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(71) Applicant: **Leone, Salvatore**
33054 Lignano Sabbiadoro (UD) (IT)

(72) Inventor: **Leone, Salvatore**
33054 Lignano Sabbiadoro (UD) (IT)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(54) Method of forming a pillar and its junction with a girder, and pillar thus obtained

(57) Method to achieve a pillar for building constructions, roads or similar, comprising a first step of preparing a containing element (44), a second step wherein into the containing element (44) a metal structure (14) is inserted, of a self-supporting type and comprising at least a first reticulated lattice (20). The first reticulated lattice (20) is arranged so that at least an upper segment thereof protrudes vertically with respect to the containing element (44) so as to be anchored to at least a main girder in correspondence with a plane (P) and thus define a structural junction (16) of a monolithic type. In a third step, a first cast of concrete (12) is made in the containing element (44) in order to drown the first reticulated lattice (20).

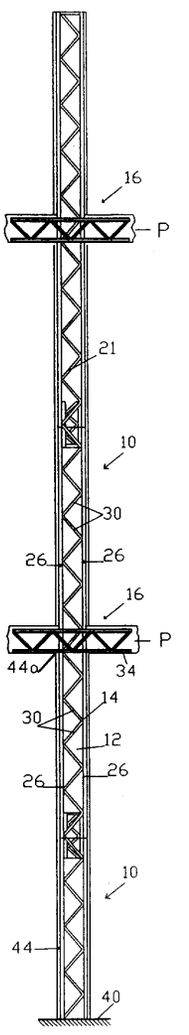

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention refers to the industrial building field, wherein prefabricated elements are used, completed on site with a cast of concrete; it concerns a method to achieve pillars and structural junctions, or nodes, with a mixed structure of steel and concrete, and the pillars thus obtained.

[0002] The pillar according to the invention consists of a self-supporting metal lattice, of a reticulated type and pre-fabricated, which is drowned in a cast of cement mix. Such metal lattice is able to be also anchored to one or more reticulated girders of the same structural category, so as thus to obtain, once drowned in the concrete with the girders, a girders-pillar junction having a homogeneous structure and guaranteeing a high level of safety in the joints.

BACKGROUND OF THE INVENTION

[0003] In the building field both prefabricated pillars made of reinforced concrete, simple or compressed, and full-walled steel pillars are known, belonging respectively to the structural categories of structures in reinforced concrete and of metal structures made of steel.

[0004] To be more exact, the structure in reinforced concrete comprises a mix of cement concrete and a metal structure consisting of a cage of metal round pieces, wherein the cage does not have its own autonomous bearing capacity and, before the cast of cement mix is consolidated, it is not able to perform any static function. This entails the double disadvantage that the positioning of the girders on such pillars is made difficult by the quantity of rods used for the metal cage, due to the fact that Italian technical regulations for reinforced concrete do not allow to use round pieces of a diameter of more than 26 mm, and that such pillars cannot be used before the days required for the seasoning of the concrete.

[0005] The reinforced concrete pillars are joined, in correspondence with the structural junctions, also to supporting girders of a known type, the so-called self-supporting reticulated girders with a "mixed structure" and drowned in the concrete, such as for example the girders known as "REP" formed by a reticulated lattice and a steel plate that constitutes an active structure and at the same time a support for the girders having the thickness of the floor and a containing formwork for the completion cast, which are described in the Italian patents n. 966.663 and 966.664 of which the Applicant is proprietor.

[0006] Said self-supporting girders, wherein the metal structure, unlike that for reinforced concrete, has a total autonomous bearing capacity even before being drowned in the cement mix, in order to achieve structural continuity and to absorb the shearing forces and negative moments, are connected to each other, in correspondence with the girders-pillar junctions, by means of iron pieces for reinforced concrete, each of which is arranged horizontally astride the pillar to join together two girders, and which is subsequently drowned in the concrete cast.

[0007] This type of connection of the girders, although it allows the structural continuity thereof, only allows to achieve it through "adherence" by means of the concrete.

[0008] Other types of reticulated girders with a mixed structure are known which, in order to achieve the aforementioned structural continuity, in correspondence with the girders-pillar junctions use the lattices of the girders themselves, which surmount the pillars and extend into the contiguous bays for the length necessary to absorb the joint moments, such as REP girders of the "TR" type as per the Italian patent n. 1.267.961 and the so-called "offset" REP girders, as per the Italian patent n. 1.175.872, of which the Applicant is proprietor.

[0009] Moreover, the Italian patent n. 1.278.613 discloses reticulated lattices for completion and connection purposes which, in correspondence with the junctions, are associated with the base girders and positioned on site astride the pillars, which for some years now have been used with the girders described in the Italian patent n. 966.663 to replace the pieces for reinforced concrete.

[0010] Both the REP girders of the "TR" type and the so-called "offset" girders, with or without connecting lattices, have the disadvantage that in correspondence with the junctions they do not achieve a total structural continuity between the horizontal and vertical structures. This even though such girders allow to obtain a mixed structure of steel-concrete also in correspondence with the girders-pillar junctions, and guarantee a greater level of safety in the joints due to the anchorage of the girders in the concrete. This anchorage, in known girders, is achieved through the cores of the lattices, which oppose the sliding actions between the concrete and the rod, functioning like the connectors provided in full-walled steel girders in order to make the metal girder solid with the concrete slab. This is due to the fact that the horizontal structures are made solid with the contiguous pillars only through adherence by means of the concrete, and no anchorage is possible with the structure of the pillar itself.

[0011] Pillars made of reinforced concrete with a prefabricated structure are also known, such as the one described in the Italian patent n. 1.123.965, which allows to cast on site, and simultaneously, the bearing structure and the walls, both external and dividing. In fact, such known pillars are equipped with profiles which serve as guide in order to insert the disposable formworks to contain the concrete cast, both of the pillar and of the walls. Even in the case of walls of considerable length, the panels of the walls can be reinforced by means of an inner frame consisting of profiles connected by round pieces, arranged plane and conformed in a zigzag. This known type of pillar also leaves the problem of structural

continuity in the girders-pillar junction totally unsolved.

[0012] Pillars belonging to another category are also known, which are based on the collaboration between concrete and steel and have a static functioning scheme similar to that of a reinforced concrete structure, and which consist of tubular elements made of steel and filled with concrete, in which each tubular element consists of a steel sheath that constitutes the structure of the pillar and at the same time acts as a formwork that prevents transverse dilatation of the concrete.

