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(54) **CONNECTION POINT FOR METAL STRUCTURES**

(57) A connecting node for metallic structures, specifically for structures based on props or pillars (1) wherewith cross beams (2) are associated, wherein said pillars (1) incorporate rosettes (3) separated by a predetermined distance, each of which having a polygonal window (31) and at least one circular hole (32); while the beams (2) include on their edges a fork (4) having a stub (41) with a polygonal configuration that projects from the lower side and has a configuration equivalent to the window (31) and at least one hole (42) in correspondence with the hole (32) of the rosettes (3); the foregoing in anticipation that a fork (4) will be fitted into a pair of rosettes (3) without possibility of sideways movement of the beam (2) and, once the structure is assembled, that it will be immobilised by means of at least one screw (6) which, passing through holes (32) and (42), establishes the definitive connection.

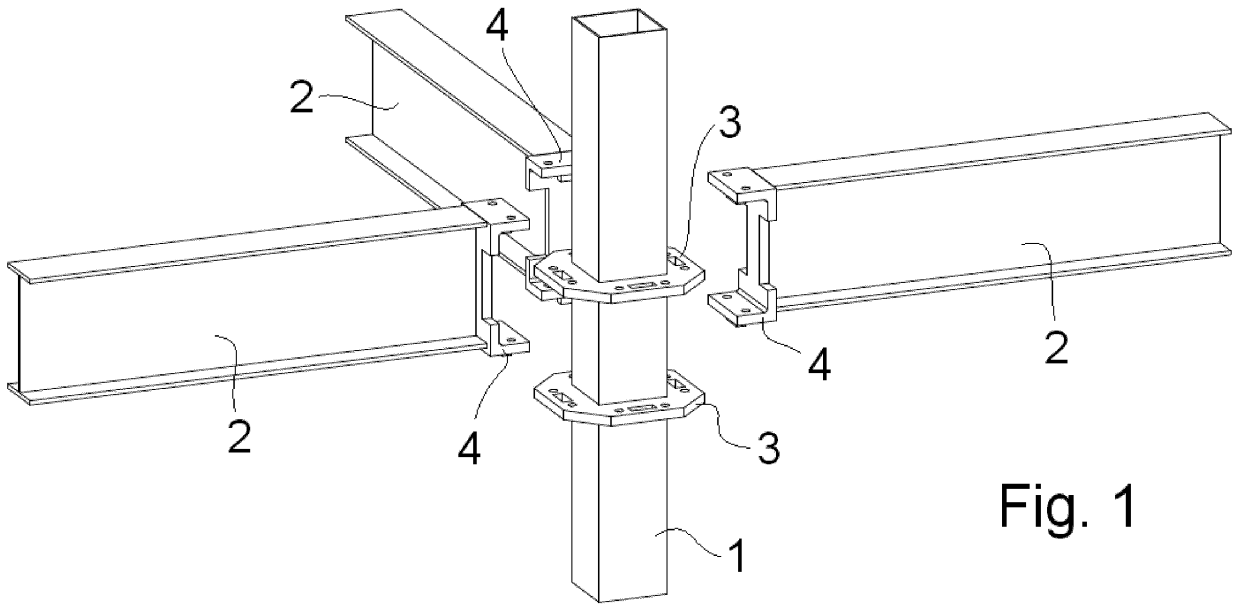

Fig. 1

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Description

OBJECT OF THE INVENTION

[0001] The objective of the present invention is a semi-rigid connecting node for metallic structures which allows connection between beams and pillars, the main application of which is the construction of multi-storey car parks, although it may be destined for the construction of any other metallic structure or construction integrating a metallic structure. This node has a high degree of prefabrication in that its components are manufactured and assembled in situ in embedding and screwing operations which make it possible to improve safety in construction and reduce work execution and completion costs and timeframes.

BACKGROUND OF THE INVENTION

[0002] Structures are known to exist, particularly for scaffolds wherein the structure is formed by props or pillars wherewith cross beams are associated, wherein said pillars include rosettes for fixing the beams, while these include fixing forks at the ends of their spans for fixing to said rosettes, envisaging the existence of identical windows and stubs in both parts which are coupled therebetween by dovetail joint, wherein in the case of the scaffolds the fixation is executed by means of a pin or latch disposed subsequently.

[0003] There are currently various references for the construction of metallic structures, the props and beams of which are connected at specific points forming connecting nodes that are secured by weld, rivets or screws. In general, these types of connections have connection stability problems, at least unless the connection is secured using the definitive methods adopted in each case, due to which it is necessary to execute the definitive fixation of the elements while executing the assembly. This operating procedure has various problems, including the lack of flexibility in the assembly given that, once the elements are joined, they cannot be separated to be adequately rearranged or positioned.

DESCRIPTION OF THE INVENTION

[0004] The invention proposes to resolve this question, for which on the one hand it is possible to execute a fast and effective pre-assembly of the structure and, once it has the adequate configuration and all its elements are in the definitive position, the nodes are definitively fixed. This fixation is preferably performed by means of screws, although it may also be the object of riveted joints.

