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(54) MODULAR ELEMENT FOR STRUCTURE ADAPTED FOR SUPPORTING A TLECOMMUNICATIONS STATION

(57) Modular element (1) for structure (1) adapted for supporting a telecommunications station (100), said modular element comprising a first lower planar surface (2) and a second upper planar surface (3) opposite and parallel to said first planar surface (2), said modular element (1) further comprising a metal core (4) embedded, at least partly, in a cementitious structure (5), said metal core (4) further comprising a perimeter metal structure (6) having polygonal plan and a central metal structure (7) integrally constrained to said perimeter structure, said perimeter metal structure (6) comprising at least one connecting metal body (10) having longitudinal axis (X) orthogonal to said first planar surface and provided with a first plurality of through holes (11) each having axis (Y) orthogonal to said longitudinal axis (X) and adapted for allowing the removable connection of said modular element (1) to an additional modular element (1').

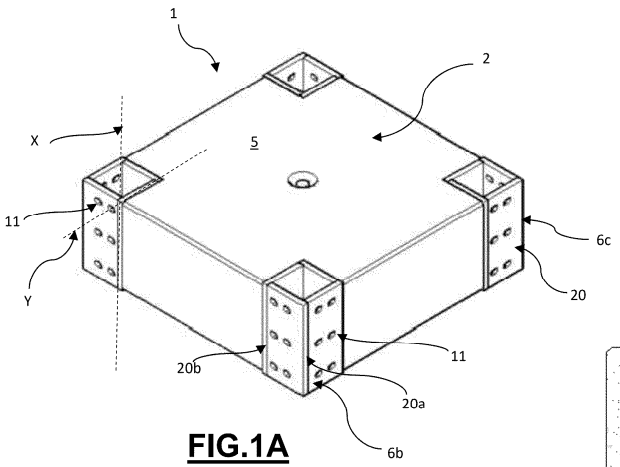

FIG.1A

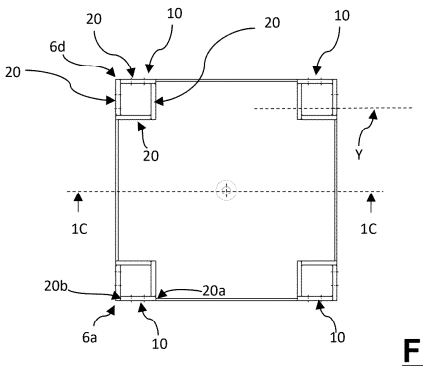

FIG.1B

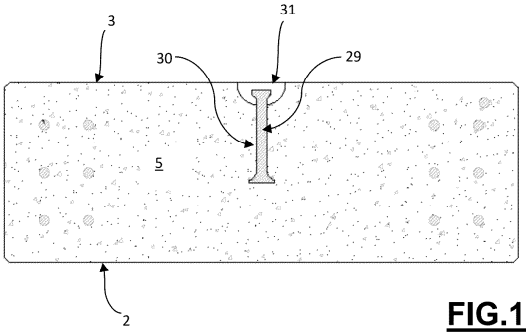

FIG.1C

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Description

FIELD OF INVENTION

[0001] The present invention relates to a prefabricated modular element for a structure adapted for supporting telecommunications stations.

KNOWN PRIOR ART

[0002] According to known art, telecommunications stations comprise a square or triangular-based lattice, or pole, for supporting the antennas, often exceeding twenty-five meters in height. The lattice, or pole, in turn, is anchored to a foundation structure of reinforced concrete, which is made on-site, with casing and in situ concrete casting. Clearly, the whole structure is sized to withstand the maximum stresses (static, seismic and meteorological) provided by the regulations in force, more precisely, the station is considered "construction" to all purposes, therefore, like any construction, it is subject both to urban rules and regulations and to the constraints imposed on the protection of the territory and public safety.

[0003] This solution has several drawbacks, indeed, being made in situ, it requires significant commitment of workers and long times, both for the processing and for the foundation concrete curing, which typically takes more than twenty-eight days after casting. Furthermore, it is clear that this structure, being a "permanent construction", has a significant environmental impact. Finally, when it is necessary to remove it, it will be mandatory to arrange for its demolition and disposal of the resulting materials, with definitely significant time and costs.

[0004] In order to mitigate most of these critical issues, solutions are known providing the construction of a set of precast elements made of reinforced concrete, to be assembled on-site in order to form a base, serving as the foundation for a lattice or a pole. The solution provides that this base or foundation is inserted into excavation dug at the location where said station is installed. The base or foundation is formed by multiple layers of precast reinforced concrete manufactured articles that are superimposed, constrained to each other, through a plurality of removable fastening means, such as, for example, bolts, plates, rods, cables and tie rods, so as to create a kind of "sandwich" coupling. Each superimposed layer is quadrilateral in shape, resulting in a parallelepiped-shaped base. The lattice or pole, along with the telecommunications apparatuses, is constrained to said base by means of appropriate nuts and bolts. In order to adapt the static performance of the bases to lattices or poles of different heights and loads, additional layers of prefabricated manufactured articles are added, or larger manufactured articles are used.

