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(54) **CONNECTOR FOR STEEL STRUCTURES**

(57) A steel structural connector, comprising a vertically-oriented connecting body for connecting to columns and a horizontally-oriented connecting body for connecting to beams, where one end of the horizontally-oriented connecting body is connected to the vertically-oriented connecting body. The vertically-oriented connecting body further includes sequentially arranged front sidewall, left sidewall, rear sidewall, and right sidewall. On at least one end of the vertically-oriented connecting body, there are several installation through-holes for connecting to columns. The vertically-oriented connecting body has installation through-holes on one end of each sidewall with an inwardly extending concave portion along the length direction of the vertically-oriented connecting body. The installation through-holes are placed within the concave portion. The present invention enhances the stability and structural strength of connections when used at locations with installation through-holes for external vertical components, while simultaneously connecting both horizontal and vertical components.

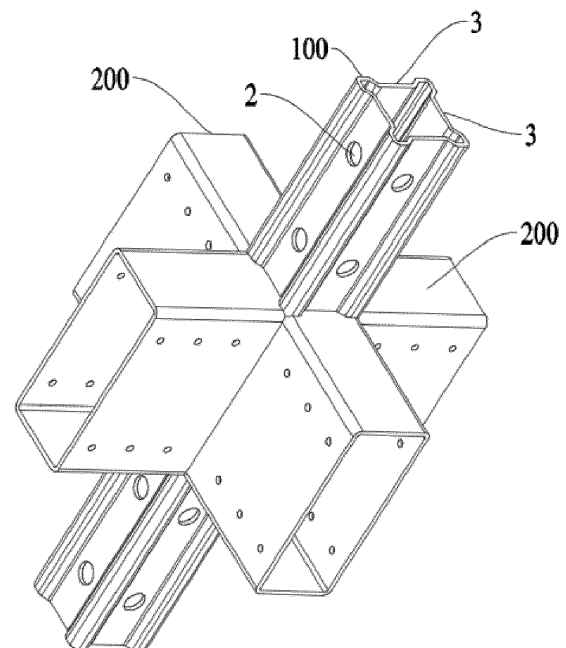


FIG. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of architectural materials technology, particularly to a connector for steel structures.

BACKGROUND OF THE INVENTION

[0002] With the maturation of technology, prefabricated construction has begun to emerge and has garnered widespread attention in the construction industry. Prefabricated construction refers to the assembly of buildings on-site using pre-made components. The advantages of such construction are rapid construction, reduced susceptibility to weather conditions, labor efficiency, and enhanced building quality.

[0003] The inventors in a previously filed Chinese patent application, with publication number CN114250860A, disclosed an invention related to a connection unit for prefabricated construction. This unit comprises a first tubular body, a second tubular body, and a connector for connecting the first and second tubular bodies. The connector has multiple installation through-holes at both ends, and the first and second tubular bodies have corresponding connecting through-holes. The ends of the connector are embedded into the first and second tubular bodies, ensuring a one-to-one correspondence between the installation through-holes and the connecting through-holes. A bolt assembly successively passes through the connecting through-holes on the first and second tubular bodies and the installation through-holes on the connector, thereby connecting the connector to the first and second tubular bodies.

[0004] However, the aforementioned patent has the following shortcomings: Firstly, it can only achieve vertical connections between components. Secondly, the structural stability at the connection point is suboptimal.

SUMMARY OF THE INVENTION

[0005] The object of the present invention is to provide a connector for steel structures that achieves simultaneous connections of both horizontal and vertical components. Furthermore, it enhances the stability and structural strength of the connection when connecting with external vertical components at locations equipped with installation through-holes.

[0006] To achieve the aforementioned object, the technical solution employed in the present invention is as follows: a connector for steel structures includes a vertically-oriented connecting body for connection to columns and a horizontally-oriented connecting body for connection to beams. One end of the horizontally-oriented connecting body is connected to the vertically-oriented connecting body. The vertically-oriented connecting body includes a front sidewall, a left sidewall, a rear sidewall,

and a right sidewall arranged sequentially. A plurality of installation through-holes for connecting with columns are provided on at least one end of the sidewalls of the vertically-oriented connecting body. An inward concave portion extending in a length direction of the vertically-oriented connecting body is located on the sidewalls of the vertically-oriented connecting body. The installation through-holes are located on the inward concave portion.

[0007] Further improved aspects of the aforementioned technical solution are as follows:

1. In some embodiments, the inward concave portion is distributed along the length of the vertically-oriented connecting body and is situated at the center of each sidewall.

2. In some embodiments, the horizontally-oriented connecting body can be set at 1 to 4, with each horizontally-oriented connecting body being welded to a sidewall of the vertically-oriented connecting body.

