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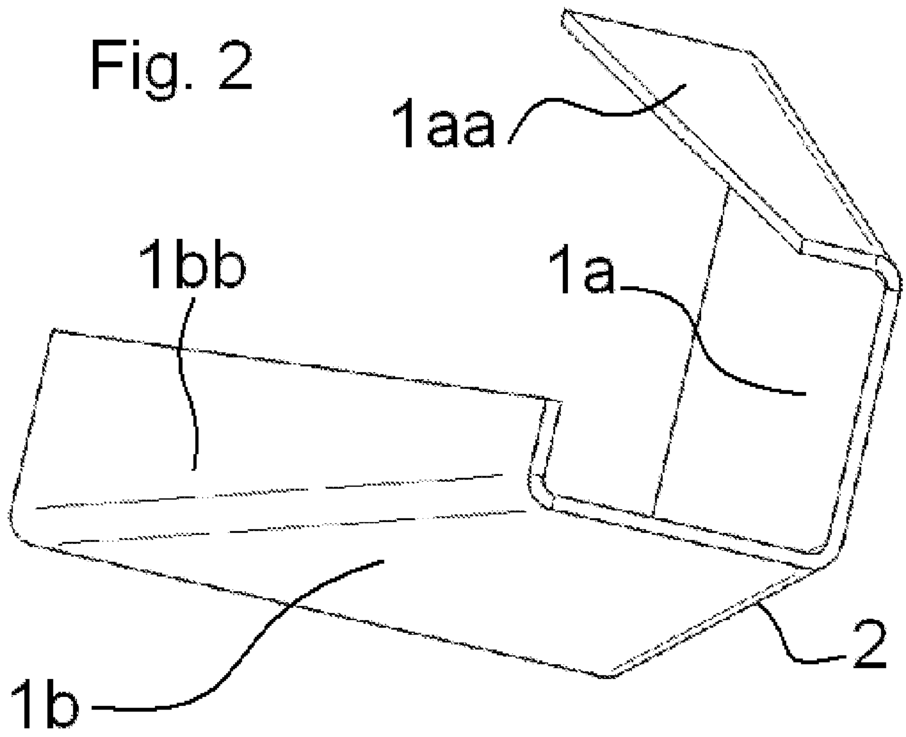
(54) **Upright structural element for a tower designed to support electrical cables and method of obtaining the same**

(57) The present invention relates to an upright structural element for trestle supporting towers, comprising a section bar provided with a couple of walls or wings (1a, 1b) inclined with respect to one another at an angle from about 60 to 120 degrees, each wall or wing (1a, 1 b) of the couple of walls or wings (1a, 1b) ending with at least one respective portion (1aa, 1bb) and being inclined with respect to its respective wall or wing (1a, 1b), at least one portion (1aa, 1bb) of a wall or wing (1a, 1 b) of the couple facing at least one portion (1 bb, 1 aa) of the other wall or wing (1 b, 1 a) of the couple. The present invention also regards an upright structural element for towers designed to support electrical cables or the like, comprising a section bar having a couple of walls or wings (1a, 1b) inclined with respect to one another at an angle from about 60 and 120 degrees, the upright element being substantially tapered upwards, in use.

Fig. 2



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Description

[0001] The present invention relates to a new structural element for towers designed to support electrical cables or the like, as well as a method of obtaining the same.

[0002] As known, trestle towers are usually formed by three (for towers triangular in cross-section) or four upright elements or "angle bars" (for towers square in cross-section), that are suitably fixed together and stiffened at various levels of the tower by means of "wall cross-arms" (ledgers or braces), which are fixed between two respective upright elements typically through bolting.

[0003] The upright elements are usually obtained through hot-rolling of section bars and have a substantially L-shaped cross-section with an angle of about 90° (for towers square in cross-section), or an angle of 90°, subsequently reduced to 60° (for towers triangular in cross-section). This latter type of upright elements is used outside Europe.

[0004] On one hand, such a solution ensures a low-cost supporting function for electric cables, and on the other the combined bending and compressive stress performance (the most important stress in trestle upright elements) that can be obtained with it is rather poor due to the huge difference between the two main radii of gyration of the section and the very low value of the smaller radius of the two. For this reason, i.e. for the very low combined bending and compressive stress performance of a hot-rolled angle bar, wide capacities to withstand combined bending and compressive stress can be obtained only by arranging a plurality of upright elements (from two up to four) in parallel, with a respective facing side, thereby obtaining towers having a so called "composite" cross-section.