[0005] The pre-assembly of the constituent parts of a node can only be executed in a stable position, wherein the parts adopt well-defined and geometric positions which therefore do not require subsequent adjustments. For example, on assembling several beams on a prop disposed at 90°-, the interlocking thereof is necessarily a right angle, i.e. perpendicular to the sides of the prop and it is only possible with a minimum tolerance margin.

[0006] This node is composed of two differentiated elements: a post or pillar having coupling means for the relevant beams at an adequate height or heights, identical to other embedding means disposed on the edges of the beams, which allows the fast initial connection of the elements, to be fixed in a second phase by means of screws, which establish a definitive joint. This assembly method will have the greatest advantages since, on being all the components assembled in-factory and transported to the construction site, the structure will be ready to be assembled without need for welds or for dedicating excessive time to aligning the beams and introducing the connecting bolts, screwing them one by one and giving them the necessary tightening torque.

[0007] If we take into account that the calculation of the structures is currently performed using computer programs that determine the necessary dimensions and cross-sections in accordance with the stress generated by the loads introduced, the required design and calculations can be reduced by using a previously determined manufacturing system. Furthermore, these types of nodes are adaptable to any type of profiling among the wide variety of existing profile families, which a priori enables the selection thereof, despite the infinite number of connection combinations and solutions that may be executed.

[0008] Likewise, the development of this construction system makes it possible to reduce environmental pollution and the health risks posed to welders who are frequently exposed to welding fumes and gases. The execution of this product by means of robotised welding enhances the quality and properties of the weld. Another advantage that must be highlighted with respect to the construction materials is that the steel structures are recyclable.

[0009] Furthermore, when designing a type of structure that adapts to the needs of a multi-storey car park, ease of use and obtaining acceptable performance by means of a sufficiently high occupation rate must be taken into account.

[0010] This node makes it possible to eliminate the prior design stage of the connections, thereby reducing the time required to execute the connections between the beams and pillars of the structure, obtaining better characteristics during the execution of the work than using a traditional system. Another advantage consists of improving the structure assembly process with a fast and effective system for executing the connection, such that the beam to be mounted rests on the pillar node, preventing it from remaining in a centred position while the screws are fixed to ensure the connection, said connection being executed by disposing bolts that support shear stresses, reducing the cost of installation on not requiring high-resistance screws and facilitating the execution of the connection.

[0011] This structural node is composed of beams and

pillars of a certain type of profile for each case, which may adopt different dimensions in accordance with the pillars for the first or last floor and depending on the beam span.

[0012] The connection elements are assembled on the pillar and at the ends of the beam span and are composed of two differentiated elements which, on becoming joined, form the connecting node. These elements are serially manufactured at the factory's facilities and are transported ready to be installed onsite, being capable of easily forming the metallic structure of a new multistorey car park and with faster execution timeframes than conventional timeframes. In addition, the steel structures are more manageable and lightweight compared to those of precast concrete, thereby reducing the necessary foundations for anchoring the pillars of the first floor of the building.

[0013] The pillars that form part of this node incorporate a pair of rosettes fixed thereabout and separated by a predetermined distance. Each of these rosettes includes, at least on each of the sides whereon a cross beam, a polygonal window and at least one circular hole are susceptibly fixed. Each of the beams that form a constituent part of one of these nodes has a C-shaped fork fixed to each of the edges of these beams, the flanges of which are separated therebetween at a distance equivalent to that which separates the rosettes of the pillars. Each of the flanges has a stub having a polygonal configuration that projects from the lower side having an equivalent configuration to the window of the rosettes and also at least one hole in correspondence with that of said rosettes.

[0014] Thus disposed the pillars and beams, a C-shaped fork of any beam fits it into a pair of rosettes of any pillar, introducing and coupling the stubs thereof in the windows existing therein; in such a manner that there is no sideways movement of the beam and the simple coupling between stubs and advantages enables the stable formation of the structure. Subsequently, upon assembling the structure of a floor, it is immobilised by means of screws which, passing through the holes in the rosettes and forks, establish the definitive connection therebetween.

[0015] A variant of embodiment of this node has been envisaged for those assemblies that require connection between two cross beams, joining the ends of one of the beams at an intermediate point of the other; in this case, there is a pair of rosettes fixed at different heights, separated by a predetermined distance, at the intermediate point of the beam and sides thereof. Each of these rosettes incorporates, at least on each side whereto a cross beam, a polygonal window and at least one circular hole are susceptibly fixed. This rosette perfectly emulates that disposed on the pillars, allowing the fixation thereon of a second cross beam with respect thereto, which carries the node-forming rosettes, provided that it includes a C-shaped fork such as that described earlier.

[0016] The configuration chosen for the windows in the rosettes and for the stubs in the forks is respectively a rectangular cavity and cross-section, since a polygon is the simplest shape and that least susceptible to pitching or sideways movements of the beams, forming the connections at 90º or with the angle marked by these windows disposed on the rosette fixed to the pillar or to the ancillary beam.