3. In some embodiments, the horizontally-oriented connecting body can be one of a steel pipe connector, an I-beam connector, or a C-beam connector.

4. In some embodiments, the installation through-holes are situated at one end of the vertically-oriented connecting body, and at least two sidewalls on the other end of the vertically-oriented connecting body are each connected to a horizontally-oriented connecting body.

5. In some embodiments, at least two horizontal connecting bodies are connected to the two sidewalls in the middle area of the vertically-oriented connecting body, and installation through-holes are provided at both ends of the vertically-oriented connecting body.

6. In some embodiments, the front, left, rear, and right sidewalls are connected sequentially.

7. In some embodiments, the sidewalls of the same width in the front, left, rear, and right are interconnected with right-angled wall plates bent inwardly.

8. In some embodiments, the widths of the front, rear, and right sidewalls are the same and are smaller than the width of the left sidewall. The right sidewall opposite the left sidewall is interconnected with the front and rear sidewalls by right-angled wall plates bent inwardly.

9. In some embodiments, the widths of the front and right sidewalls, which are the same, are smaller than the widths of the left and rear sidewalls. The front sidewall connected to the left sidewall and the right sidewall connected to the rear sidewall are interconnected by right-angled wall plates bent inwardly.

[0008] Due to the application of the aforementioned technical solution, the present invention offers the following advantages when compared to existing technology:

[0009] The connector for steel structures in the present invention includes a vertically-oriented connecting body for attachment to columns and a horizontally-oriented connecting body for attachment to beams. The vertically-

oriented connecting body includes sequentially arranged front, left, rear, and right sidewalls. Multiple installation through-holes for connecting with columns are provided on sidewalls of at least one end of the vertically-oriented connecting body. An inward concave portion extending along the length direction of the vertically-oriented connecting body is situated on the sidewalls at one end of the vertically-oriented connecting body. The installation through-holes are positioned within the inward concave portion. This design achieves simultaneous connections of both horizontal and vertical components, enhances the structural strength of the vertically-oriented connecting body itself, prevents position misalignment between interconnected components when connecting to external vertical components at locations equipped with installation through-holes, thereby improving connection stability and structural strength. Additionally, when connecting to external vertical components, the inward concave portion provides an embedding area for the bolt head, ensuring the planarity and smoothness of the connection structure's external facade and facilitating subsequent decorative construction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 shows a schematic diagram of the connector for steel structures according to one embodiment in the present invention.

FIG. 2 shows a top view of the connector depicted in FIG. 1.

FIG. 3 shows a partially-enlarged view of the connector from FIG. 2.

FIG. 4 shows a schematic diagram of the connector for steel structures according to another embodiment in the present invention.

FIG. 5 shows a top view of the connector depicted in FIG. 4.

FIG. 6 shows a partially-enlarged view of the connector from FIG. 5.

FIG. 7 shows a schematic diagram of the connector for steel structures according to yet embodiment in the present invention.

FIG. 8 shows a top view of the connector in FIG. 7.

FIG. 9 shows a partially-enlarged view of the connector from FIG. 8.

FIG. 10 shows a cross-sectional view of the connector for steel structures in use.

[0011] In the drawings: 100, vertically-oriented connecting body; 200, horizontally-oriented connecting body; 11, front sidewall; 12, left sidewall; 13, rear sidewall; 14, the right sidewall; 2, installation through-hole; 3, inward concave portion; 4, right-angled wall plate.

DETAILED DESCRIPTION OF THE INVENTION

EMBODIMENT ONE

[0012] As shown in FIGS. 1-3, the present invention provides a connector for steel structures. The connector for steel structures includes a vertically-oriented connecting body 100 for attachment to columns and a horizontally-oriented connecting body 200 for attachment to beams. One end of the horizontally-oriented connecting body 200 is connected to the vertically-oriented connecting body 100, as illustrated in FIG. 1, where the horizontally-oriented connecting body 200 is horizontally linked to the vertically-oriented connecting body 100, typically through welding or other suitable means.

[0013] The connector for steel structures is intended for use in architectural scenarios featuring columns and beams. The vertically-oriented connecting body 100 serves for column connections, while the horizontally-oriented connecting body 200 is used for beam connections. As shown in FIG. 1, the horizontally-oriented connecting body 200 connects vertically to the vertically-oriented connecting body 100.

[0014] Furthermore, the vertically-oriented connecting body 100 comprises sequentially arranged front sidewall 11, left sidewall 12, rear sidewall 13, and right sidewall 14. It should be noted that the front sidewall 11 is opposite the rear sidewall 13, while the left sidewall 12 is opposite the right sidewall 14. The orientation of front, rear, left, and right is based on the perspective of FIG. 1.

