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(54) Connection node for joining members of space structures

(57) The invention pertains to the connection node for joining members of space structures in particular structural space frames. The node is formed by interconnecting the members (10,20) to spacer plates (30) using overlapping bolt holes (40,41) at the ends of each member and on the plates (30). The main assets of the system are that it can be utilised for various space structures and it can be fabricated using simple elements.

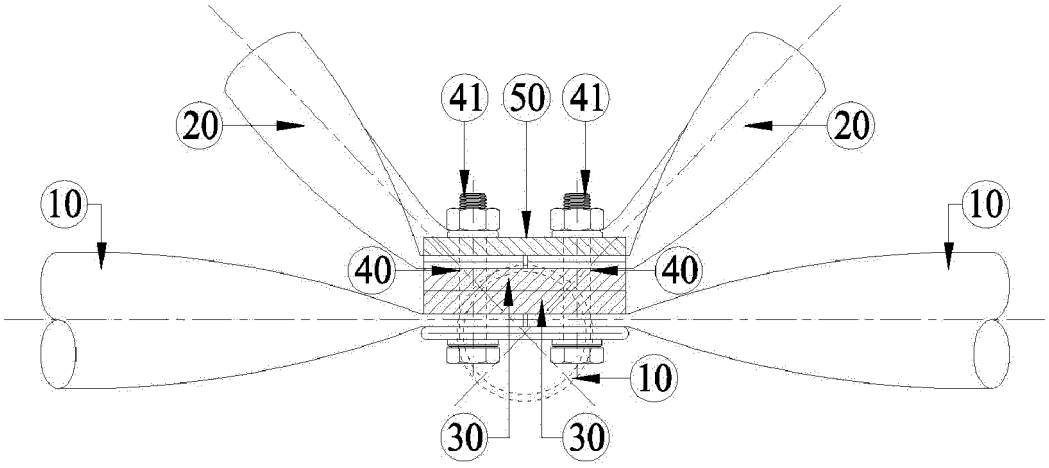


FIG.2

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Description

BACKGROUND DESCRIPTION OF THE INVENTION

[0001] The invention is an effective node solution to successfully design and construct space structures made up of different sectional elements. The node was developed to be capable of connecting the various sectional members located in three dimensional space together to a single joint. In order to be capable of transferring the complex forces, the node had to be designed as strong, stiff, structurally stable yet mechanically simple with minimum eccentricity. These characteristics were achieved considering that elements of the node could be fabricated easily without using extraordinary technology and thus opting for repetitive, mass production techniques.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] The invention can be more fully understood by reading the subsequent detailed description with references made to the accompanying drawings, wherein:

FIG. 1 is a plan view showing the edges of the boom and diagonal elements assembled over the spacer plates with the bolt holes aligned.
FIG. 2 is a sectional elevation through the main boom elements showing all the elements assembled with the bolts tightened.
FIG. 3 is a plan view showing a variation of the system where the spacer plates above and below the diagonal elements are rotated by 45 degrees.
FIG. 4 is a sectional elevation through the main boom elements showing the variation of the system where the spacer plates above and below the diagonal elements are rotated by 45 degrees.

DETAILED DESCRIPTION OF THE INVENTION

[0003] The invention is aimed towards spaceframe structures of up to approximately 20m clear span, employing an efficient, fast and clean design, manufacture and assembly of such structures, both for aesthetic and functional purposes.

[0004] These space structures are manufactured from any type of member of any material which is structurally adequate, and amenable to the method of manufacture. The size of the elements ***(10, 20)*** varies with the structural/aesthetic requirements of the project in hand. The elements are divided into 2 main groups - the *main booms* ***(10),*** those parallel to the direction of span, and the *diagonal* members ***(20).*** Welding is removed from the jointing system, implying the possibility of a cost-effective and if required a relocatable solution.