[0017] Likewise, the holes in the rosettes and in each C-shaped fork are preferably two and are disposed respectively on the sides of the window and of the stubs, respectively, of the rosettes and fork, coupled therebetween during assembly and disposed in opposition in order to enable the insertion of a safety screw.

DESCRIPTION OF THE DRAWINGS

[0018] As a complement to the description being made and for the purpose of helping to make the characteristics of the invention more readily understandable, this specification is accompanied by a set of figures which, by way of illustration and not limitation, represent the following:

Figure 1 shows a perspective view of a node wherein a pillar (1) and three beams (2) coincide before being coupled therebetween;
Figure 2 shows a plan and sectional view along line A-A of a pillar (1);
Figure 3 shows an elevational and sectional view along line A-A of a beam (2);
Figures 4 and 5 show the node of figure 1, once formed and upon securing the connection by means of screws (6), respectively;
Figure 7 shows a perspective view of a connecting node, in this case between a main beam (2b) and two cross beams (2a-2c); and
Figures 8 and 9 show the node of figure 7, once formed and upon securing the connection by means of screws (6), respectively.

PREFERRED EMBODIMENT OF THE INVENTION

[0019] As can be observed in the referenced figures, on the one hand the node of the invention resolves the connection between a pillar (1) and a series of beams (2) or also between various beams (2), forming in both cases a fast and stable assembly node, susceptible of being immobilised a posteriori or being secured by means of screws (6).

[0020] Figure 1 shows the essential elements for forming this node. These elements are two rosettes (3) fixed perimetrally to the pillar (1), which are fixed in a parallel position, separated by a pre-established distance, and a C-shaped fork (4) fixed to the edge of the beams (2), having a distance between their flanges equivalent to that of the separation between the rosettes (3).

[0021] The rosettes (3) are welded to the pillar (1) infactory. In the embodiment represented, the body of the rosette is flat and has a polygonal or circular configura-

tion, whereto sections of the profile that forms the pillar (1) are welded on both sides until forming a pillar of the desired height which includes the rosettes (3) in the adequate position. On each of the sides of the pillar (1) (normally, normalised pillars having a quadrangular cross-section shall be used, although any other configuration would be feasible) each rosette (3) has an elongated window (31) and at least one hole (32). In figure 2, this window is rectangular and is accompanied by two lateral holes (32).

[0022] The C-shaped fork-like terminations (4) have corresponding parallel flanges that are separated by a standard distance equivalent to that of the separation of the rosettes (3). Each of these flanges has a stub projecting downwards, with a configuration equivalent to that of the windows (31) and corresponding holes (42) in correspondence with the holes (32) of the rosettes (3).

[0023] Figures 3 and 7 show the possibility of assembling this node between two beams: a pass-through beam (2b) which receives the confluence of another or other cross beams (2a-2b). In this case, the rosettes (5), similar to the rosettes (3) destined for fixing to the pillars (1), are fixed to the sides of a beam (2b) and have a window (51) and holes (52) equivalent to those existing in the rosettes (3) in terms of layout and configuration.

[0024] The assembly can be easily observed in figures 1, 5 and 6 in the case of a node between a pillar and a beam and in figures 7, 8 and 9 in the case that the connecting node is executed between two beams. In both cases the termination (4) of the beam is disposed with its two flanges on top of the rosettes (3 or 5), fitting the stubs (41) into the windows (31) or (51). Coupling the beam (2) by both ends is sufficient to form the structure of an entire floor. The installation of the fixing screws (6) can be performed a posteriori, i.e. before proceeding to assemble the next floor.

[0025] This system has the following advantages with respect to a current welded or screwed joint:

- Fast manufacture (machining of parts and cutting of beams and pillars) thanks to standardisation and serial manufacturing at the factory.
- Fast and secure assembly of the parts in-factory, with the possibility of controlling the optimum necessary conditions for correct welding.
- Easy onsite assembly and disassembly due to its screwed nature (detachable structure).
- Assembly without need to immediately prop or secure with screws due to the housing for embedding the parts, which also ensures greater accuracy in the alignment of the beams between pillars.
- Use of screws without pre-tensing on working with right angles, as opposed to those used in traditionally screwed cap plates, saving in execution time (there is no need to apply tightening torque) and in cost of screws (it does not require HV high-resistance screws).

[0026] Having sufficiently described the nature of the invention, in addition to an example of preferred embodiment, it is hereby stated for the relevant purposes that the materials, shape, size and layout of the described elements may be modified, provided that it does not imply altering the essential characteristics of the invention claimed below:

Claims

1. A connecting node for metallic structures, specifically for structures based on props or pillars (1) wherewith cross beams (2) are associated, wherein said pillars (1) include rosettes (3) for fixing the beams (2), while these include a fork (4) on the edges of their ends for fixing to the aforementioned rosettes, **characterised in that** it comprises:

   - a pair of rosettes (3) fixed around the pillar (1) separated by a predetermined distance, each of which includes, at least on each side wherein a cross beam (2), a polygonal window (31) and at least one circular hole (32) are susceptibly fixed;
   - a C-shaped fork (4) fixed on each of the edges of the beams (2), the flanges of which are separated therebetween by a distance equivalent to that which separates the rosettes (3), each of which has a stub (41) having a polygonal configuration, which projects from the lower side and has a configuration equivalent to the window (31) of the rosettes (3) and at least one hole (42) in correspondence with the hole (32) of said rosettes;

   the foregoing in anticipation that a C-shaped fork (4) will be fitted into a pair of rosettes (3), introducing and coupling the stubs (41) to the windows (31) thereof, without possibility of sideways movement of the beam (2) and that, upon assembling the structure, it will be immobilised by means of at least one screw (6) which, passing through the holes (32) and (42), establishes the definitive connection between the pair of rosettes (3) and the corresponding fork (4).