[0015] The front sidewall 11, left sidewall 12, rear sidewall 13, and right sidewall 14 are connected sequentially, forming an enclosed vertically-oriented connecting body 100 with an inner cavity. In use, columns can pass through this inner cavity and connect with the vertically-oriented connecting body 100. Moreover, several installation through-holes 2 for column connections are provided on various sidewalls of the vertically-oriented connecting body 100 at least one end.

[0016] As columns pass through the inner cavity, users can secure them by passing fasteners through the installation through-holes 2, ensuring a strong connection between the columns and the vertical connector. The vertically-oriented connecting body 100 also features inward concave portions 3 extending in the length direction of the vertically-oriented connecting body 100 on the sidewalls where the installation through-holes 2 are located. The installation through-holes 2 are positioned within these inward concave portions 3.

[0017] These inward concave portions 3 extend along the entire length of the vertically-oriented connecting body 100 and are centrally located on each sidewall. The installation through-holes 2 are positioned at one end of the vertically-oriented connecting body 100, and at least two sidewalls on the other end of the vertically-oriented connecting body 100 are each connected to one of the horizontal connecting bodies 200. In alternative embodiments, installation through-holes 2 are provided at both

ends of the vertically-oriented connecting body 100.

[0018] Furthermore, as shown in FIGS. 1 and 2, the horizontal connecting bodies 200 are set at four. Each of these horizontal connecting bodies 200 is welded to the front sidewall 11, left sidewall 12, rear sidewall 13, or right sidewall 14 in the middle region of the vertically-oriented connecting body 100.

[0019] The lengths of the front sidewall 11, left sidewall 12, rear sidewall 13, and right sidewall 14 can be equal, as seen in FIGS. 1-3. In other embodiments, the lengths of these sidewalls may also be equal.

[0020] As an example, in further embodiments as shown in FIGS. 4-6, the lengths of the front sidewall 11, left sidewall 12, rear sidewall 13, and right sidewall 14 are unequal. Specifically, the left sidewall 12 and right sidewall 14 have equal lengths, while the front sidewall 11 and rear sidewall 14 have unequal lengths. Referring to FIG. 4, the length of the front sidewall 11 is shorter than the rear sidewall 13. In this case, the front sidewall 11 is connected to the left sidewall 12 by a right-angled wall plate 4 bent inwardly, and the front sidewall 11 is also connected to the right sidewall 14 through another right-angled wall plate 4 bent inwardly. As shown in FIGS. 4-5, there are three horizontal connecting bodies 200. Each of these horizontal connecting bodies 200 is welded to the front sidewall 11, rear sidewall 13, or right sidewall 14 in the middle region of the vertically-oriented connecting body 100.

[0021] As illustrated in FIG. 10, when connecting the vertically-oriented connecting body 100 to external vertical components, fasteners such as bolts or expansion screws are used to pass through the installation through-holes. The inward concave portions provide a recessed area for the bolt heads, ensuring that they do not protrude, which enhances aesthetics. This feature also facilitates subsequent decorative finishing.

[0022] In another embodiment, the lengths of the front sidewall 11, left sidewall 12, rear sidewall 13, and right sidewall 14 are equal, as shown in FIGS. 7-9.

[0023] The sidewalls with equal lengths, namely, the front sidewall 11, left sidewall 12, rear sidewall 13, and right sidewall 14, are interconnected through right-angled wall plates 4 bent inwardly. As depicted in FIG. 9, the front sidewall 11 is connected to the left sidewall 12 through a right-angled wall plate 4 bent inwardly. It is also connected to the right sidewall 14 through another right-angled wall plate 4 bent inwardly. The rear sidewall 13 is connected to the left sidewall 12 through a right-angled wall plate 4 bent inwardly and also to the right sidewall 14 through another right-angled wall plate 4 bent inwardly. In this embodiment, the horizontal connecting bodies 200 can be set at four, with each of them being welded to the front sidewall 11, left sidewall 12, rear sidewall 13, or right sidewall 14 in the middle region of the vertically-oriented connecting body 100.

[0024] The horizontal connecting bodies 200 can be steel pipe connectors or I-beam connectors.

[0025] When using the connector for steel structures

described above, the vertically-oriented connecting body further includes sequentially arranged front sidewall, left sidewall, rear sidewall, and right sidewall, with several installation through-holes for column connections provided on at least one end of the vertically-oriented connecting body on various sidewalls. The vertically-oriented connecting body also has installation through-holes located at one end of the sidewalls with an inward concave portion extending along the length direction of the vertically-oriented connecting body, with the installation through-holes situated within the inward concave portion. This design allows simultaneous connections of both horizontal and vertical components, enhancing the structural strength of the vertically-oriented connecting body itself. It also prevents position misalignment between interconnected components at locations equipped with installation through-holes when connecting to external vertical components, thus improving connection stability and structural strength. Moreover, when connecting to external vertical components, the inward concave portion provides an embedding area for the bolt heads, ensuring the planarity and smoothness of the connection structure's external facade and facilitating subsequent decorative construction.