[0013] So-called "circled" pillars are also known, consisting of tubular steel elements, reinforced with longitudinal iron round pieces, such as the "PCM" pillar as per the Italian patent n. 1.266.538, wherein each tubular steel element acts only as a formwork for the cast and, due to the circling effect of the sheath, as a containment for the concrete to prevent the transverse dilatation thereof. In this pillar the tubular element has no vertical static function, and therefore in this solution too the metal structure consisting of the longitudinal round pieces has no bearing capacity of its own, autonomous from the association with the concrete; moreover the connection between the girders through the pillar, which is achieved by means of continuing rods, occurs through adherence with the cement concrete.

[0014] Moreover, both the tubular pillars and the circled pillars reinforced with longitudinal rods adjacent to the sheath, in which the structure is not adequately protected from fire, have the disadvantage that they must be treated with fire-proofing paints.

[0015] The Applicant has devised and embodied the present invention to overcome the shortcomings of the state of the art and to give also to prefabricated pillars the advantages typical of those made on site, such as being able to create a rod-covering layer of the centimetres needed for the REI, or FRT (Fire Resistance Time), required in the work.

SUMMARY OF THE INVENTION

[0016] The present invention is set forth in the main claims, while other innovative characteristics of the present invention are disclosed in the dependent claims.

[0017] One purpose of the present invention is to perfect a method to achieve a pillar wherein the structure is self-supporting even during the first step, that is to say, that it has a bearing capacity autonomous from the cement mix in which it is drowned, and that it can be made solid with the girders not only through adherence but also through "anchorage" in the concrete, so as to obtain a girders-pillar structural junction, or node, of great safety and reliability.

[0018] Another purpose is to achieve a pillar which can belong to the same structural category as the girders with which it is associated, so as to obtain in the building a structural homogeneity of all the supporting elements that, in substance, defines a structure of monolithic type.

[0019] In accordance with these purposes, the pillar according to the present invention is of the mixed structure type and comprises a metal structure made of steel of the self-supporting type, which on site is drowned in a concrete mix. The aforesaid metal structure comprises at least a first reticulated lattice arranged vertically, which is inserted inside a mould, or formwork, or metal sheath, to be drowned in the concrete. The reticulated lattice consists of metal elements having a transverse section of whatever form, such as round, square or otherwise.

[0020] An upper segment of such first reticulated lattice protrudes from the formwork and is equipped with a device, advantageously consisting of two other reticulated lattices arranged horizontal and able to flank the girders converging in the junction that define the horizontal structure of a determinate plane. These other two horizontal lattices can also be anchored to the lattices of the girders converging in the junction, for example by means of welding, or tying. In a preferential embodiment, the first reticulated lattice, consisting of the longitudinal rods connected to the four sides of the cores conformed in a diagonal, for a certain segment above the determinate horizontal plane comprises only a pair of opposite cores, with respect to the average vertical plane passing through the center line of the pillar, arranged in a direction parallel to the main girders converging in the junction.

[0021] To be more exact, the cores that connect the vertical longitudinal elements of the lattice are arranged for said segment only in the direction parallel to the main girders, so that the structure has two free sides which define an open intermediate compartment, in which it is possible to position one or more girders, lowering them in from above.

[0022] In a preferential embodiment of the invention, on the reticulated lattice of the structure, in correspondence with the girder-pillar junction, two horizontal metal lattices are attached by means of welding. Advantageously the aforesaid metal lattices also have a reticulated structure and each one of them comprises one or more lower longitudinal elements and one or more upper longitudinal elements connected by a diagonal core.

[0023] Such horizontal lattices can also be connected to each other, at the outer sides protruding from the pillar, by means of transversal stiffening cross brackets or by means of a steel plate, which can also be a support for the girders as described in the Italian patents n. 966.663 and 966.664.

[0024] Said horizontal lattices can also be anchored, for example by means of welding or tying, to the reticulated lattices of the main girders converging in the junction and/or to the lattices connecting the girders, and can also be anchored to the ends of the secondary girders arriving in the other direction.

[0025] Such anchorage, which by itself allows to achieve a monolithic metal structure, is then completed with the concrete cast.

[0026] In other words, both the girders converging in the junction and also the pillar have a structure of "mixed" type, so that in correspondence with the girder-pillar junction a joint is achieved which is much safer and more reliable than the one obtained, through adherence only, with the reinforced concrete pillars of a traditional type.

[0027] The pillar according to the invention can be also used advantageously in combination with reinforced concrete girders, because the horizontal lattices protruding at the outer sides of the pillar, which cross the junction without joints and anchor, by means of the cores of the lattices, beyond the face opposite to the intersection face, cause a secure structural continuity of the girders, and at the same time respect the norms laid down for declared seismic zones.

[0028] In one form of embodiment of the invention, the metal structure consists of several reticulated lattices, of a prefabricated type, and comprises in particular one or more reticulated lattices, which are axially coupled one on the other when the pillar is realized.

[0029] Advantageously, the reticulated lattices are sized according to the height of the plane, so that their coupling point is in correspondence with the point of zero moment of the pillar, that is, in the intermediate zone between two girder-pillar junctions.

[0030] In a preferential embodiment, on the first vertical lattice a second reticulated lattice is coupled, having the same size and a reticulated structure closed on all sides, as far as the plane.

[0031] Advantageously the connection between the two reticulated lattices is made by means of a bayonet coupling. In this case, the upper end of the first lattice, or the lower end of the second lattice, have a reduction in section to allow a stable coupling of the second lattice on the first lattice.

[0032] According to a variant, the connection between the first and the second lattice is achieved by means of a third connecting reticulated lattice welded inside the first or second lattice.

[0033] According to another variant, the first reticulated lattice can be multiplane. In this case the double pair of opposite cores consisting of the diagonal meshes which connect the longitudinal rods include, for a certain section, in the direction parallel to the girders, a window that allows to insert, into the vertical lattice between the two horizontal lattices, some reticulated girders with a mixed structure; said girders are of the type described in the Italian patents n. 966.663 and n. 966.664.

[0034] According to another characteristic, the square or rectangular pillar according to the invention as described above has a great resistance to fire (REI), comparable to that of reinforced concrete pillars of a traditional type, which can easily be obtained by creating a rod-covering layer of the thickness required for the class of REI required in the work, by means of sizing the formwork containing the concrete cast with respect to the metal lattice itself.

[0035] In another embodiment, which pre-supposes the use of supporting tubular elements filled with concrete as structure, in order to make the girders-pillar junction only one portion of the first lattice is used, on which the two horizontal lattices are welded. This segment is inserted into the tubular element before the filling concrete cast and on it, after the concrete cast of the plane has been made, the tubular element of the subsequent plane is then inserted and made solid with the lower tubular element in known manner, by means of the upper and lower flanges with which tubular pillars are normally equipped.