[0005] This clearly involves an enormous waste of material and a high additional cost in terms of bolting, since the angle bars "composite" in cross-section must be mutually joined together by means of bolts and plates.

[0006] Moreover, with trestle towers formed by conventional upright elements it is geometrically impossible to obtain faces bolted to each other in the various upright elements and perfectly coplanar with wall cross-arms in the so-called "tapered" towers, this causing undesired stresses particularly in the bolting system (see Figures 1a and b).

[0007] Furthermore, in trestle towers stress applied to an upright element increases from the top to the base of the tower, and thus it would be advisable to use upright elements with a larger cross-section where the stress is greater, and vice-versa. Nevertheless, this would involve high production and assembling costs, and thus one usually prefers to maintain the same section bar for long sections of the tower.

[0008] The main object of the present invention is then to provide a new upright structural element for trestle towers which is suitable for ensuring definitely better performance with respect to conventional upright structural elements.

[0009] Another object of the present invention is to provide a new upright structural element for trestle towers which makes it possible to achieve significant savings in material with respect to upright structural elements proposed up to now.

[0010] Another object of the present invention is to provide new upright structural elements which are suitable for ensuring that the faces of the structural upright elements secured to each other in a tower are coplanar. Another object of the present invention is to provide a method of obtaining upright structural elements for trestle towers.

[0011] According to a first aspect of the present invention an upright structural element for trestle supporting tower is provided, which comprises a section bar having a couple of walls or wings inclined with respect to one another at an angle from about 60 to 120 degrees, and characterized in that each wall or wing of said couple of walls or wings ends with at least one respective portion, each portion being inclined with respect to the relative wall or wing, and at least one portion of a wall or wing of said couple is facing towards at least one portion of the other wall or wing of said couple.

[0012] Advantageously, each portion of the structural element is inclined with respect to its respective wall or wing of a substantially perpendicular angle.

[0013] According to another aspect of the present invention, an upright structural element for towers supporting electrical cables or similar is provided, comprising a section bar having a couple of walls or wings inclined with respect to each other at an angle from about 60 to about 120 degrees, the upright element being substantially tapered upwards, in use.

[0014] According to a third aspect of the present invention, an upright structural element for supporting towers triangular or squared in cross-section is provided, which comprises an section bar having a couple of walls or wings inclined with respect to each other, each wall or wing of the wall or wing couple being inclined with respect to the other at an angle from about 60° and 75° for towers triangular in cross-section and from about 90° to about 105° for towers squared in cross-section.

[0015] According to a further aspect of the present invention, a method of obtaining of obtaining an upright structural element is provided which comprises the following steps:

- providing a plane metallic sheet formed by two portions or wings extending at an angle from opposite sides with respect to an intermediate bending axis and ending with transversal edges,
- bending the sheet along to two lateral bending axes, and
- bending the sheet along said main bending axis.

[0016] Further features and advantages of the present invention will more readily appear from the following detailed description of presently preferred embodiments of an upright structural element, in conjunction with the accompanying drawings, in which:

Figures 1a and 1b show two details of a tapered trestle tower including conventional upright elements and cross-arms according to the prior art;
Figures 2 and 3 are perspective views slightly from above of two embodiments of upright elements according to the present invention; and
Figure 4 is a perspective view slightly from below of portions of a structural elements forming the upright elements of a tapered supporting tower having four upright elements.

[0017] In the accompanying drawings, the same or similar portions or components have been indicated with the same reference numeral.

[0018] With reference first to Figure 2, a portion or length 1 of an upright structural element for a tapered tower, e. g. including three or four upright elements for supporting electrical cables or radio-tv broadcasting instrumentation, is provided, which is formed by a metal rolled section comprising two portions or wings 1 a and 1 b extending from opposite sides with respect to an intermediate bending or curving axial area and having a respective end or stiffening portion 1aa and 11 bb. The rolled section is profiled according to three cross bending or curving axes: an intermediate main axis along the edge 2, and two secondary lateral axes at the end portions 1aa and 1bb of the wings. Each end portion 1aa and 1bb preferably extends at a bending or curving angle of about 90° with respect to the wing adjacent thereto, whereas the two portions or wings 1 a and 1 b delimit an angle of about 90° therebetween. The end portions 1aa and 1 bb are inclined one with respect to, and substantially facing the other.