[0026] The above embodiments are provided for illustrating the technical concept and characteristics of the present invention. Their purpose is to enable those skilled in the art to understand the content of the present invention and implement it. They do not, however, limit the scope of protection of the present invention. Equivalent changes or modifications made in accordance with the essence of the present invention are encompassed within the scope of protection of the present invention.

Claims

1. A connector for steel structures, comprising a vertically-oriented connecting body (100) for connecting to columns and a horizontally-oriented connecting body (200) for connecting to beams, wherein one end of the horizontally-oriented connecting body (200) is connected to the vertically-oriented connecting body (100);

the vertically-oriented connecting body (100) comprises a front sidewall (11), a left sidewall (12), a rear sidewall (13), and a right sidewall (14) which are sequentially arranged;

characterized in that

a plurality of installation through-holes (2) for column connections are provided on each sidewall of the vertically-oriented connecting body (100) at least one end;

the vertically-oriented connecting body (100) has an inward concave portion (3) extending along the length direction of the vertically-oriented connecting body (100) on each sidewall

where the installation through-holes (2) are located.

2. The connector for steel structures according to claim 1, **characterized in that** the inward concave portion (3) is distributed along the length direction of the vertically-oriented connecting body (100) and is located at the center of each sidewall. 5
3. The connector for steel structures according to claim 1, **characterized in that** the horizontally-oriented connecting body (200) is provided in a range of 1 to 4, with each horizontally-oriented connecting body (200) being welded to one sidewall of the vertically-oriented connecting body (100). 10 15
4. The connector for steel structures according to claim 1, **characterized in that** the horizontally-oriented connecting body (200) is selected from the group consisting of steel pipe connectors, I-beam connectors, or C-section steel connectors. 20
5. The connector for steel structures according to claim 1, **characterized in that** the installation through-holes (2) are located at one end of the vertically-oriented connecting body (100), and at least two sidewalls of the other end of the vertically-oriented connecting body (100) are each connected to one of the horizontal connecting bodies (200). 25 30
6. The connector for steel structures according to claim 1, **characterized in that** at least two of the horizontal connecting bodies (200) are each connected to two sidewalls in the middle region of the vertically-oriented connecting body (100), and the vertically-oriented connecting body (100) has installation through-holes (2) at both ends. 35
7. The connector for steel structures according to claim 1, **characterized in that** the front sidewall (11), left sidewall (12), rear sidewall (13), and right sidewall (14) are sequentially connected. 40
8. The connector for steel structures according to claim 1, **characterized in that** sidewalls of the same width for the front sidewall (11), left sidewall (12), rear sidewall (13), and right sidewall (14) are interconnected by right-angled wall plates (4) that are inwardly bent. 45
9. The connector for steel structures according to claim 1, **characterized in that** the front sidewall (11), rear sidewall (13), and right sidewall (14) have the same width and are all smaller than the width of the left sidewall (12), and the right sidewall (14) positioned opposite the left sidewall (12) is interconnected to the front sidewall (11) and rear sidewall (13) through right-angled wall plates (4) that are inwardly bent. 50 55
10. The connector for steel structures according to claim 1, **characterized in that** the width of the front sidewall (11) and the right sidewall (14), both of which have the same width, is smaller than the width of the left sidewall (12) and the rear sidewall (13), and the front sidewall (11) connected to the left sidewall (12) and the right sidewall (14) connected to the rear sidewall (13) are interconnected through right-angled wall plates (4) that are inwardly bent.