2. The connecting node for metallic structures, according to claim 1, specifically for the connection between beams (2), joining the ends of certain beams with intermediate points of others, **characterised in that** it comprises:

   - at the intermediate point of the beam (2) wherein the termination of a second beam will be fixed, it has a pair of rosettes (5) fixed at different heights separated by a predetermined distance, each of which incorporates, at least on each side wherein a cross beam (2), a polygonal window (51) and at least one circular hole (52) are sus-

ceptibly fixed;
- a C-shaped fork (4) fixed to each of the edges of the beams (2), the flanges of which are separated therebetween by a distance equivalent to that which separates the rosettes (5), each of which has a stub (41) projecting towards the lower side having a polygonal configuration, equivalent to the window (51) of the rosettes (5) and at least one hole (42) in correspondence with the hole (52) of said rosettes;

the foregoing in anticipation that a fork (4) will be fitted into a pair of rosettes (5), introducing and coupling the stubs (41) to the windows (31) thereof, without possibility of sideways movement of the beam (2) and that, upon assembling the structure, it will be immobilised by means of at least one screw (6) which, passing through the holes (52) and (42), establishes the definitive connection between the pair of rosettes (3) and the corresponding fork (4).

3. The connecting node for metallic structures, according to claim 1, **characterised in that** the windows (31-51) and projecting stubs (41) respectively have a rectangular cavity and cross-section.

4. The connecting node for metallic structures, according to claim 1, **characterised in that** the holes (32-52) in the rosettes (3-5) and the holes (42) located on each C-shaped fork (4) are two and are respectively located on the sides of the window (31) and the stubs (41).