[0036] In all the solutions described above, the pillar and the structural junction achieved according to the present invention can be calculated advantageously as elements to dissipate seismic energy.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] These and other characteristics of the present invention will become apparent from the following description of some preferential forms of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

- fig. 1 is a longitudinal section of a pillar according to the invention, formed by two elements arranged one above the other;
- fig. 2 is a right lateral view of the metal structure of the pillar in fig. 1;
- fig. 3 is a front view of the dis-assembled metal structures of the pillar in fig. 1;
- fig. 4 is a right lateral view of the metal structures in fig. 3;
- fig. 5 is a plane section of the metal structure in fig. 2;
- fig. 6 shows the step of installing two metal girders on the structure in fig. 5;
- fig. 7 is a partial and perspective view of a pillar according to the present invention during the installation step, wherein the anchorage can be seen of two girders with the horizontal lattices that surmount the pillar;
- fig. 8 is a front view of a variant of the dis-assembled metal structures in fig. 3;
- fig. 9 is a front view of the assembled metal structures in fig. 8;
- fig. 10 is a right lateral view of the metal structures in fig. 9;
- fig. 11 is a front view, partly in section, of a pillar formed by two tubular elements, arranged one above the other, according to a variant of fig. 1;
- fig. 12a is a plane view of the inner structure of the pillar in fig. 11;
- figs. 12b and 12c show the step of installing the girders and connecting lattices on the structure in fig. 12a;
- fig. 13 is a front view of the dis-assembled metal

structures of the pillar in fig. 11;

- fig. 14 is a front view of the metal structures of the pillar in fig. 11 in assembled position;
- fig. 15 is a right lateral view of the metal structures of the pillar in fig. 14, without the horizontal girders.

DETAILED DESCRIPTION OF SOME PREFERENTIAL FORMS OF EMBODIMENT ACCORDING TO THE PRESENT INVENTION

[0038] With reference to fig. 1 a pillar 10 according to the present invention comprises a cement concrete mix 12 inside which a self-supporting metal structure 14 is drowned, made of steel for welded structures.

[0039] The metal structure 14 (figs. 2, 3, 4) consists of at least a first reticulated lattice 20 and has its own bearing capacity, autonomous from the mix 12.

[0040] According to a characteristic feature of the present invention, the first reticulated lattice 20 comprises at least an upper segment 20a which protrudes upwards from the mix 12 in order to be anchored in a junction, or node, zone 16 (fig. 1), in correspondence for example with a horizontal plane P of a building, with a pair of horizontal girders 18a, 18b (figs. 6-7), as will be described in more detail hereafter.

[0041] The first reticulated lattice 20 is of the double type (figs. 2, 3 and 4) and above the plane P comprises two cores 21, 22 which extend axially, parallel to each other, in an opposite position with respect to a vertical center line plane M (fig. 2) of the pillar 10 and which define an intermediate compartment 31 open on two opposite sides.

[0042] Each core 21, 22 is included between a first and a second pair of longitudinal elements 26 and 28, which are parallel to each other and consist in this case of a pair of profiles, with a section of round, square or any other shape. Each core 21, 22 comprises a plurality of first diagonal rods 30 (figs. 5-7) which are welded at the ends to the longitudinal elements 26, 28 so as to form two reticulated meshes.

[0043] The longitudinal elements 26, 28 are also connected, below the junction zone 16 (fig. 2), by means of second diagonal rods 32, which close the intermediate compartment 31 at the front and form with the first diagonal rods 30 a closed reticule to reinforce the metal structure 14. This encourages the support of the horizontal girders 18a, 18b by the metal structure 14.

[0044] According to another characteristic feature of the present invention, a pair of horizontal lattices 34, 36, parallel to each other and made for example of Fe 510 C type steel, are fixed to the metal structure 14, for example by means of welding. To be more exact, the two horizontal lattices 34, 36 are arranged on the two outer sides of the longitudinal elements 26, 28 of the first reticulated lattice 20 and, between them, in the compartment 31, the girders 18a, 18b are able to be inserted and anchored. The horizontal lattices 34 and 36 can also be connected to each other by means of a metal plate, or by means of stiffening cross brackets, which are welded in the lower part of the horizontal lattices 34 and 36.

[0045] The first reticulated lattice 20 is able to be associated, during the making of the pillar 10, with a second lower reticulated lattice 120 (figs. 2-4), which in turn is anchored to a foundation, or bottom plane 40.

[0046] To be more exact, the second reticulated lattice 120 has a reticulated structure closed on the four sides, and for the whole of its length, by respective first and second diagonal rods 130, 132.

[0047] The connection between the first and the second reticulated lattice 20, 120 is obtained, in this case, by means of a third connecting lattice 220 smaller in size than the first two, which is partly inserted firstly inside the second reticulated lattice 120 and subsequently closed at the top by the first reticulated lattice 20.

[0048] The connecting lattice 220 is also closed on all four sides by means of diagonal rods 230, 232.

[0049] According to a variant, not shown in the drawings, the connection between the first reticulated lattice 20 and the second reticulated lattice 120 is obtained by means of a reduction in section of the upper terminal portion of the second reticulated lattice 120. This solution can be used when the longitudinal elements 26, 28 have a relatively limited section, so that it is possible to bend them slightly towards the inside.

[0050] It is clear that within the field of the present invention a plurality of reticulated lattices can be used, inserted axially one on the other, wherein the first reticulated lattice 20 is provided with the horizontal lattices 34, 36 to anchor horizontal girders 18a, 18b. It is also clear that by coupling a plurality of prefabricated reticulated lattices 20, 120, 220 it is possible, according to the present invention, to make pillars 10 of great size and absolute resistance in a very short time.

[0051] In the event that above the horizontal plane P, and on the same median plane M, another pillar 10 has to be anchored, the segment 20a extends beyond the plane P, thus defining a cross-like structure with the first reticulated lattice 20 and the horizontal lattices 34, 36.

[0052] Moreover, in the case of several pillars 10, arranged one above the other, thanks to the intermediate position of the horizontal lattices 34, 36 of the first reticulated lattice 20, the connection with the second lower reticulated lattice 120 and with a possible third lattice 220 is made in correspondence with the point of zero moment between the plane P and the foundation 40, and therefore far from the junction zone 16, as laid down by the legislation at present in force in Italy.

[0053] For example, according to a variant shown in figs. 8, 9 and 10, the first reticulated lattice 20 is multiplane, is closed on all four sides by means of diagonal rods 30, 32, and in correspondence with the junction zone 16 and the upper segment 20a it has, in the direction parallel to the girders, an aperture 131, or window, which allows to insert the girders 18a, 18b, positioned between the two horizontal lattices 34, 36.

[0054] In this case the connecting lattice 220 is partly

inserted first inside the first reticulated lattice 20 and subsequently into the second reticulated lattice 120.

[0055] We shall now describe the method to make the pillar 10 and the subsequent anchorage thereof to the girders 18a, 18b (figs. 1-7).