[0019] In Figure 3 a portion of an upright element for a tapered triangular cross-section tower is shown, which is similar to the upright element shown in Figure 2 but has a bending angle of about 60° along its intermediate axis.

[0020] According to the present invention, an angle from 60° to 120°, and preferably from about 60° to about 75°, is delimited along the intermediate axis of each upright element for towers triangular in cross-section, and from about 90° to 105° for towers square in cross-section.

[0021] Preferably, an upright structural element according to the present invention is tapered upwards, in use, thus the area delimited by each upright element decreasing from lower to upper tower portions.

[0022] Moreover, when tapered towers are to be obtained, according to the present invention upright elements are adopted delimiting an angle greater than 60° (for triangular cross-section towers), preferably between 60° and 75°, and greater than 90° (for square cross-section towers), preferably from 90° to 105°, between the intermediate portions 1a and 1b thereof, and in general such angle is wider the greater the taper of the upright element.

[0023] Such a solution can be applied both to conventional and tapered upright elements, as well as to upright elements provided with end portions 1 aa, 1 bb.

[0024] With reference to Figure 4, a tower having four upright elements similar to that shown in Figure 2 is illustrated, the upright elements being stiffened by screwing respective cross bars or arms 3 thereto.

An upright structural element according to the present invention can be obtained through a method comprising the following steps, not necessarily in sequence:

- providing a sheet formed by two portions or wings 1a, 1b extending at an angle from opposite sides with respect to an intermediate bending axis thereof and ending with transverse edges,
- bending the sheet according to two lateral bending axes, and
- bending the sheet along a main bending axis.

[0025] The sheet is preferably obtained through laser cutting ("hot" cutting) or through water cutting ("cold" cutting) of a metal sheet.

[0026] With such a method for producing an upright element according to the present invention, it is possible to use a material selected from the group comprising steel, carbon structural steel, stainless steel, special high tensile steel and steel commercially known as "COR-TEN (Corrosion resistance - Tensile strength). More particularly, stainless steel, high tensile steel and steel commercially known as "COR-TEN cannot be adopted in the manufacture of upright elements according to conventional processes, since these metal materials cannot be rolled. The use of such metal materials ensures a very long life (e. g. because they do not become rusty) as well as high mechanical resistance for upright elements obtained according to the present invention.

[0027] Advantageously, the main bending axis is an axis of symmetry for the metal sheet.

[0028] It should then be clear that an upright element according to the present invention ensures optimum combined bending and compressive stress performance owing to the provision of the end portions 1 aa, 1 bb.

[0029] Moreover, with tapered upright structural elements substantial saving of material is also achieved, since much less material is obviously required for top, in use, portions or sections of each upright element with respect to conventional portions or sections, whithout impairing the performance of the upright elements according to the present invention.

[0030] However, upright elements with an angle along the intermediate axis greater than 60° for triangular cross-section towers, and with a angle greater than 90° for square cross-section towers, allow cross arms to be correctly located, i.e. a each cross arm correct abutts against both its respective upright elements both at bottom and top tower zones.

[0031] The above described upright structural element is susceptible to numerous modifications and variations within the protection scope as defined by the claims.

[0032] Thus, for example, each wall or wing can have more than one end portion, e. g. a first portion inclined at 45° with respect to each wall or wing and a second portion inclined at 45° with respect to the first portion, so as to obtain a total inclination of the assembly formed by the first and the second portion of about 90° with respect to each wall or wing.

Claims

1. An upright structural element for trestle supporting towers, comprising a section bar having a couple of walls or wings (1a, 1b) inclined with respect to one another at an angle from about 60 to 120 degrees, and **characterized in that**:

- each wall or wing (1 a, 1 b) of said couple of walls or wings (1a, 1b) ends with at least one respective portion (1aa, 1 bb), each portion being inclined with respect to the relative wall or wing (1 a, 1 b), and
- at least one portion (1 aa, 1 bb) of a wall or wing (1 a, 1 b) of said couple is facing towards at least one portion (1 bb, 1 aa) of the other wall or wing (1 b, 1 a) of said couple.

2. An upright structural element according to claim 1, **characterized in that** each portion (1aa, 1bb) is inclined at a substantially perpendicular angle with respect to its respective wall or wing (1 a, 1 b).