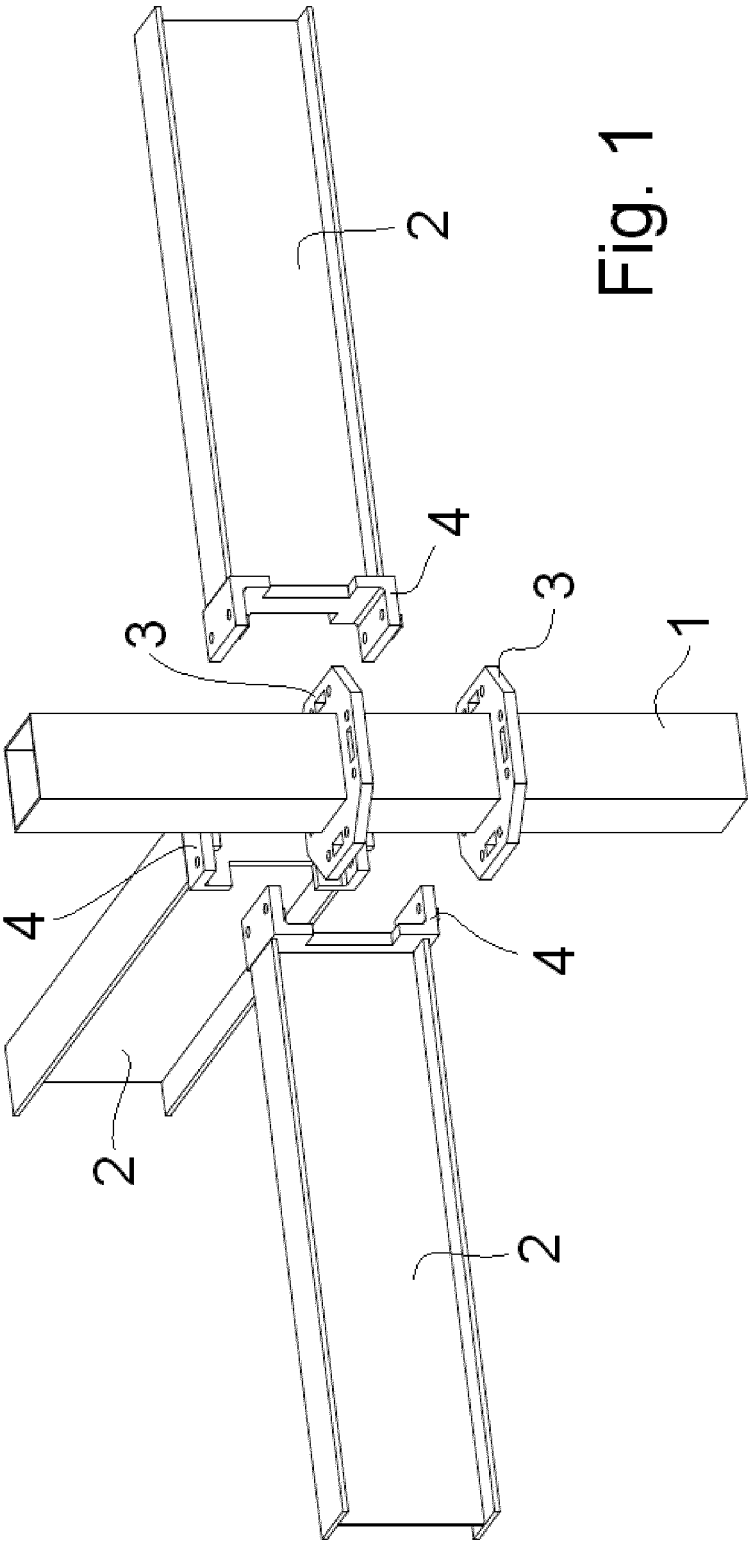


Fig. 1

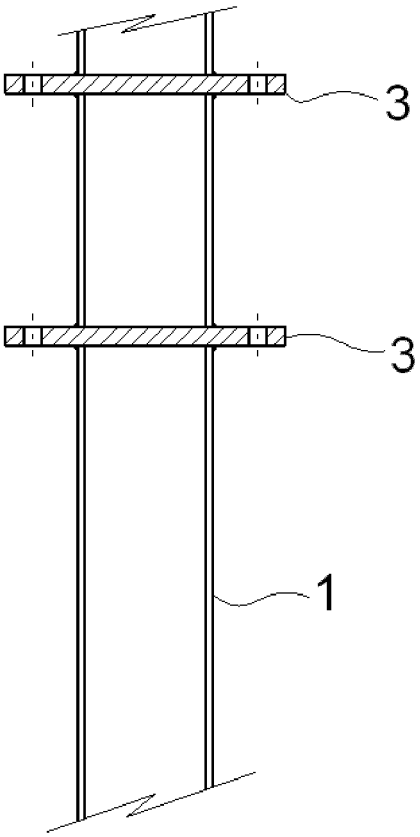
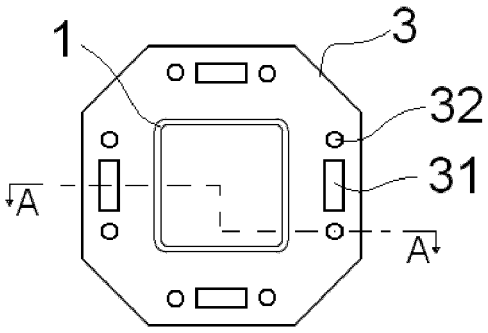