[0056] In a first step, around the second reticulated lattice 120, anchored to the foundation 40, a square or rectangular containing formwork 44 is prepared in a known manner, having the size of the pillar to be made. Subsequently, inside the containing formwork 44 the second reticulated lattice 120 is inserted inside which the connecting lattice 220 is welded. Then the first reticulated lattice 20, already provided with its horizontal lattices 34, 36 is inserted on the connecting lattice 220, so as to complete the metal structure 14 between the foundation 40 and the plane P.

[0057] To be more exact, the horizontal lattices 34, 36 are made to rest on the upper end 44a of the containing formwork 44.

[0058] The sizes of the metal structure 14 and the relative formwork 44 are chosen so that their relative distance is such as to ensure the pillar 10 an adequate thickness of rod-covering layer, and such as to give the pillar, once covered by the concrete cast 12, a class of resistance to fire (REI) corresponding to that required by the work.

[0059] In a subsequent step, the horizontal girders 18a, 18b are inserted into the compartment 31 of the metal structure 14. To be more exact, the girders 18a, 18b can consist of reticulated lattices 50 and 52 (fig. 6) of a double type, which surmount the pillar 10 in the junction, and of a possible lower steel plate 56, flush with the pillar, which constitutes the structure for the girder and at the same time functions as a support for the floors and a containing formwork for the cast.

[0060] Alternatively, a concrete bottom is provided in the girders 18a, 18b instead of the lower plate 56.

[0061] According to a variant shown in fig. 7, the girders 18a and 18b comprise respectively a lower plate 56, flush with the pillar with a supporting end, and a base lattice 51, of a single type, which are connected to each other, in correspondence with the junction zone 16, by means of a pair of connecting reticulated lattices 54 of a known type.

[0062] It is clear that modifications and/or additions may be made to the pillar 10 and the relative method to make it as described heretofore, without departing from the field of protection of the present invention.

[0063] According to another variant (figs. 11-15), a pillar 110 comprises a structure 114 consisting of a first tubular supporting element 114a, made of steel, inside which, in correspondence with the girder-pillar junction zone 16, a reticulated lattice 111 is inserted of a smaller size than the first tubular element 114a itself, and having a portion 111a that emerges with respect to a plane P. To be more exact, the tubular element 114a also acts as a containing formwork for the concrete 12.

[0064] Above the tubular element 114a, also protruding on the outer sides of the reticulated lattice 111, the two horizontal lattices 34, 36 are welded.

[0065] The reticulated lattice 111 is inserted into the tubular element 114a (fig. 12a and 13), and a first concrete cast 12 is made. Subsequently, after the girders 18a, 18b and the possible connecting lattices 54 (fig. 12b and 12c) have been installed, the cast of concrete is done to make the plane P.

[0066] In a second step, a second tubular supporting element 114b of a second pillar 110 is inserted on the reticulated lattice 111 in order to make a subsequent plane. The second tubular element 114b is made solid with the lower pillar 110 in a known manner, by means of flanges 115 respectively upper and lower.

Claims

1. Method to achieve a pillar for building constructions, roads or similar, comprising a first step of preparing a containing element (44), **characterized in that** it comprises a second step wherein into said containing means (44) a metal structure (14) is inserted, of a self-supporting type and comprising at least a first reticulated lattice (20, 111), arranged so that at least an upper segment (20a, 111a) thereof protrudes vertically with respect to said containing means (44) so as to be anchored to at least a main girder (18a, 18b) and thus define a structural junction, or node, (16) of a monolithic type, and a third step wherein a first cast of concrete (12) is made in said containing means (44) in order to drown said first reticulated lattice (20, 111).

2. Method as in claim 1, **characterized in that** said first reticulated lattice (20) comprises at least a pair of cores (21, 22) opposite and parallel to each other, which are able to define an intermediate compartment (31) into which, in correspondence with said upper segment (20a), said at least one main girder (18a, 18b) is inserted.

3. Method as in claim 1 or 2, **characterized in that** said first reticulated lattice (20) is associated with a second reticulated lattice (120) anchored in a foundation or in a lower plane (40).

4. Method as in claim 3, **characterized in that** said first reticulated lattice (20) is coupled bayonet-wise in said second reticulated lattice (120).

5. Method as in claim 3, **characterized in that** said first reticulated lattice (20) is connected to said second reticulated lattice (120) by means of a third connecting reticulated lattice (220) smaller in size than said first and said second reticulated lattice (20, 120), and **in that** said third connecting reticulated lattice (220) is inserted partly both inside said first

reticulated lattice (20) and also inside said second reticulated lattice (120).

6. Method as in any claim from 3 to 5 inclusive, **characterized in that** said first reticulated lattice (20) and said second reticulated lattice (120) are superimposed one above the other in correspondence with the point of zero moment of the pillar of the plane.

7. Method as in any claim hereinbefore, **characterized in that** to said upper segment (20a) of said first reticulated lattice (20) is fixed at least a horizontal reticulated lattice (34, 36) protruding at the two sides of said first reticulated lattice (20) and on which at least a main girder (18a, 18b) is anchored.

8. Method as in claim 7, **characterized in that** a pair of horizontal metal reticulated lattices (34, 36), parallel to each other and protruding at the two sides of said first reticulated lattice (20), are fixed orthogonally to said upper segment (20a) of said first reticulated lattice (20).

9. Method as in claims 2 and 8, **characterized in that** said horizontal reticulated lattices (34, 36) are welded on the longitudinal elements of said first reticulated lattice (20).

10. Method as in any claim from 7 to 9 inclusive, **characterized in that** said main girder (18a, 18b) is of the reticulated metal type and is anchored to a corresponding horizontal reticulated lattice (34, 36) in order to define a substantial structural continuity between said main girder (18a, 18b) and said metal structure (14) in correspondence with said junction (16).

11. Method as in claim 10, **characterized in that** after said main girder (18a, 18b) has been anchored to said metal structure (14) a second cast of cement concrete is made.

12. Method as in claim 10, **characterized in that** said cast of cement concrete is made after said main girder (18a, 18b) has been anchored to the metal structure (14), in order to achieve simultaneously a homogeneous mixed structure, common to said pillar (10) with said main girder (18a, 18b).

13. Method as in claim 1, **characterized in that**, before said cast of cement concrete, said first reticulated lattice (111), which is fixed to two horizontal reticulated lattices (34, 36), is inserted in a tubular metal supporting element (114a), which also functions as a containing means.

14. Method as in claim 13, **characterized in that**, after said first cast of cement concrete and a subsequent cast of cement concrete of a plane (P), a second tubular element (114b) of a subsequent pillar (110) is inserted on said upper segment (111a), and is made solid with the lower pillar (110) by means of corresponding flanges (115).

