] As seen in Figure 2, the metal connection elements 10 are fitted into the above-described valleys, with the right angle between the central plate portion 11 and the second plate portion 14 fitted into the right angles between the side portions 22 of the auxiliary piece 20 and the planar surface 6.

[0024] The preceding description with reference to Figures 2 and 3 is valid without changes for an assembly comprising an I-joist connected to the planar surface 6.

[0025] In the embodiment shown in Figure 2, the length of the auxiliary piece 20 is about the same as the length of the metal connection elements 10, but the auxiliary piece 20 could be longer than the connection elements 10. Alternatively, several auxiliary pieces of the same width could be placed next to each other, which together cover about the same length as the length of the metal connection elements 10.

[0026] Small holes 25 may be present for screwing the metal connection elements 10 to the underlying surfaces of the lateral beams 2, the auxiliary piece 20, and the surface 6. This fixation does not establish the actual connection between the joist 5 and the surface 6. This latter connection is realized by securing the metal connection elements 10 to the U-joist 5 and to the surface 6 by bolt and nut connections through the larger holes 26 and 27. The smaller holes 25 are therefore only present for realizing a preliminary fixation that keeps the metal connection elements 10 in place when the securing bolt and nut connections are made.

[0027] The larger holes 26 in the central plate portion 11 allow the passage of two bolts. In most practical embodiments, these bolts secure the U-joist 5 to a structure placed adjacent to it. According to an embodiment, this may be an I joist or a second U-joist placed back to back with the first U-joist, and equally provided with two metal connection elements 10 and an auxiliary piece 20, placed back to back with these same components on the first U-joist. The two bolts pass through the corresponding

holes 26, for securing the joists together. The larger holes 27 in the second plate portion 14 allow the passage of bolt connections to the underlying surface 6. When this surface is the surface of a flat wooden plank, these bolt connections may pass through an additional set of connection elements 10 mounted on the opposite side of the plank, between a further I joist or U-joist oriented at a right angle to the plank but on the opposite side to the first joist 5. In this way, a total of 8 connection elements allows to realize a right angle connection between two planks 6a and 6b and four U-joists 5a,5a' and 5b,5b', assembled in a cross-shape as illustrated in a side and front view in Figures 4a and 4b. Bolts 28 pass through the holes 26 and 27 and are secured by nuts 29. This may be used for the construction of walls in wooden buildings as illustrated in Figure 5, by assembling multiple wall compartments. Figure 5 shows 4 compartments, each comprising a set of parallel U-joists or I-joists 5 attached to two parallel planks 6. In the center of the assembly, the four compartments are held together by four right angle connections 30 of the type described above. Further right angle connections 30 are present at the edges of the assembly, which may be connected thereby to a fixed structure or to further compartments.

[0028] The auxiliary piece 20 is dimensioned as a function of the dimensions of the U-joist 5, and as a function of the dimensions of the metal connection elements 10. By providing auxiliary pieces 20 adapted to different standardized U-joists, one single size for the connection element 10 can be used in combination with various sizes of the U-joist. This is an easier solution than providing different sizes of the metal connection element 10 for the different standard sizes of the U-joist. Moreover, the mounting of the auxiliary piece 20 is easier than mounting a separate beam element in the middle of the U-joist, because the width W' of the auxiliary piece 20 is dimensioned to closely fit between the beams 2 of the U-joist 5. The level strip-shaped portions 13 of the metal elements 10 and the fact that these are lying against the upper surfaces of the beams 2 of the U-joist 5 and against the central portion 20 of the auxiliary piece 20 increase the contact surface between the metal connection elements and the U-joist, leading to a stronger connection. When the holes 25 are present in these level strip-shaped portions 13, these holes allow an easier fixation of the connection elements 10 to the beams 2 of the U-joist and to the central portion 21 of the auxiliary piece 20, as the holes 25 in the level strip-shaped portions 13 are more easily accessible than any holes in the upstanding strip-shaped portions 12.

[0029] Figure 6 illustrates an embodiment wherein the profiles of the metal connection elements are not symmetrical, but wherein one upward step is higher than the other. In particular, the upward steps towards the central portion 21 of the auxiliary piece 20 are higher, enabling the use of an auxiliary piece with a thicker central portion 21. This embodiment increases the compression resistance of the assembly in the vertical direction Z indicated

in Figure 6.