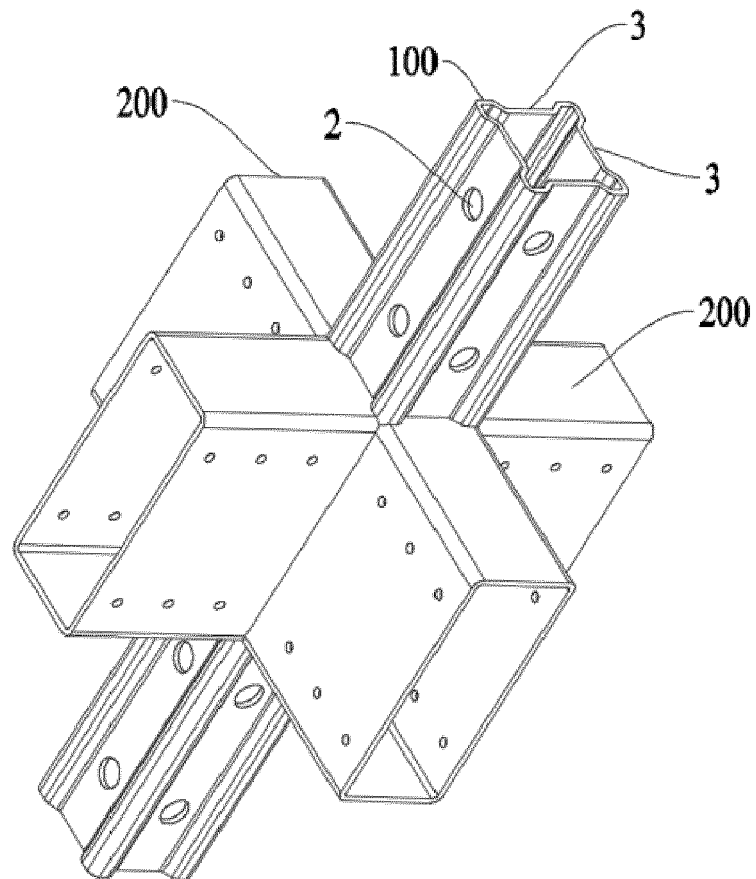


FIG. 1

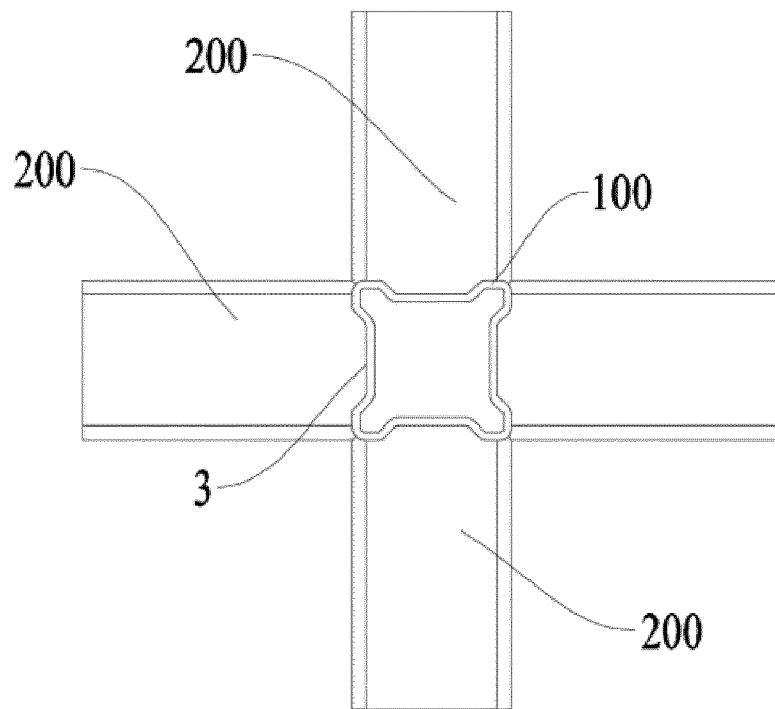


FIG. 2

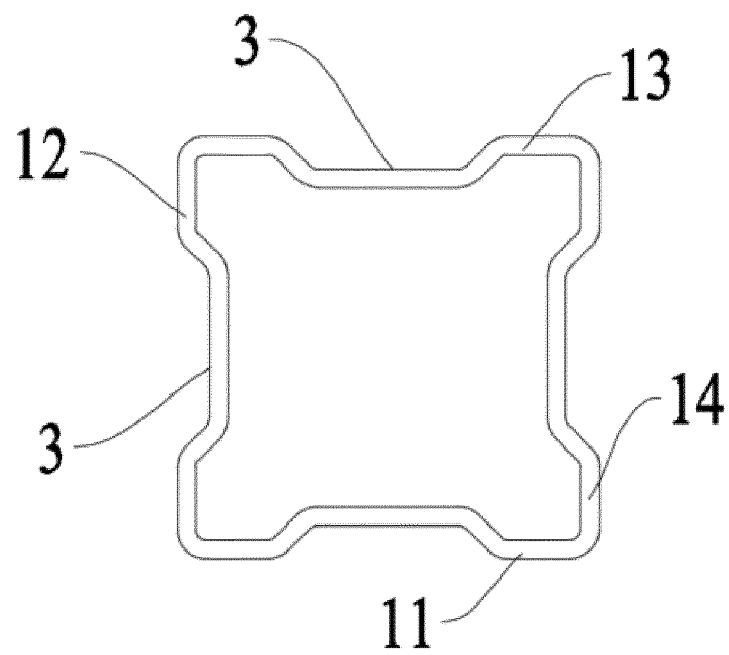


FIG. 3

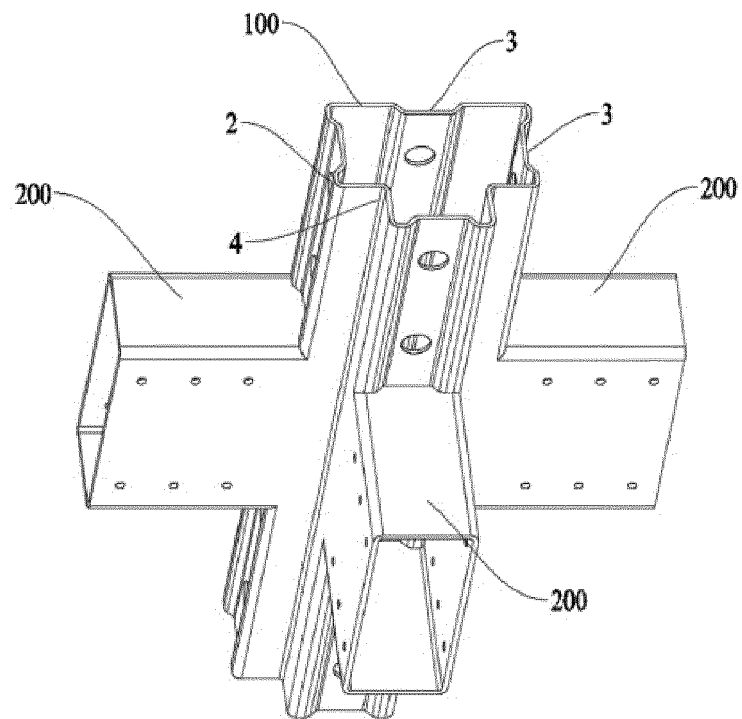


FIG. 4

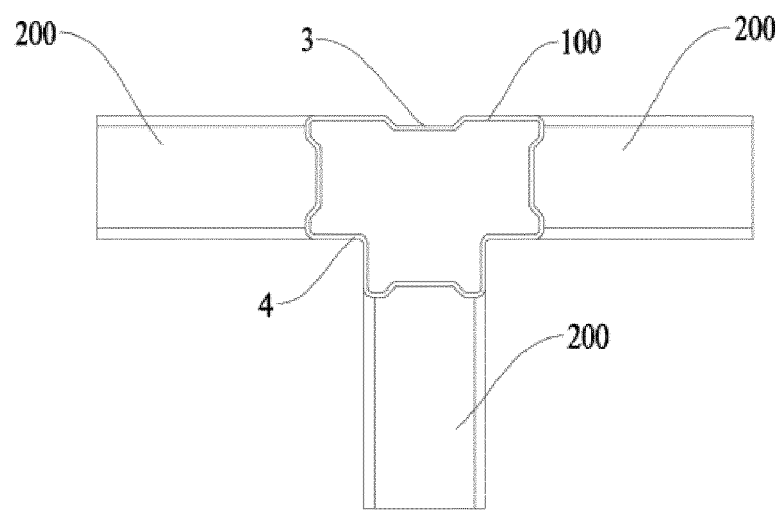


FIG. 5

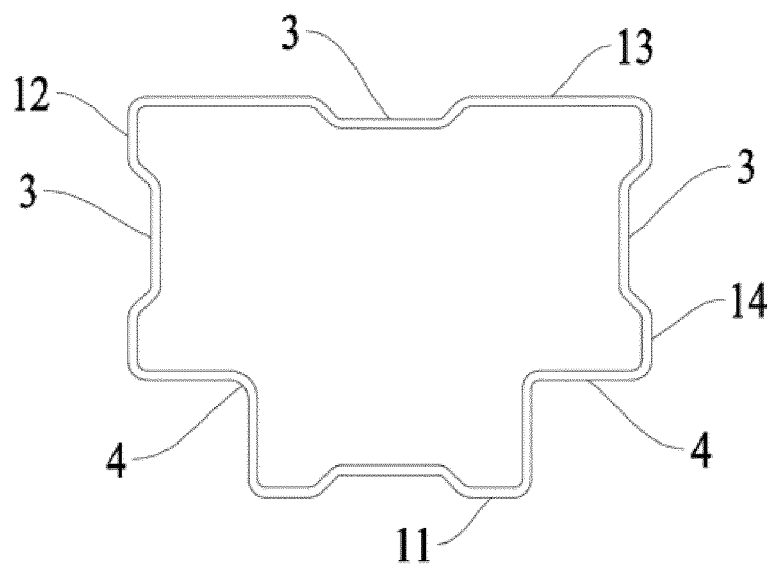


FIG. 6

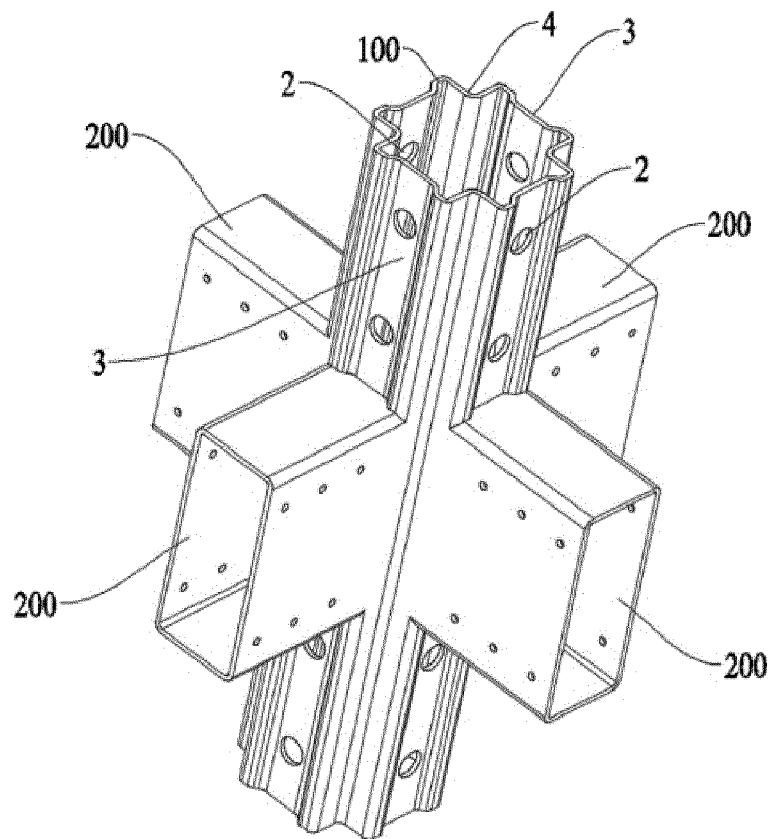


FIG. 7

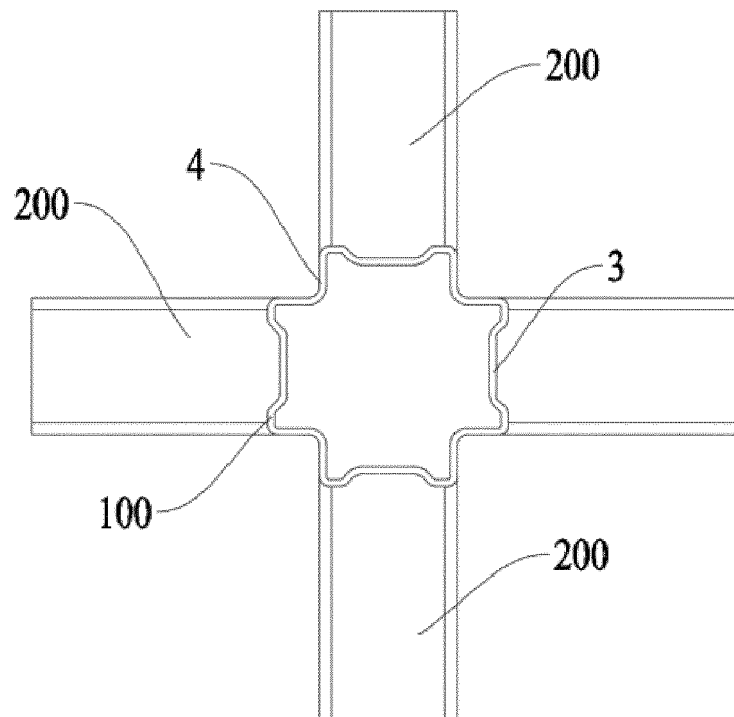


FIG. 8