[0005] As shown in ***FIG 1 - 4*** the ends of the *elements* ***(10, 20)*** are cut to size and prepared in a pressing machine or other similar equipment to prepare the adequate jointing surface. When circular hollow sections are utilised, the edges are squashed to approximately half the flattened width, or one fourth of the pipe circumference. The ends of the *diagonal* members ***(20)*** are also bent to the required angle depending on the design height of the space frame and then cut or sheared to form the 45 degree rotated end shown in **FIG 1 and 3.** Two holes ***(40)*** are drilled or punched at the ends of the *main booms* ***(10),*** while one hole is drilled or punched at the ends of the *diagonal* elements ***(20).*** The size of these holes ***(40)*** depends on the size of the bolts ***(41)*** which in turn are related to the structural/aesthetic requirements of the project and on practical end distances required by the relative British Standards and Eurocodes. These elements are assembled together at the node as shown in **FIG 1-4.** Adequate spacers in the form of plates ***(30)*** with four holes ***(40)*** of a diameter and spacing similar to that of the rest of the node are placed between the *diagonal* elements ***(20)*** and the *main booms* ***(10),*** as shown in **FIG 1-4,** to enable the lines of force of the structural system to meet at one point. Therefore, the depth of these spacers ***(30),*** that is, the distance between the main booms ***(10)*** and the diagonals ***(20)*** at the node, will vary with the particular structural geometry of the specific project. A finishing plate ***(50)*** with four holes ***(40)*** of a diameter and spacing similar to that for the rest of the node is then placed over the diagonal members before final fixing with four adequate strength bolts ***(41).*** The size and grade of the bolts is generally a result of strength requirements.

[0006] Although this invention has been described in its preferred forms with a certain degree of particularity, various changes and modifications may be carried out without departing from the scope of the invention as defined by the appended claims.

Claims

1. A spaceframe node comprising of several members cut to size with its edges prepared to form a flat joining surface while the diagonal members are also bent to the required angle. The flattened edges of bottom chord are placed in the two most bottom planes where in the most bottom plane will be placed the booms spanning in the shortest distance were applicable. Subsequently, the spacer plates are placed on the third plane to accommodate the diagonal member edges on top of it. Finally in the top most plane comprises a finishing plate. All elements are connected together using a series of bolts which pass through the overlapping holes through the members and spacer plates.

2. The node in accordance with claim 1 wherein the number, size and spacing of the bolts may vary from that indicated in the drawings.

3. The node in accordance with claim 1 wherein addi-

tional diagonal members and spacer plates are installed on the bottom part of the node such that these appear as a mirror image along the bottom booms when viewed from a sectional elevation. This is the case with a double layer spaceframe or other space structures.

4. The node in accordance with claim 1 wherein the section type and size might vary from that indicated.

5. The node in accordance with claim 1 wherein the size, thickness and rotation of the plates might vary from that indicated.

6. The node in accordance with claim 1 wherein the angle of the diagonal members may vary according to the depth of the spaceframe.

7. The node in accordance with claim 1 wherein the material of the elements may be other than structural steel, provided that it is amenable and structurally adequate.