Fig. 2



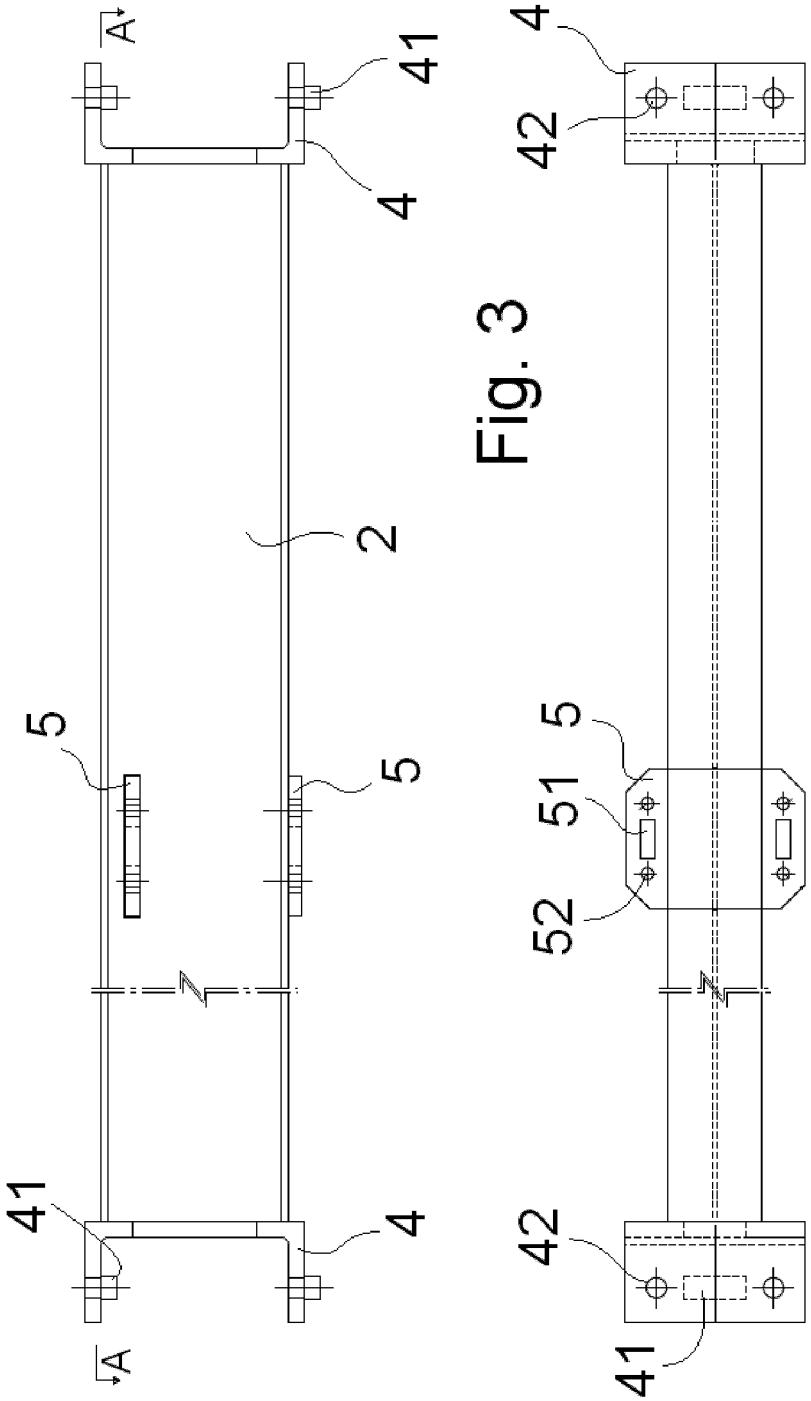


Fig. 3

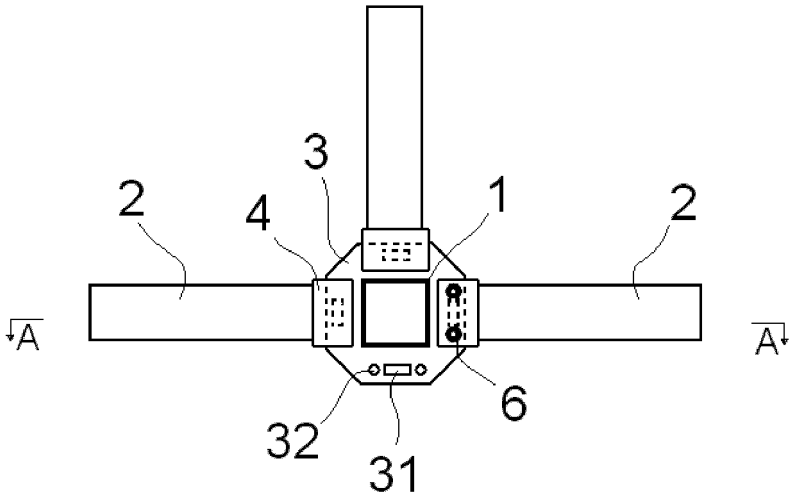


Fig. 4