15. Pillar for building constructions, comprising an internal metal structure (14, 114) drowned in a concrete mix (12), **characterized in that** said metal structure (14, 114) comprises at least a first reticulated lattice (20, 111) anchored to the foundations.

16. Pillar as in claim 15, **characterized in that** said first reticulated lattice (20, 111) comprises an upper segment (20a, 111a) which protrudes with respect to said concrete mix (12) so as to be anchored to at least a main girder (18a, 18b) and define a structural junction, or node, (16) of a monolithic type.

17. Pillar as in claim 15 or 16, **characterized in that** said first reticulated lattice (20, 111) comprises at least a first pair of cores (21, 22) parallel and opposite with respect to a median plane (M) passing through the center line of said metal structure (14).

18. Pillar as in claim 17, **characterized in that** each of said cores (21, 22) comprises a plurality of first diagonal rods (30) fixed to two vertical longitudinal elements (26, 28) arranged parallel to each other, so as to form two walls with opposite triangular meshes, between which an intermediate compartment (31) of a through type is made.

19. Pillar as in claim 17, **characterized in that** said first reticulated lattice (20) is at least partly closed on the four sides and comprises a second pair of cores, orthogonal to said first pair of cores (21, 22) and having second diagonal rods (32) that close said intermediate compartment (31), so as to form a reticule with triangular meshes on all said four sides.

20. Pillar as in any claim from 16 to 19 inclusive, **characterized in that** to said upper segment (20a) of said first reticulated lattice (20) is fixed at least a horizontal reticulated metal lattice (34, 36) which protrudes at the two sides of the first reticulated lattice (20) on which at least said one main girder (18a, 18b) is anchored.

21. Pillar as in claim 20, **characterized in that** a pair of horizontal reticulated metal lattices (34, 36), parallel to each other, are fixed orthogonally to said upper segment (20a) of said first reticulated lattice (20).

22. Pillar as in claim 21, **characterized in that** said horizontal reticulated lattices (34, 36) are welded on the longitudinal elements (26, 28) of said metal struc-

ture (14).

23. Pillar as in any claim from 20 to 22 inclusive, **characterized in that** said main girder (18a, 18b) is of the reticulated metal type and is anchored to a corresponding horizontal reticulated lattice (34, 36) in order to define a substantial structural continuity between said main girder (18a, 18b) and said metal structure (14) in correspondence with said junction (16), and thus define a structural junction (16) of a monolithic type.

24. Pillar as in any claim from 20 to 23 inclusive, **characterized in that** said horizontal reticulated lattices (34, 36) are able to be connected to each other, at the two sides protruding from the pillar, by means of cross stiffening brackets or a steel plate (56).

25. Pillar as in any claim from 15 to 24 inclusive, **characterized in that** it comprises a second reticulated lattice (120) coupled axially with said first reticulated lattice (20).

26. Pillar as in claims 16 and 25, **characterized in that** said second reticulated lattice (120) has four sides and is closed on all said four sides and substantially for the whole of its length in order to obtain a reinforcement of said metal structure (14) below said junction (16).

27. Pillar as in claim 25 or 26, **characterized in that** the longitudinal elements (26, 28) of at least one of the two of said first reticulated lattice (20) and said second reticulated lattice (120) are bent in correspondence with one end in order to obtain a narrower section and allow a bayonet joint between said first reticulated lattice (20) and said second reticulated lattice (120).

28. Pillar as in any claim from 25 to 27 inclusive, **characterized in that** it comprises a third connecting reticulated lattice (220) which connects said first reticulated lattice (20) to said second reticulated lattice) (120).

29. Pillar as in claim 16, **characterized in that** said metal structure (114) comprises at least a tubular supporting element (114a, 114b) functioning as a containing means, in which said mix (12) is contained and into which said first reticulated lattice (111) is inserted, so that said upper segment (111a) emerges.

30. Pillar as in claim 29, **characterized in that** said first reticulated lattice (111) has a reduced length with respect to said tubular element (114a, 114b).

31. Pillar as in claim 16, **characterized in that** said first reticulated lattice (20) is multiplane and is closed on all sides by means of diagonal rods (30, 32) and **in that** in correspondence with said junction (16) and with said upper segment (20a) it has an aperture, or window, into which said main girders (18a, 18b) are able to be inserted.

32. Pillar as in any claim from 15 to 31 inclusive, **characterized in that** said first reticulated lattice (20, 111) is equipped with an anti-seismic dissipater or shock-absorber.