[0030] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, 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. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A construction assembly comprising a planar surface (6) and a wooden I-joist or a wooden U-joist (5), oriented at a right angle to the planar surface, the joist (5) comprising a planar mid-section (3) and a pair of lateral beams (2) of rectangular cross section at one side or both sides of the planar mid-section (3) and elevated relative to the mid-section (3), the assembly further comprising :

- a pair of metal connection elements (10) placed side by side, each connection element comprising the following components which together form a uniform metal piece :

- a central plate portion (11) having two opposite and mutually parallel longer sides, and at least one shorter side perpendicular to the longer sides,
- two lateral upstanding strip-shaped plate portions (12) fixed to the two opposite parallel longer sides and forming right angles with the central plate portion (11), so that the edges of the upstanding portions (12) are parallel to and elevated from the central plate portion (11),
- two level strip-shaped plate portions (13) fixed to the edges of the upstanding portions (12), forming right angles with said upstanding portions (12) and being oriented away from the central plate portion (11), thereby defining a profile formed of two upward steps on either side of the central plate portion (11),
- a second plate portion (14) fixed to the shorter side of the central plate portion (11) and at a right angle to the central plate portion (11),

- an auxiliary piece (20) having a flat back side lying against the mid-section (3) of the joist (5), and a width that corresponds to the distance between the lateral beams (2) of the joist (5), so that the auxiliary piece (20) closely fits between said lateral beams (2), and wherein the auxiliary piece (20) comprises at its front side a central elevated portion (21) of constant width W1, extending in the length direction of the piece (20), so that the auxiliary piece has a first thickness T1 in the central portion (21), and a second thickness T2 in two lateral portions (22) of the piece (20), on either side of the central elevated portion (21), the thickness T2 being lower than T1 and lower than the height of the lateral beams (2) relative to the mid-section (3) of the joist, so that two valleys are formed between the lateral beams (2) of the joist and the central portion (21) of the auxiliary piece (20),

wherein for each of the two connection elements (10) :

- the central plate portion (11) is secured to the lateral portions (22) of the auxiliary piece (20) and to the mid-section (3) of the joist (5),
- the second plate portion (14) is secured to the planar surface (6),

wherein the width W1 of the central portion (21) of the auxiliary piece (20) and the thicknesses T1 and T2 are adapted to the dimensions of the joist (5) and to the dimensions of the metal connection elements (10) so that:

- the profiles of the connection elements (10) closely fit into the valleys between the lateral beams (2) of the joist (5) and the central portion (21) of the auxiliary piece,
- for each of the two connection elements, one level strip-shaped plate portion (13) of the metal elements (10) is in contact with the upper surface of a lateral beam (2) of the joist (5) and the other level strip-shaped portion (13) is in contact with the central portion (21) of the auxiliary piece (20).

2. The assembly according to claim 1, wherein the level strip-shaped strip portions (13) of the metal connection elements (10) are screwed onto the beams (2) of the joist (5) and onto the central portion (21) of the auxiliary piece (20) by screws passing through through-holes (25) provided in the level strip-shaped portions (13).
3. The assembly according to claim 1 or 2, wherein the central plate portion (11) and the second plate portion (14) comprise bolt holes (26,27) and wherein

the central plate portion (11) and the second plate portion (14) are secured respectively to the mid-section (3) of the joist (5) and to the planar surface (6), by bolts (28) passing through the holes (26,27) and secured by nuts (29).

4. The assembly according to any one of the preceding claims, wherein the upward steps of the profiles of both metal connection elements (10) are the mirror-image of each other relative to the longitudinal center lines of the central plate portions (11) of the connection elements (10).
5. The assembly according to any one of claims 1 to 3, wherein the upward steps of the profiles of both metal connection elements (10) are higher on the side of the central portion (21) of the auxiliary piece (20) than on the side of the beams (2) of the joist (5).
6. The assembly according to any one of the preceding claims, wherein the auxiliary piece (20) is a wooden piece.
7. The assembly according to any one of the preceding claims, comprising a further structure adjacent to the joist, and wherein the securing of the central plate portions of the metal connection elements to the mid-section of the joist also secures the joist to the further structure.
8. The assembly according to claim 7, wherein the further structure is a further joist placed parallel to the first joist and also equipped with a pair of metal connection elements (10), placed back to back with the first pair of connection elements.
9. A kit of parts for realizing a right angle connection between an I joist or a U joist and a planar surface, the kit of parts comprising two metal connection elements and an auxiliary piece as described in any one of the preceding claims.