3. An upright structural element for towers supporting electrical cables or the like, comprising a section bar having a couple of walls or wings (1 a, 1 b) inclined with respect to one another at an angle from about 60 to about 120 degrees, **characterized in that** it is substantially tapered upwards, in use.

4. An upright structural element for triangular cross-section towers, comprising a section bar having a couple of walls or wings (1a, 1b) inclined with respect to each other, and **characterized in that** each wall or wing (1 a, 1 b) of said couple of walls or wings is inclined with respect to the other wall or wing (1b, 1a), of said couple of walls or wings, at an angle from about 60° to 75°.

5. An upright structural element for squared cross-section towers, comprising a section bar provided with a couple of walls or wings (1 a, 1 b) inclined with respect to each other, **characterized in that** each wall or wing (1a, 1b) of said couple of walls or wings is inclined with respect to the other wall or wing (1b, 1 a) of said couple of walls or wings at an angle from about 90° to 105°.

6. An upright structural element according to any preceding claim, **characterized in that** said walls or wings are inclined with respect to each other along a line of symmetry of said structural element.

7. An upright structural element according to any preceding claim, **characterized in that** it is made of a material selected from the group comprising steel, structural carbon steel, stainless steel, special high tensile steel.

8. A method of obtaining an upright structural element according to any claim 1 to 7, **characterized in that** it comprises the following steps:

- providing a plane metallic sheet formed by two portions or wings extending at an angle from opposite sides with respect to an intermediate bending axis and ending with transversal edges,
- bending the sheet along to two lateral bending axes, and
- bending the sheet along said main bending axis.

9. A method according to claim 8, **characterised in that** it comprises the step of laser or water cutting out a metal sheet.

10. A method according to claim 8 or 9, **characterized in that** said main bending axis is an axis of symmetry of said sheet.

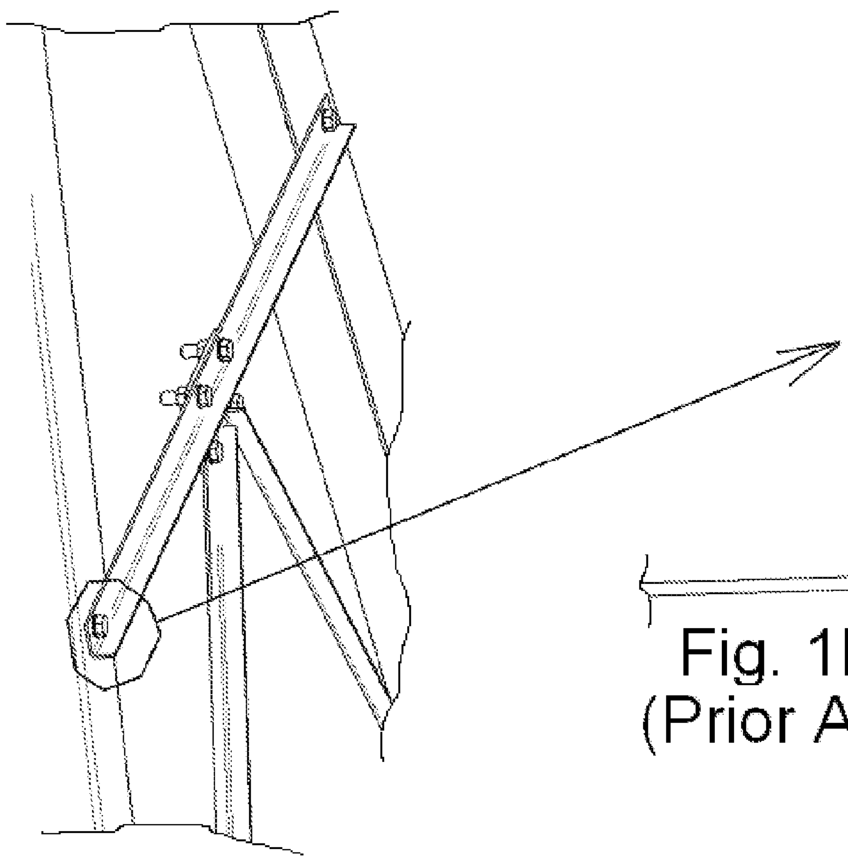


Fig. 1a
(Prior Art)