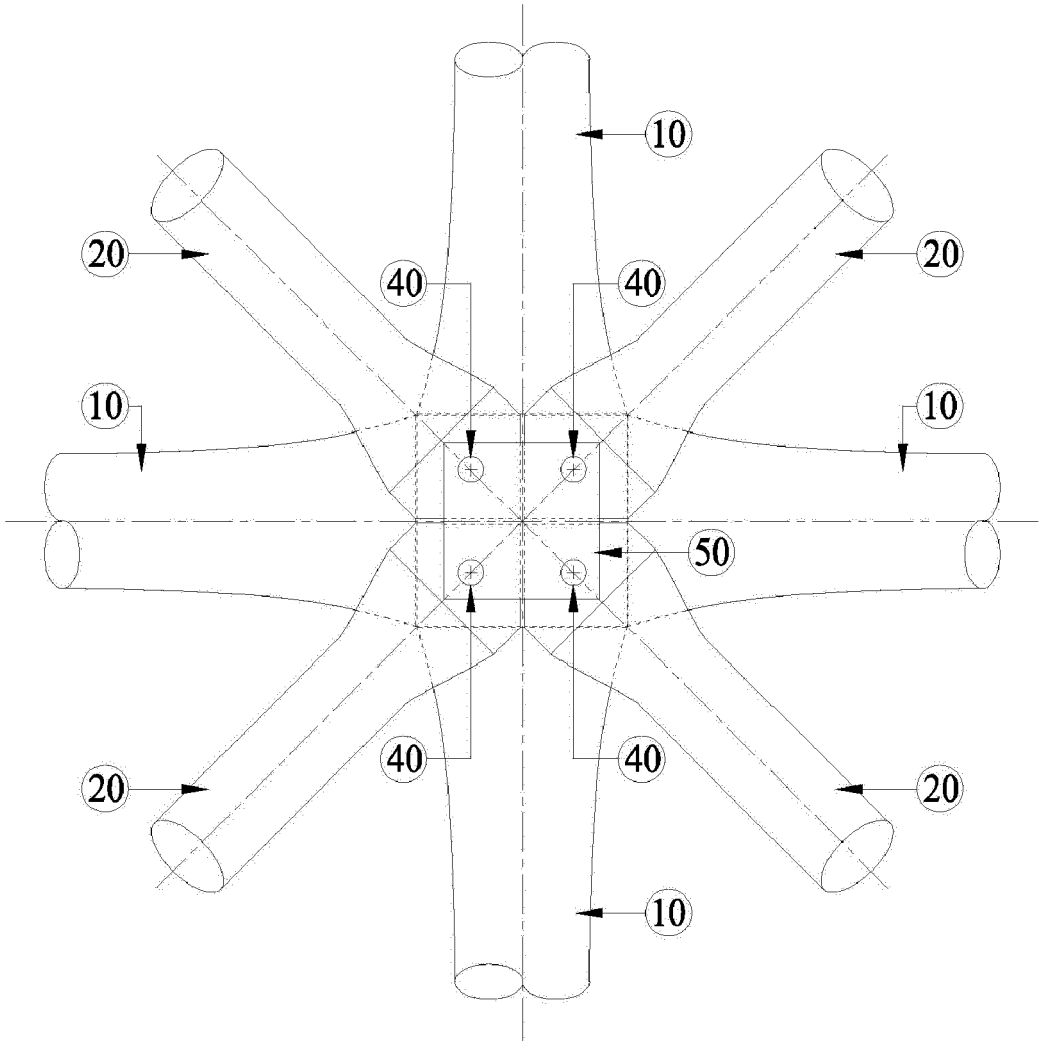


FIG.1

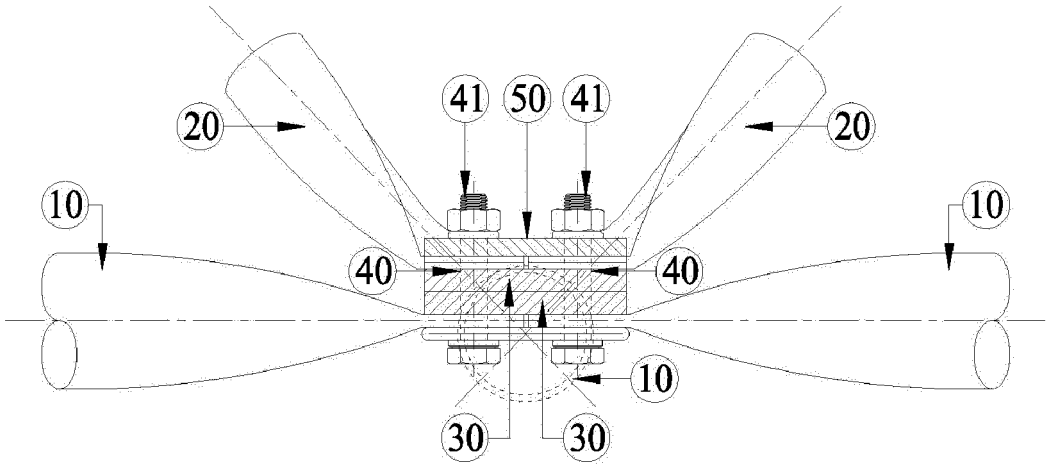


FIG.2

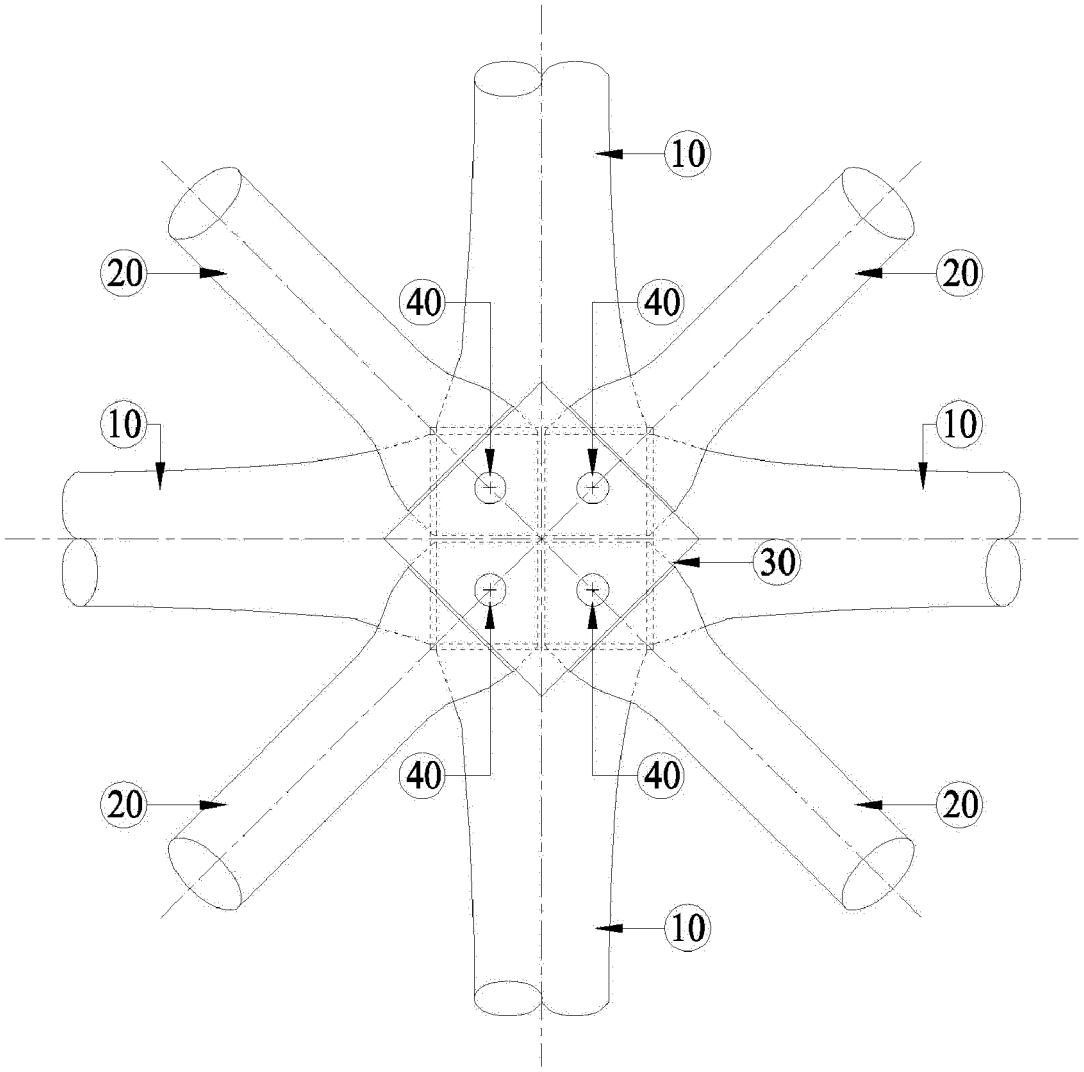


FIG.3

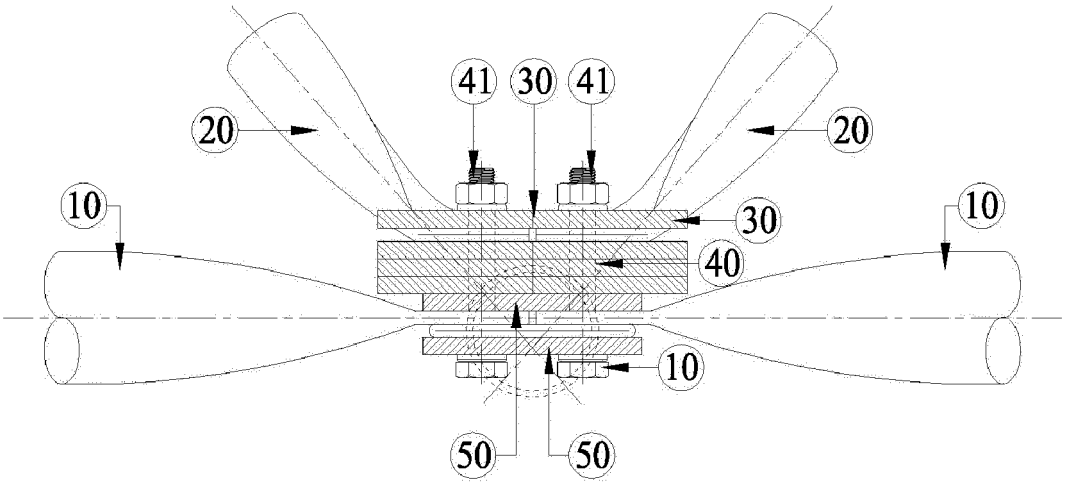


FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 4844

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	WO 85/05650 A1 (TULSERATE LTD [GB]; CODD EDWIN THOMAS [AU]) 19 December 1985 (1985-12-19) * page 3, line 14 - page 6, line 3; figures 1-6 * -----	1-7	INV. E04B1/19
X	EP 1 496 166 A1 (MIA INC [JP] MIA INC ARCHITECTURAL INST OF [JP]) 12 January 2005 (2005-01-12) * paragraph [0028] - paragraph [0046]; figures 1-13 * -----	1-7	

TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 March 2013	Couprie, Brice

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 18 4844

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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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82