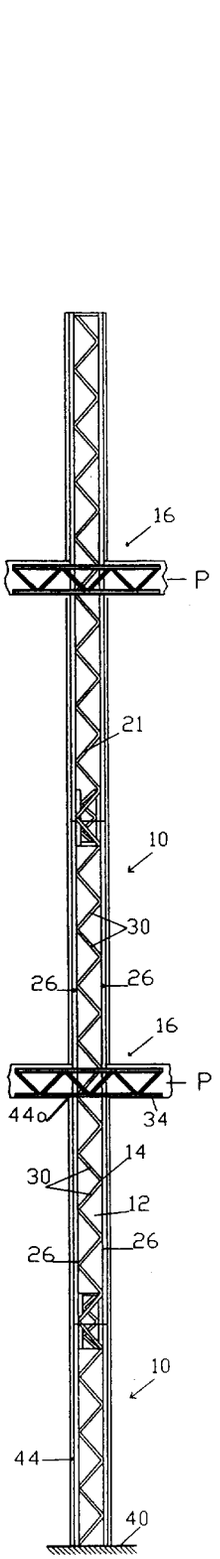

Fig. 1

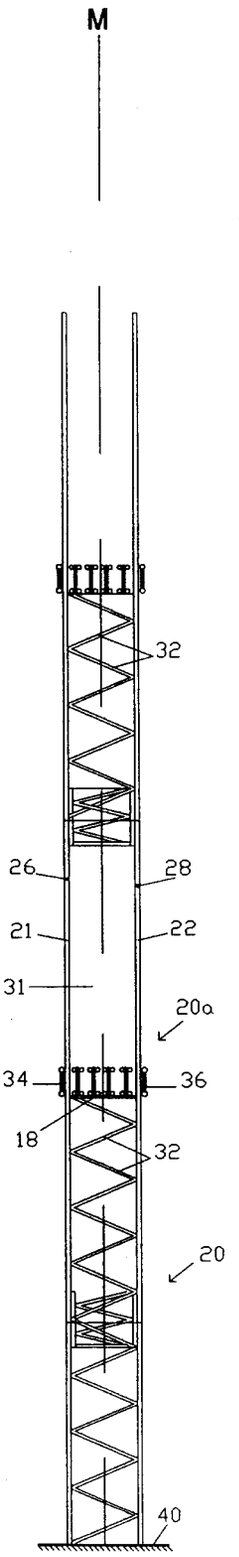

Fig. 2

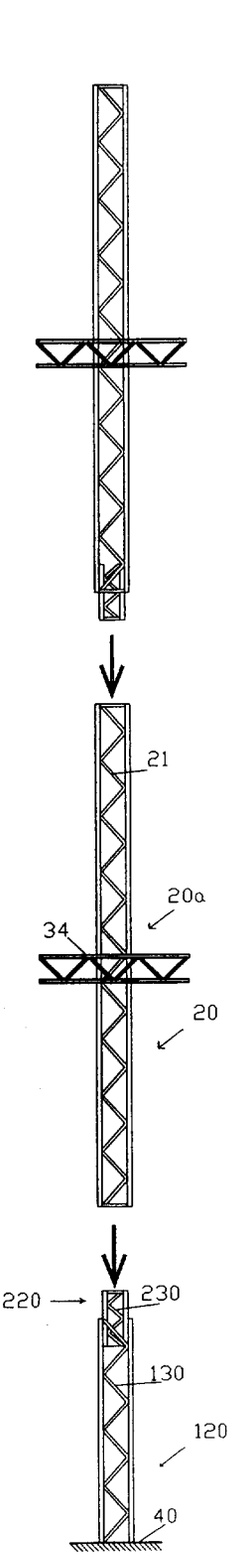

Fig. 3

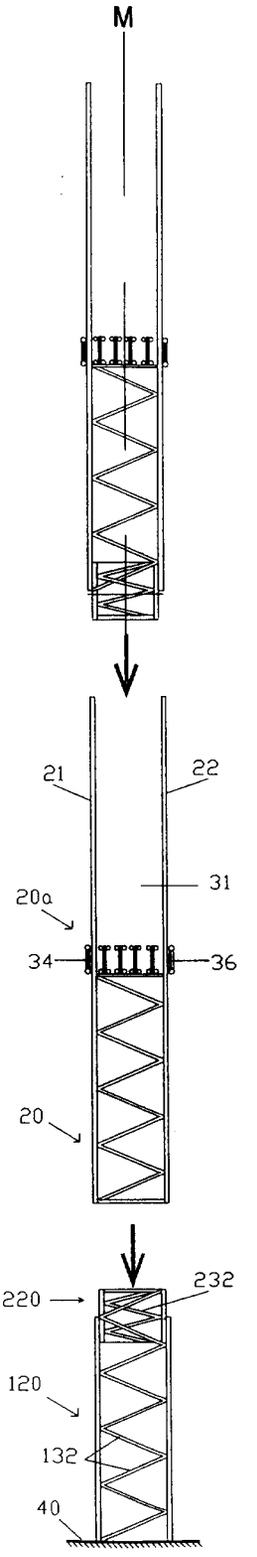

Fig. 4

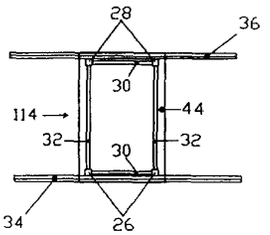

Fig. 5

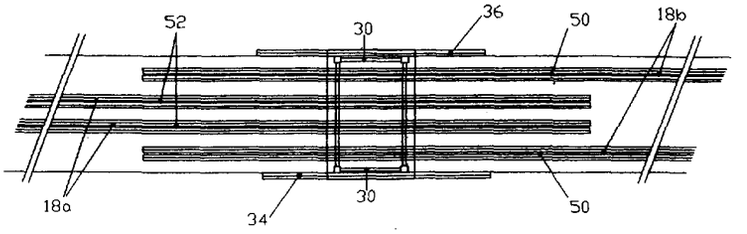