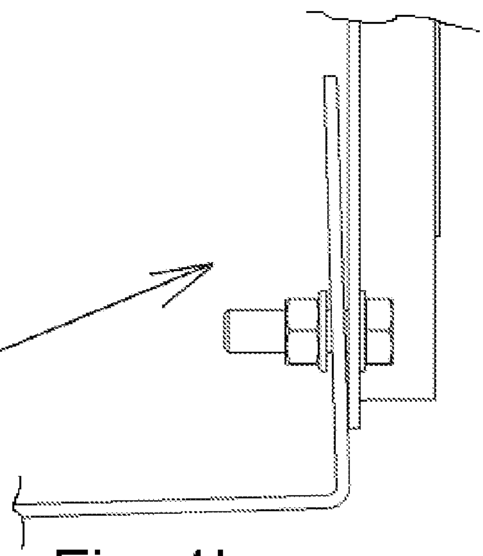
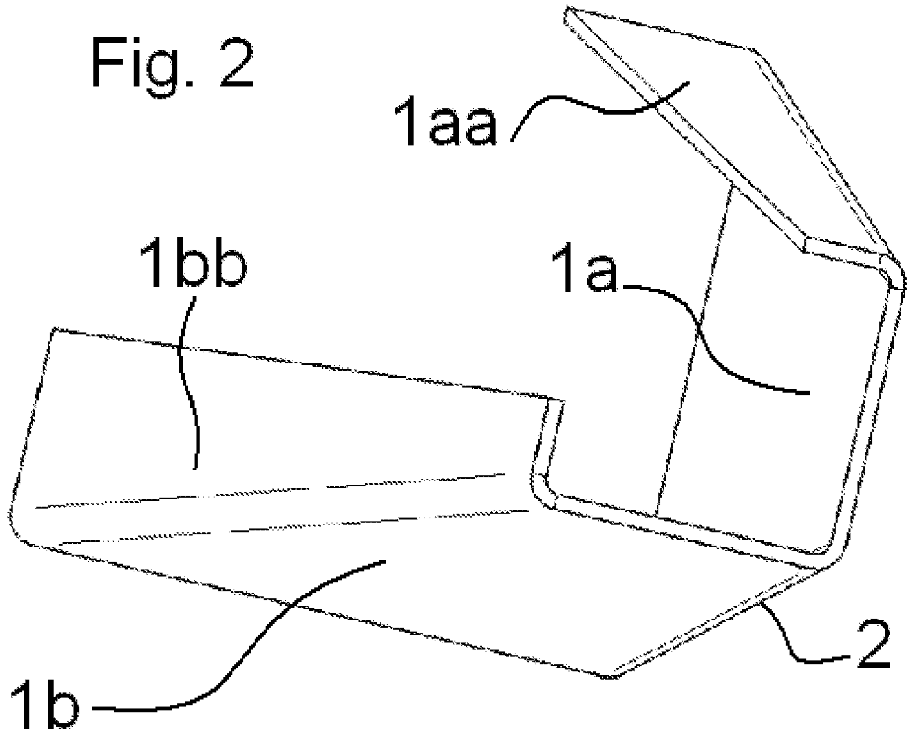


Fig. 1b
(Prior Art)