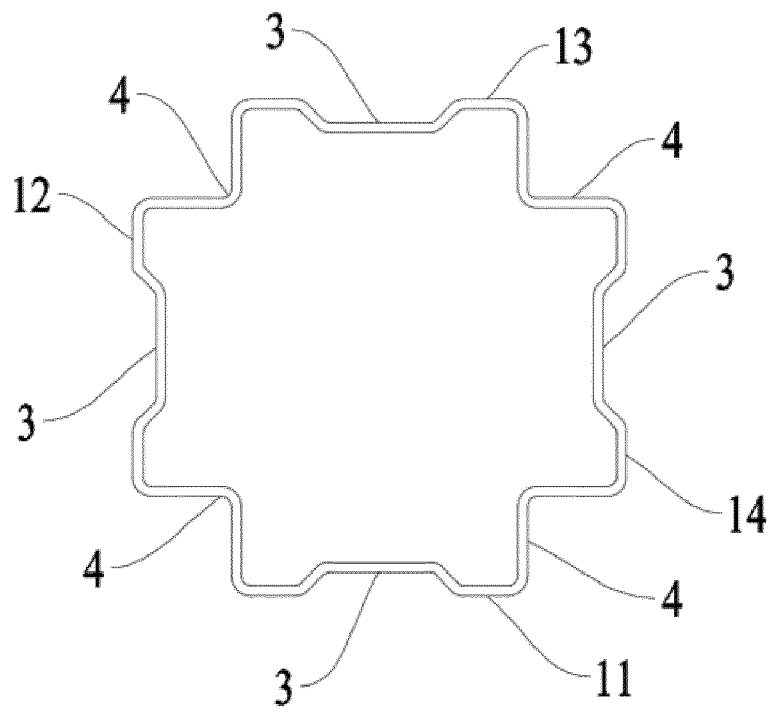


FIG. 9

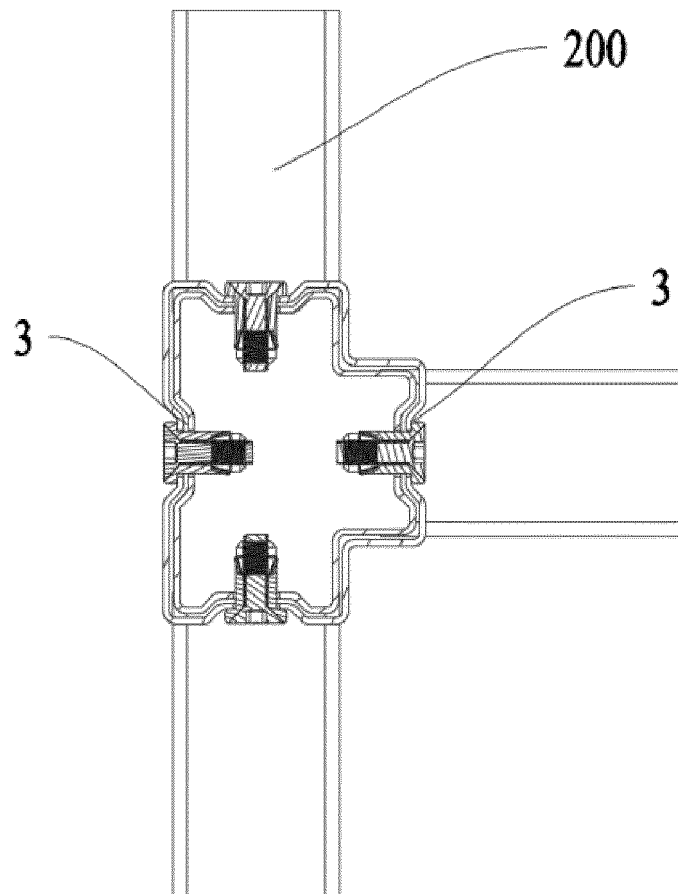


FIG. 10



EUROPEAN SEARCH REPORT

Application Number

EP 23 20 6008

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EPO FORM 1503 03.82 (P04C01)

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	CN 109 930 746 B (UNIV NANJING FORESTRY; NANJING MUYUN ARCH DESIGN CO LTD) 20 May 2022 (2022-05-20) * Translation; page 1 - page 14; figures * -----	1-4, 7-10	INV. E04B1/58 ADD. E04B1/24
X	CN 106 284 660 A (ZHEJIANG PUTIAN INTEGRATED HOUSING CO LTD) 4 January 2017 (2017-01-04) * Translation; paragraph [0009] - paragraph [0044]; figures * -----	1, 5, 6	
X	CN 105 805 112 A (CHONGQING BIAOWANG MACHINERY EQUIPMENT CO LTD) 27 July 2016 (2016-07-27) * Translation; paragraph [0007] - paragraph [0089]; figures * -----	1-3, 5-7	
			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 12 March 2024	Examiner López-García, G
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12-03-2024

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	CN 109930746 B	20-05-2022	NONE	
15	CN 106284660 A	04-01-2017	NONE	
	CN 105805112 A	27-07-2016	NONE	
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Patent documents cited in the description

- CN 114250860 A [0003]