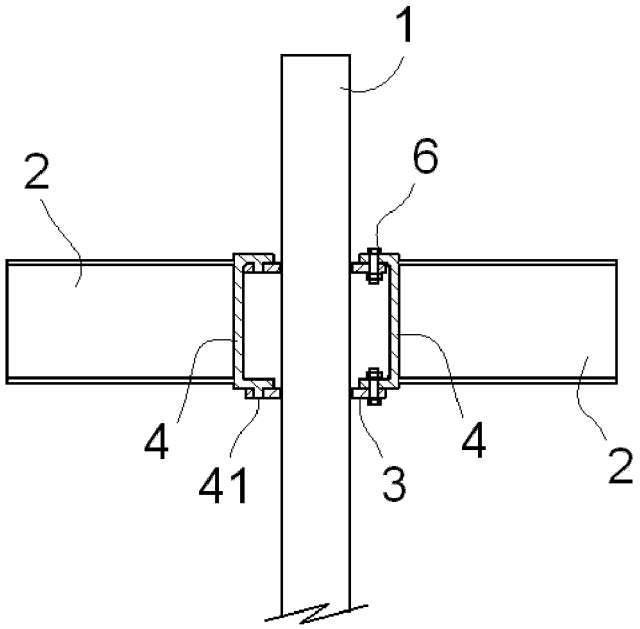


Fig. 5

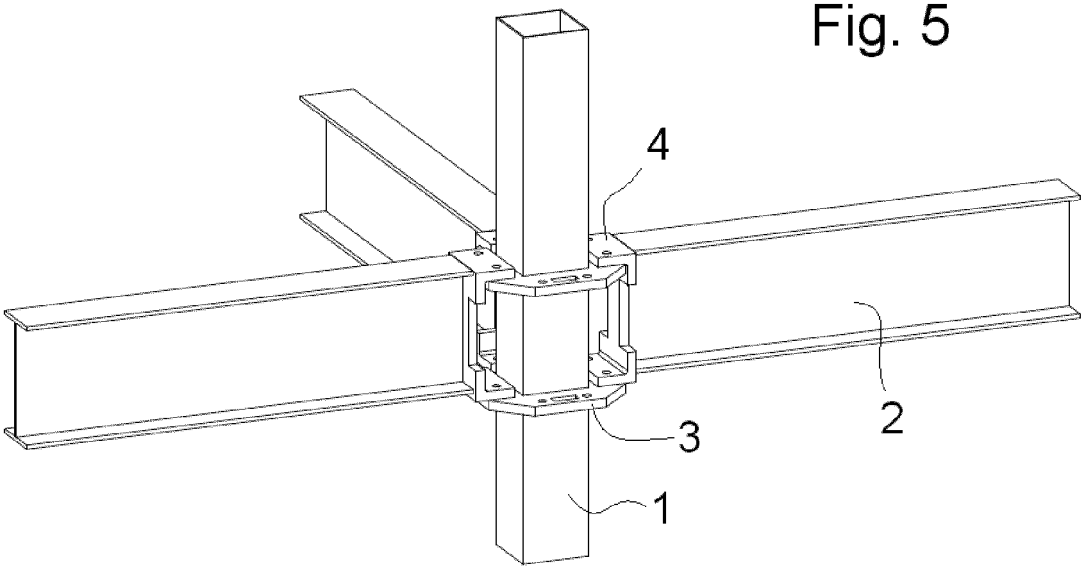
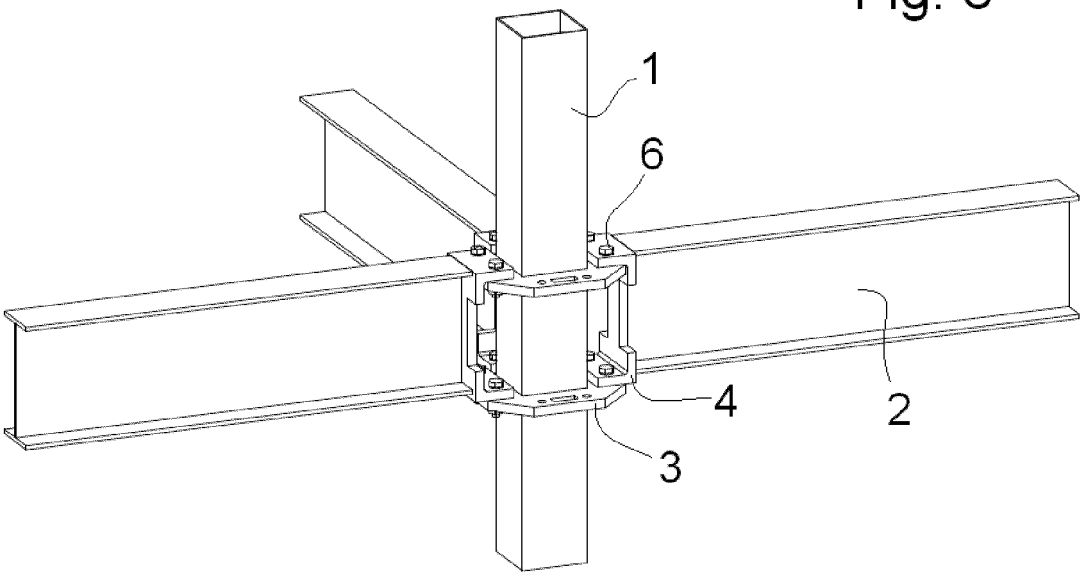