Fig. 6

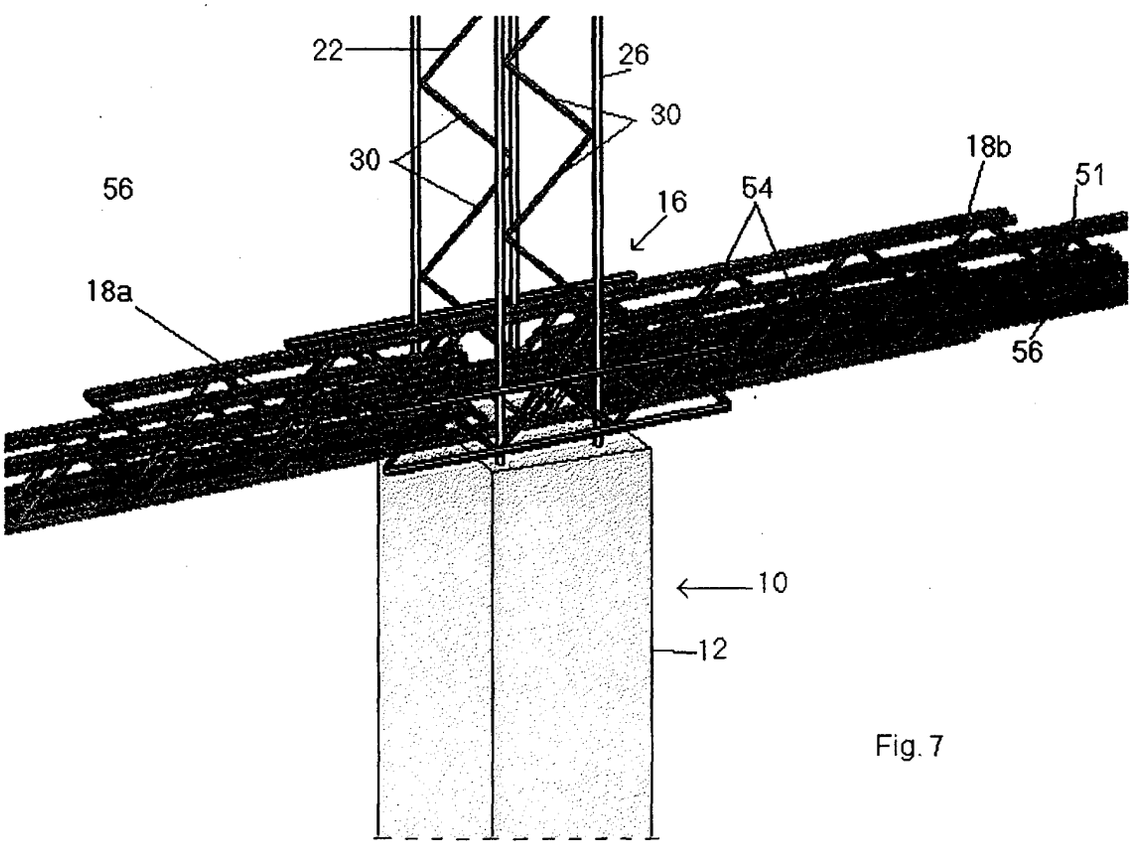

Fig. 7

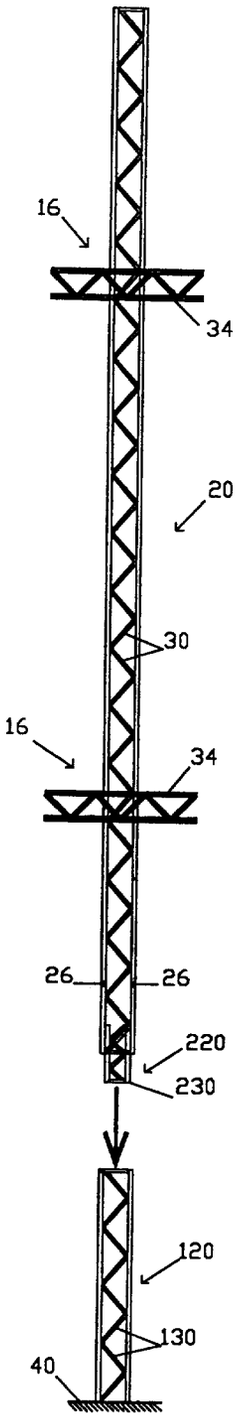

Fig. 8

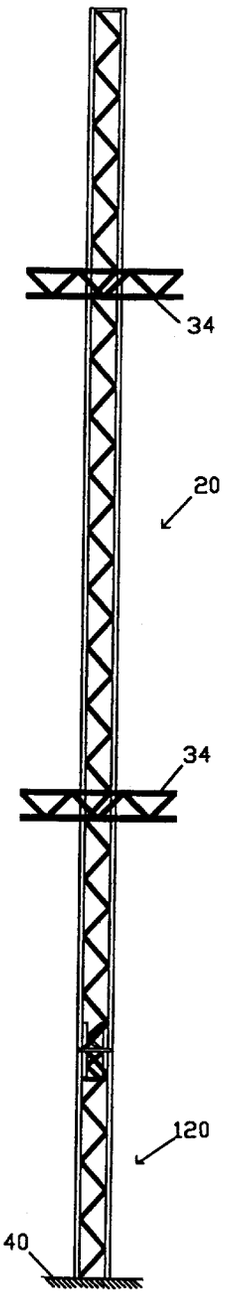

Fig. 9

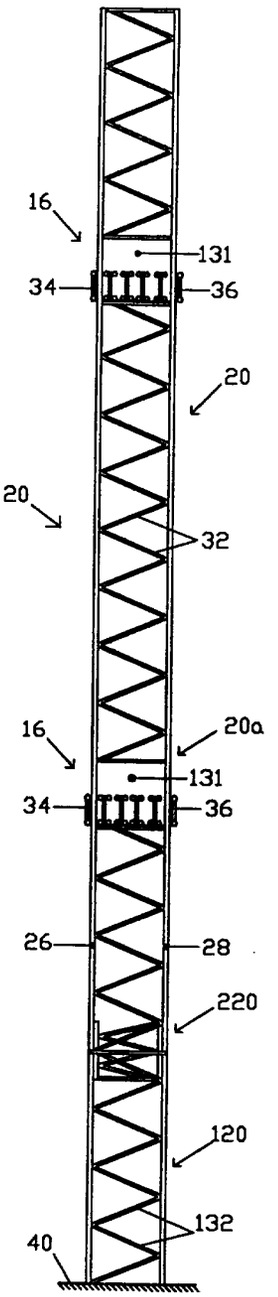

Fig. 10

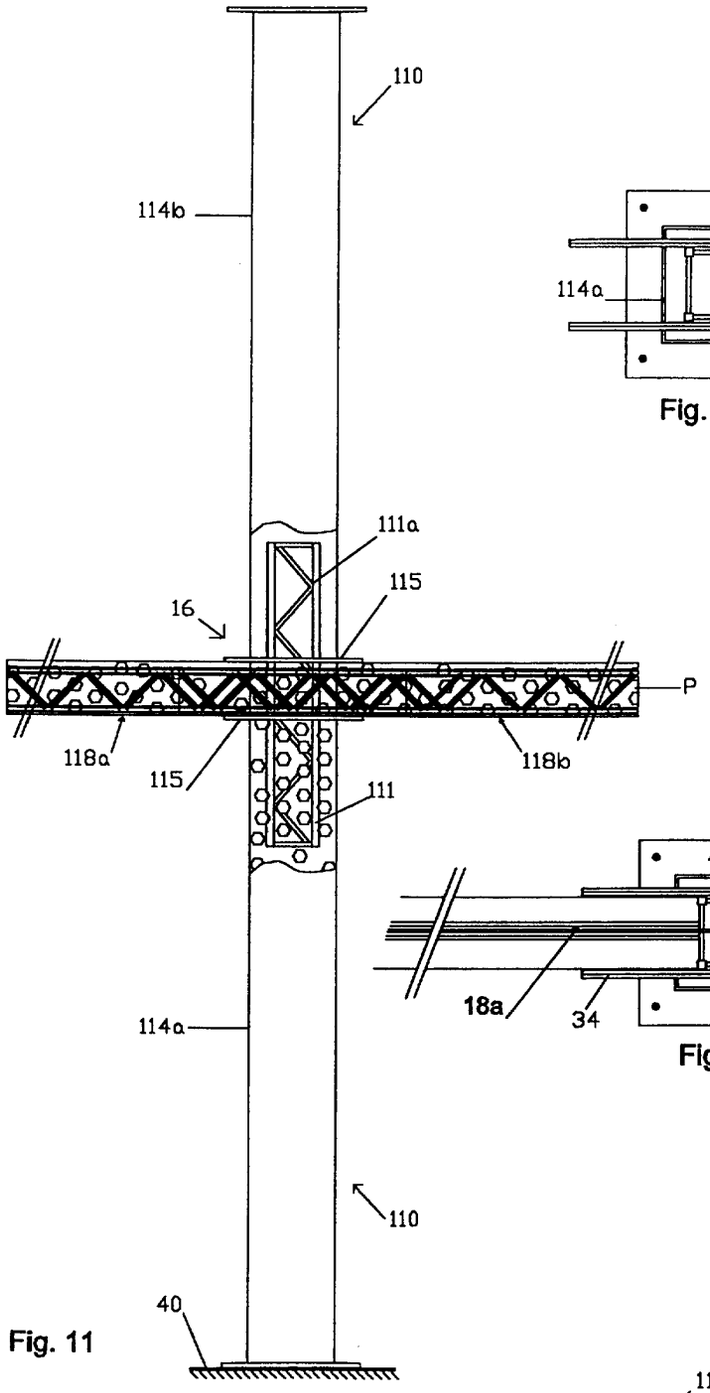

Fig. 11

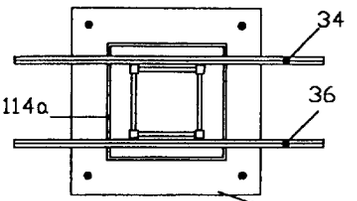