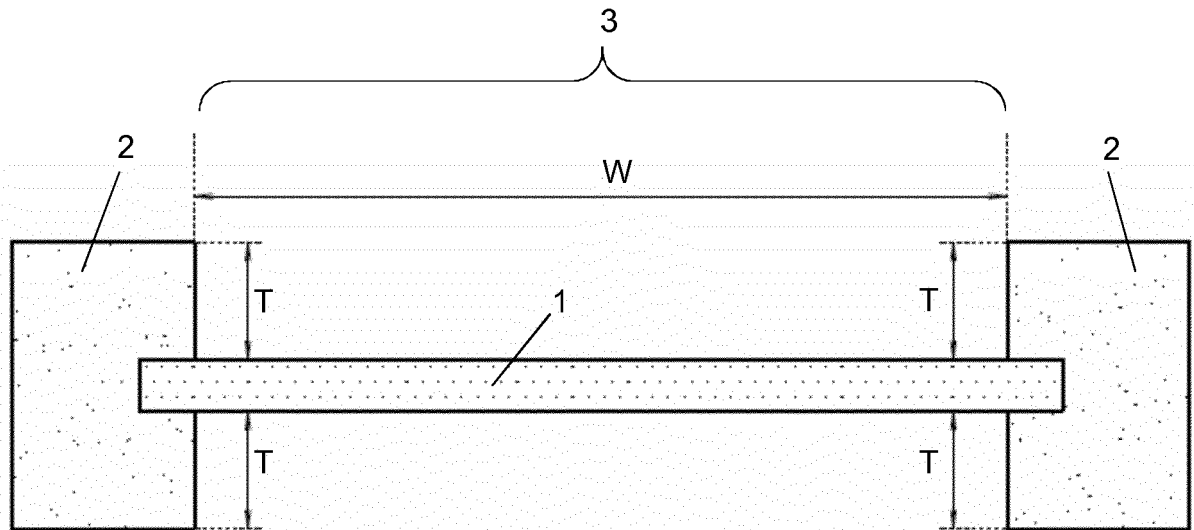


FIG. 1a

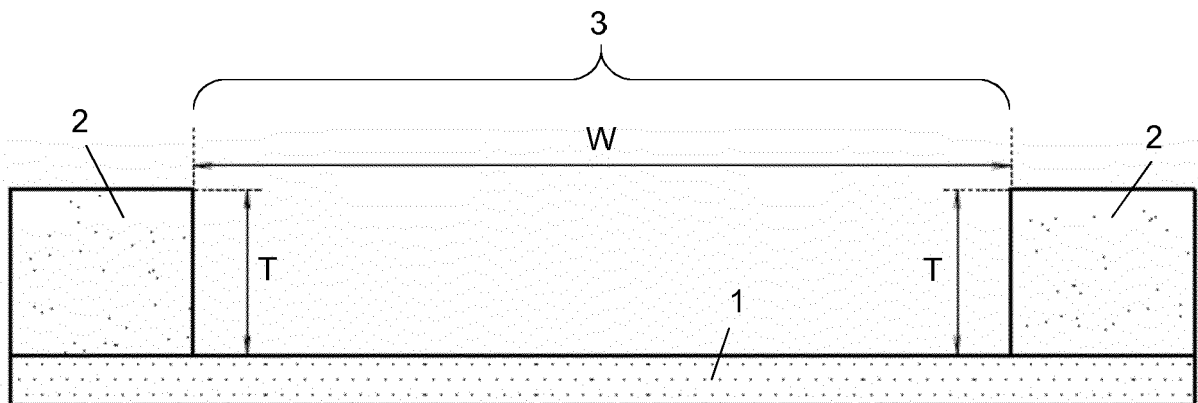


FIG. 1b

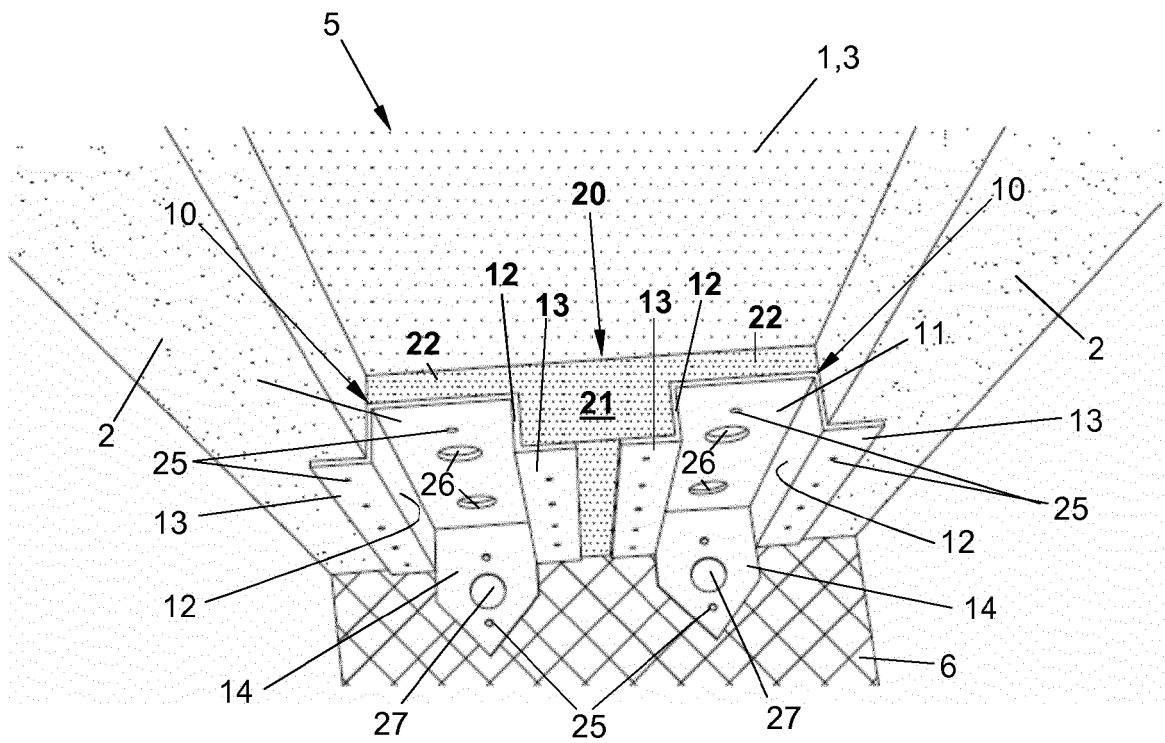


FIG. 2

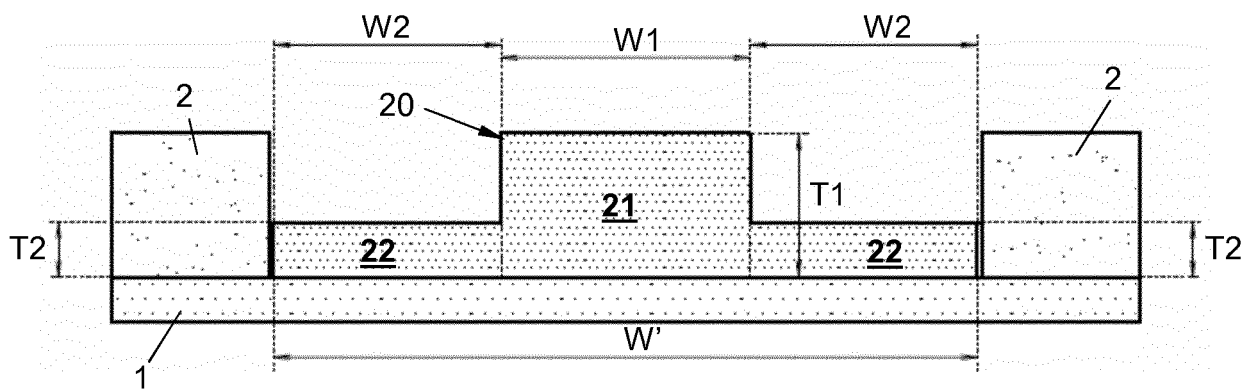


FIG. 3

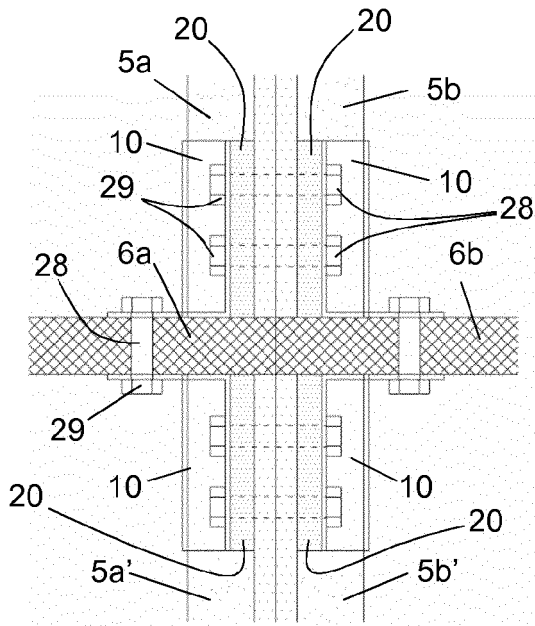


FIG. 4a

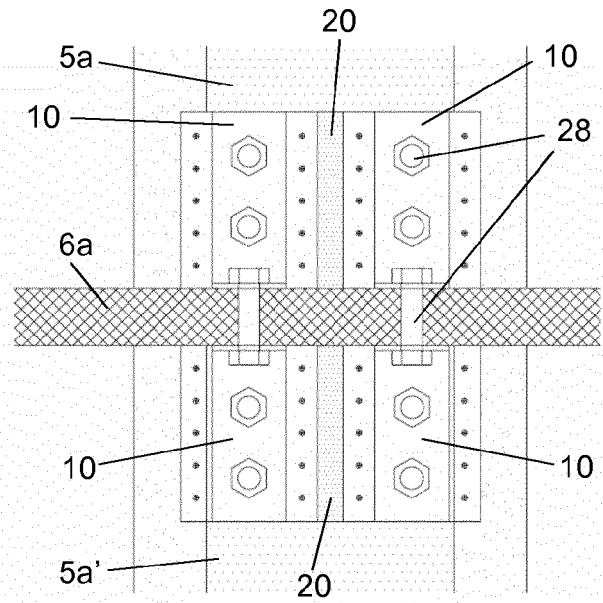


FIG. 4b