Fig. 6



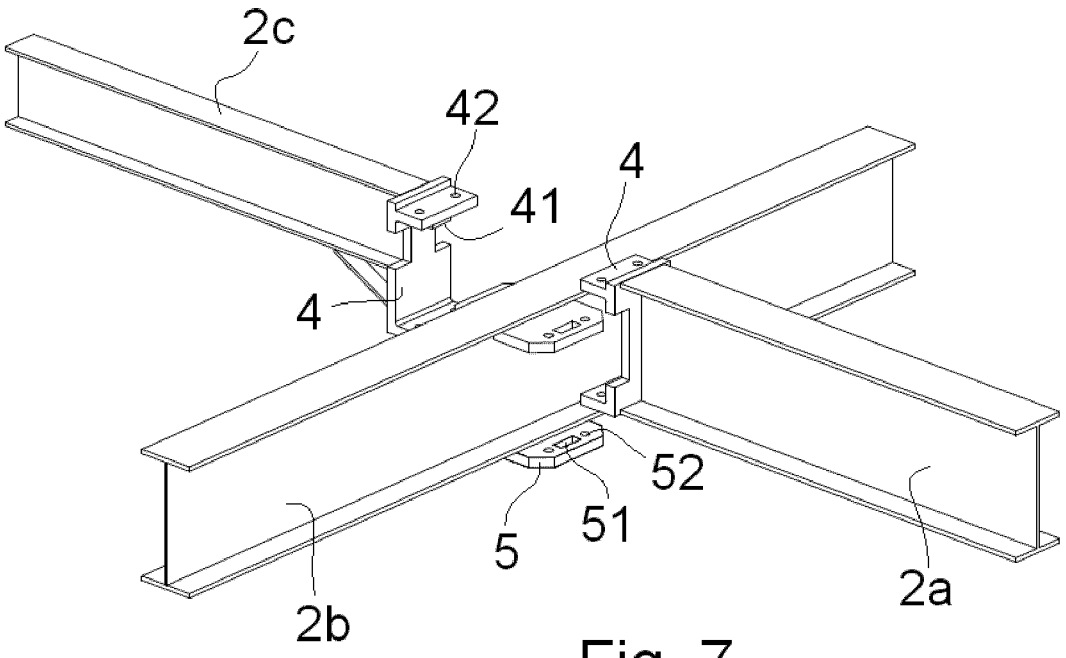


Fig. 7

Fig. 8

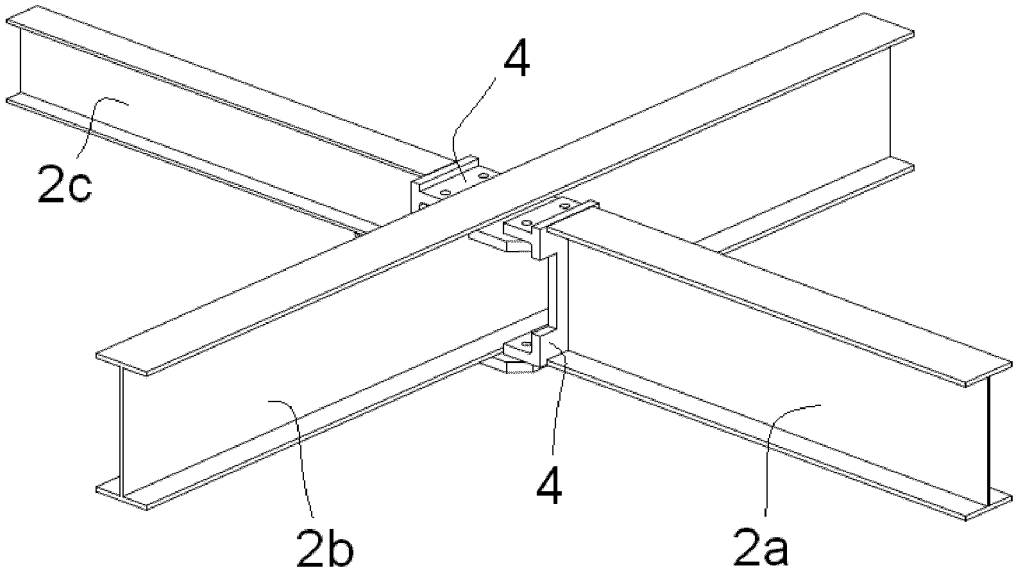
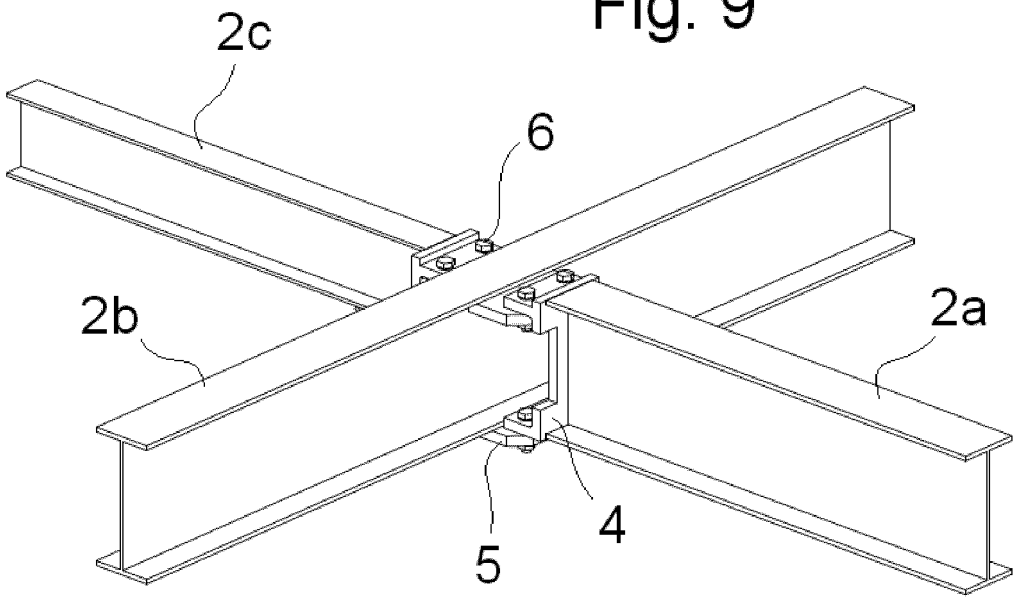


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2013/070303

A. CLASSIFICATION OF SUBJECT MATTER

E04B1/24 (2006.01)
E04B1/58 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B, E04G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 2006144006 A1 (SUZUKI KAZUAKI et al.) 06/07/2006, paragraphs[0044 - 0047]; figures 1, 3.	1, 4
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
30/01/2014	**(03/02/2014)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer S. Fernández de Miguel Telephone No. 91 3495437

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2013/070303

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2546953 A1 (CHENEL GUY) 07/12/1984, page 2, line 24 - page 4, line 23; figure 1.	1, 2

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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