Fig. 12 a

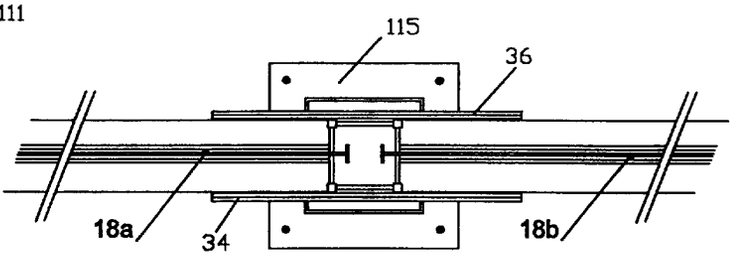

Fig. 12 b

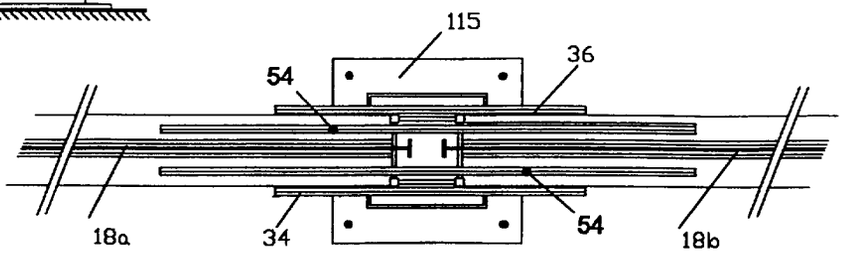

Fig. 12 c

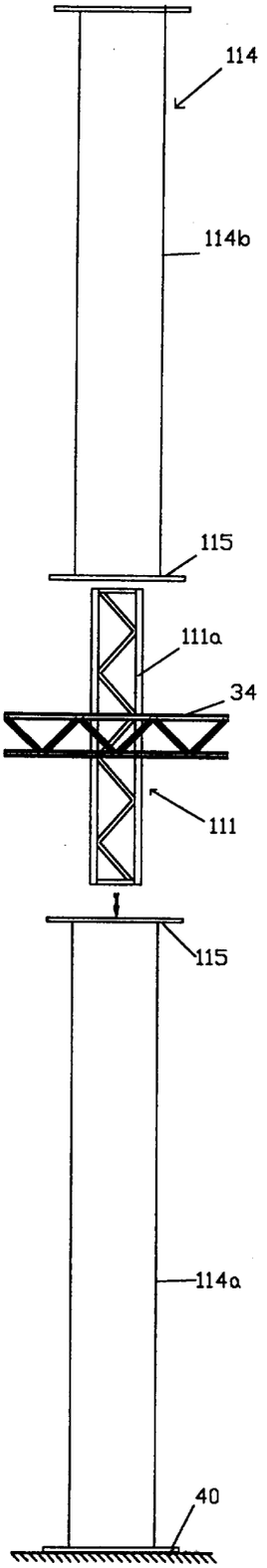

Fig. 13

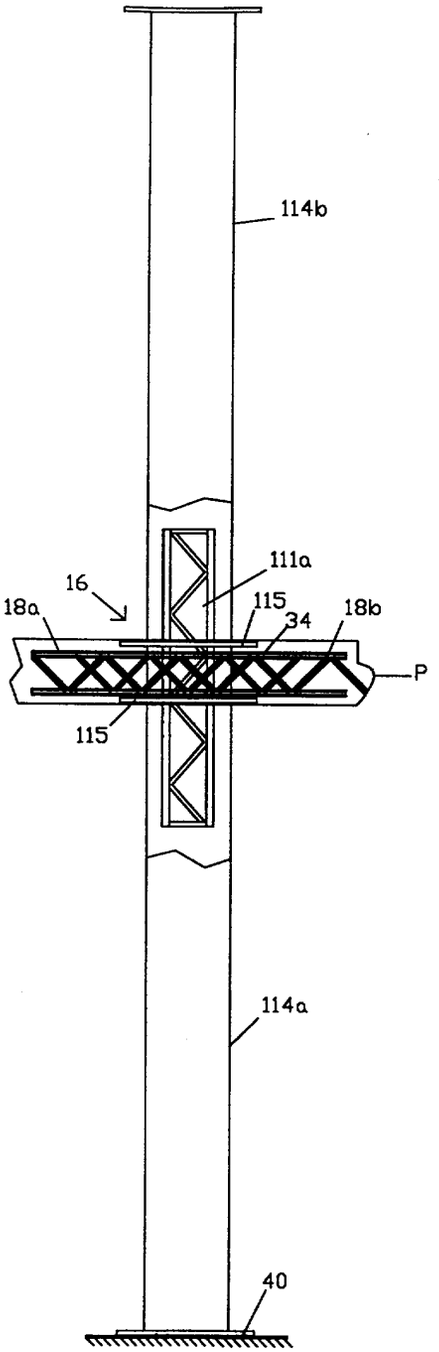

Fig. 14

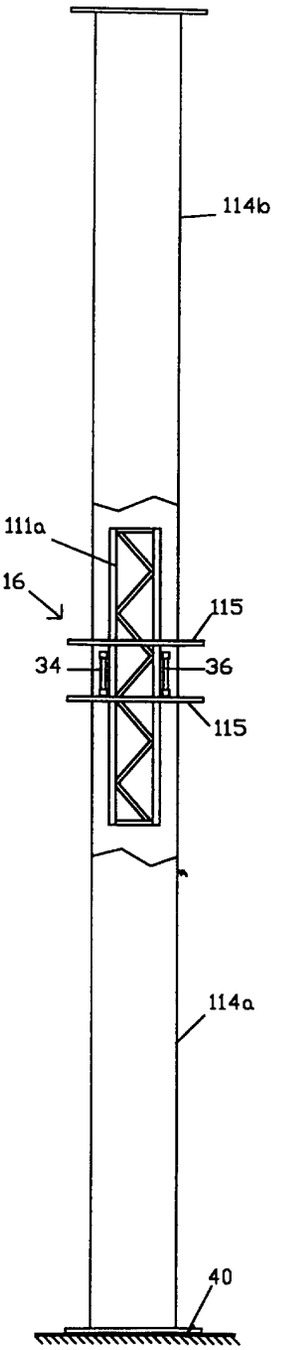

Fig. 15