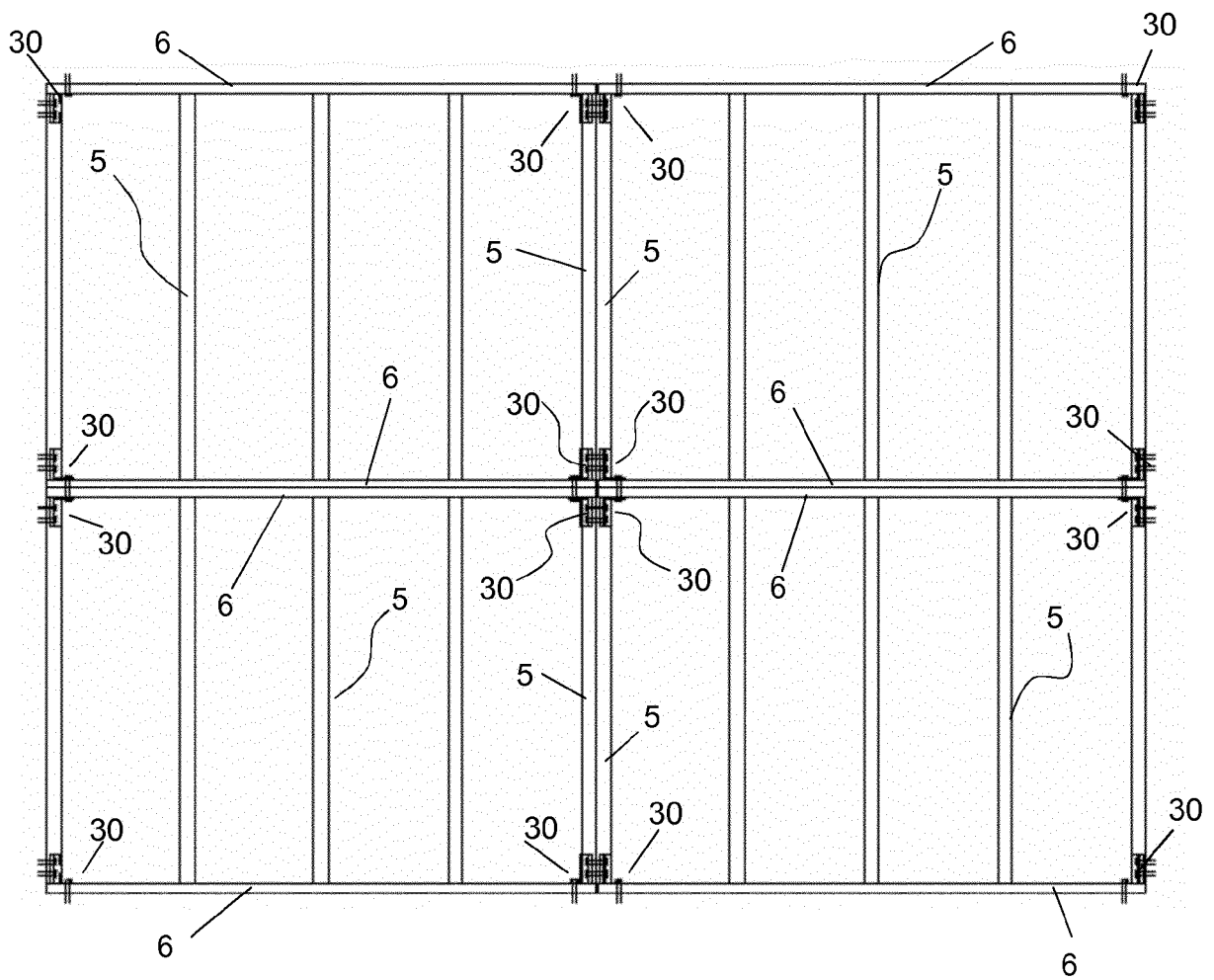


FIG. 5

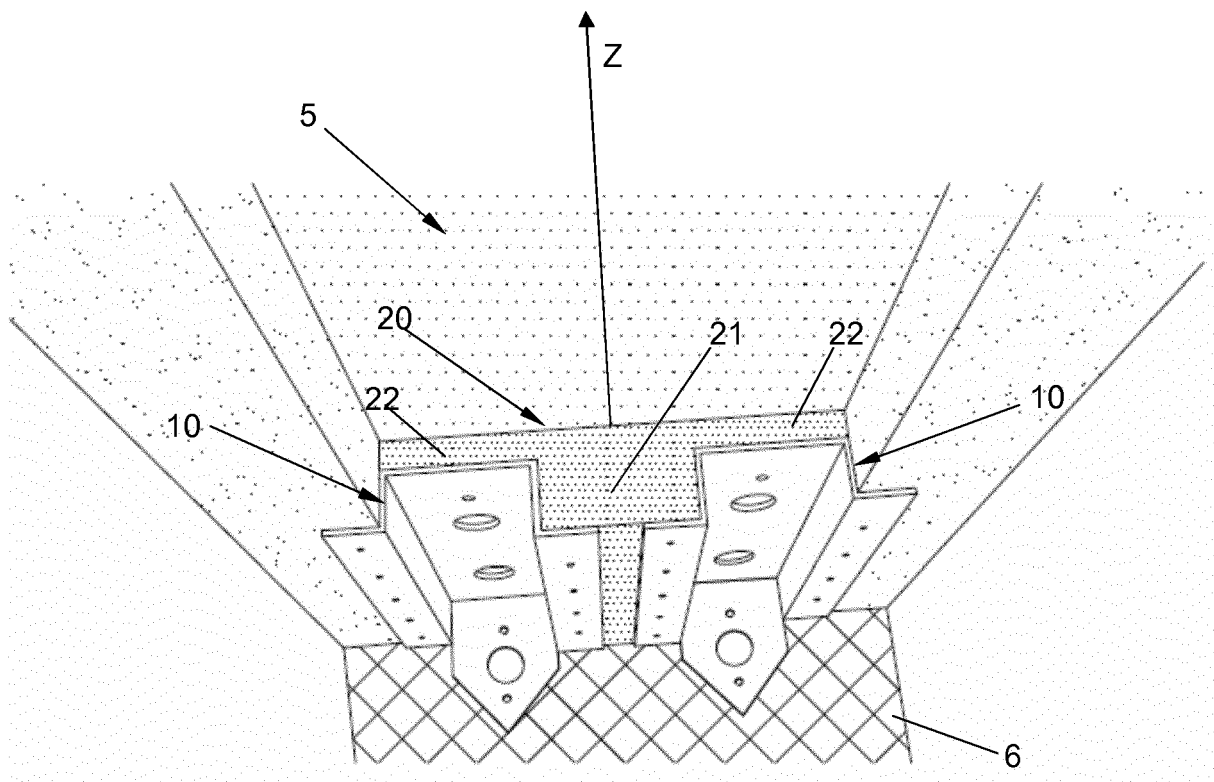


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 19 18 1451

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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A	US 4 893 961 A (O'SULLIVAN KEVIN B [US] ET AL) 16 January 1990 (1990-01-16) * abstract; figure 4 *	1	
A	US 4 423 977 A (GILB TYRELL T [US]) 3 January 1984 (1984-01-03) * abstract; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 November 2019	Examiner Galanti, Flavio
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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 18 1451

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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22-11-2019

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REFERENCES CITED IN THE DESCRIPTION

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