Fig. 2



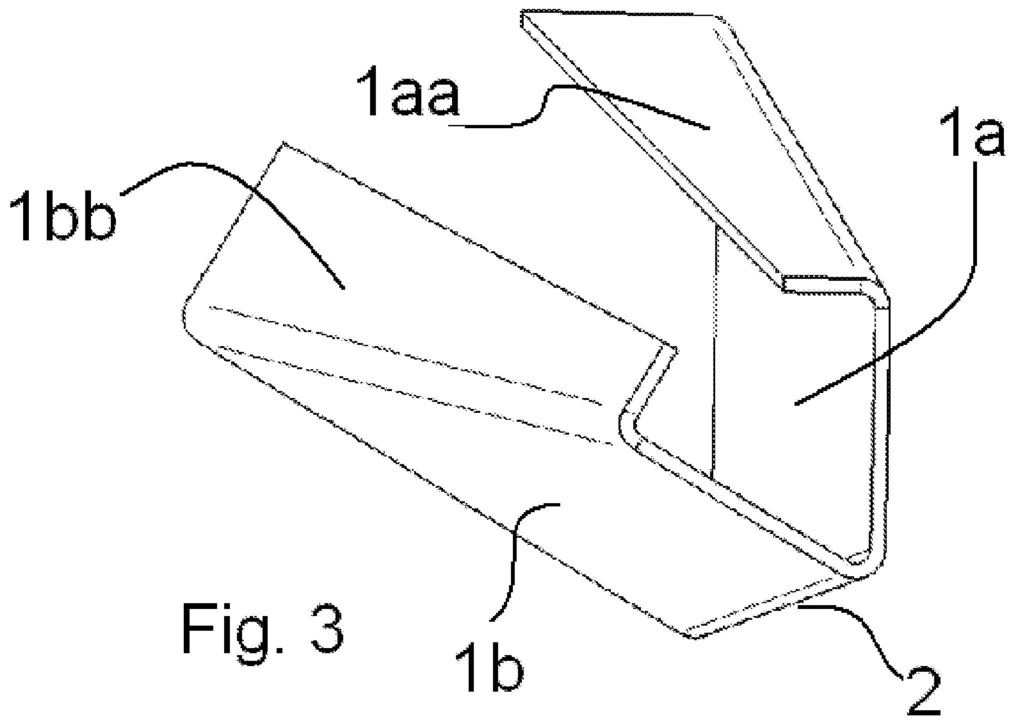


Fig. 3

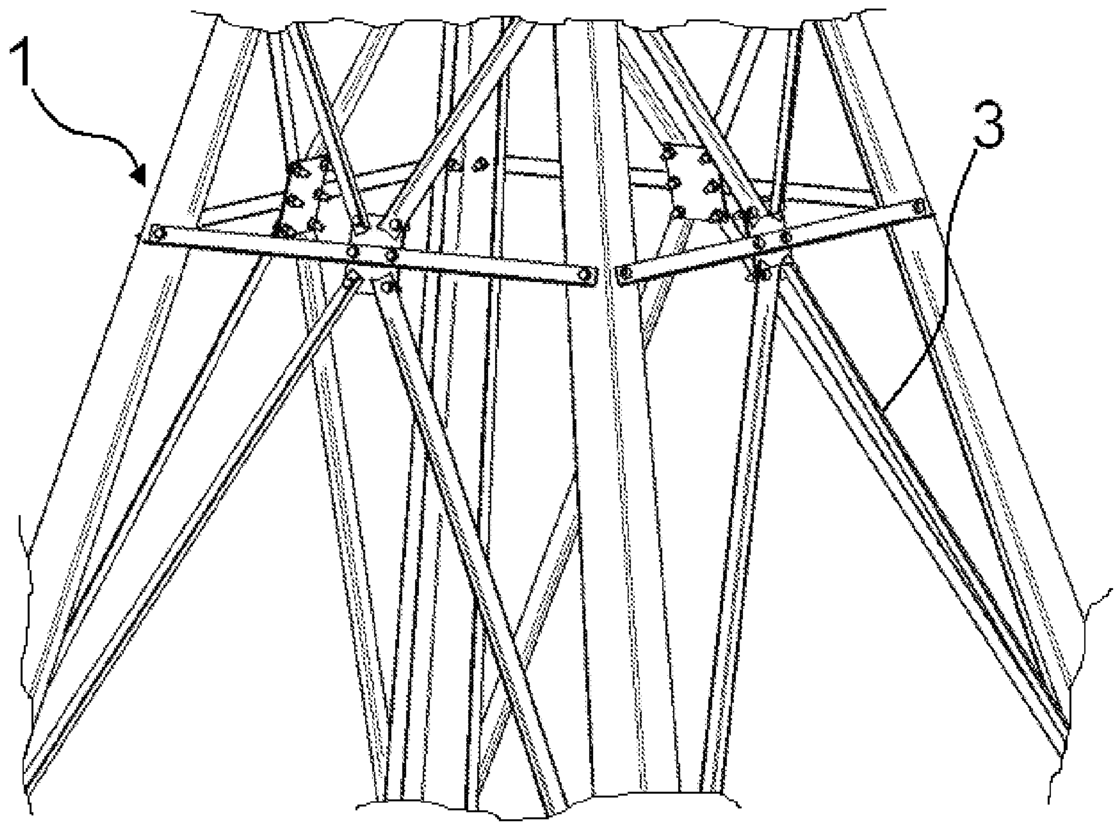


Fig. 4