[0005] The above solutions, however, are not free from drawbacks, since although many of the problems related to the structures made directly on site are overcome, the operation of the base and its stiffness, as it is made, rely exclusively on the nuts and bolts and the consequent friction between the various layers of said "sandwich".

[0006] Furthermore, these prefabricated structures cannot be transported anywhere, specifically in remote areas that can only be reached by helicopter use.

[0007] EP4194613A1 is directed to a structural unit and system for manufacturing a concrete foundation, specifically for a beach umbrella.

[0008] CA2142383A1 concerns the construction sector and specifically the manufacture of vertical concrete poles anchored to the ground.

[0009] JP2012127050A concerns a concrete foundation to be laid on a floor and a method for manufacturing the concrete foundation.

[0010] Lastly, ITMC20060023A1 concerns modular equipment for the quick installation of antennas for telephone networks.

[0011] Therefore, the object of the present invention is to make a modular element for structure for supporting telecommunications stations which, compared to prefabricated solutions of the known art, allows this structure to be implemented in a simple and quick way, regardless of the area where this structure has to be built.

[0012] Further objects of the present invention are to make a structure that is made up of a limited number of low weight repetitive elements, and therefore, that can be made in a simple, quick, easy-to-assemble way and with a modest investment in precasting molds.

[0013] Lastly, object of the present invention is to implement a method for making a structure adapted for supporting telecommunications stations, that are easily assembled and transportable.

SUMMARY OF THE INVENTION

[0014] These and other objects are achieved by a modular element for structure adapted for supporting at least one telecommunications station according to claim 1. Specifically, this modular element for structure adapted for supporting a telecommunications station comprises a first lower planar surface and a second upper planar surface opposite and parallel to said first planar surface, said modular element further comprising a metal core embedded, at least partly, in a cementitious structure, said metal core further comprising a perimeter metal structure having polygonal plan and a central metal structure integrally constrained to said perimeter structure, said perimeter metal structure comprising at least one connecting metal body having longitudinal axis orthogonal to said first planar surface and provided with a first plurality of through holes each having axis orthogonal to said longitudinal axis and adapted for allowing the removable connection of said modular element to an additional modular element.

[0015] In practice, thanks to the modular element according to the invention, a structure adapted for supporting at least one telecommunications station can be made.

This modular element is easily transportable to even inaccessible areas where the structure adapted for supporting a telecommunications station will be made, and it can also be quickly assembled with similar modular elements.

[0016] Furthermore, said at least one metal body has quadrilateral cross-section and is, preferably, hollow. Preferably, said cross-section is square or rectangular in shape.

[0017] Specifically, said at least one metal body comprises four plates welded two by two to the respective edges parallel to said longitudinal axis; two plates of said four plates, adjacent to one another and facing the outside of said modular element, comprise said first plurality of holes and, preferably, each plate is arranged at 90° with respect to the adjacent ones.

[0018] Even more specifically, said perimeter metal structure has quadrilateral plan and comprises four hollow metal bodies arranged at the four edges of said perimeter metal structure; each hollow metal body is arranged in such a way that the plates of each hollow metal body are either parallel or orthogonal to those of the remaining hollow metal bodies. In practice, two adjacent and external metal plates of each metal body, arranged at 90° with respect to each other, form the four edges of the modular element.

[0019] Again, each hollow metal body of said perimeter metal structure comprises a second plurality of through holes each having axis orthogonal to said longitudinal axis;

two plates of said four plates, adjacent to one another and facing the inside of said modular element (i.e., not facing the outside of the modular element), comprise said second plurality of holes, wherein said perimeter metal structure further comprises a plurality of connecting bars constrained at the through holes of said second plurality of through holes of two consecutive hollow metal bodies. In practice, in case of modular element having square or rectangular cross-section, they have a perimeter metal structure that forms a cage with a substantially square or rectangular shape, at edges of which there are the four connecting metal bodies.

[0020] The objects are also achieved thanks to a structure for supporting a telecommunications station, comprising one or more layers, wherein each layer comprises at least two modular elements according to one or more of claims 1 to 9. These at least two modular elements are arranged, for each layer, in contact one adjacent to the other, wherein the through holes of the first plurality of through holes of at least one hollow body of a modular element are facing the through holes of the first plurality of through holes of at least one hollow body of the adjacent modular element and have same orthogonal axis in such a way to have couples of through holes of two distinct adjacent modular elements; said structure further comprises first means for removably constraining said modular elements lying on the same layer to one another, wherein said first removably constraining means comprise a plurality of screws and respective nuts, wherein each screw operates within the holes of each of said couple of first through holes of said at least two adjacent modular elements.

[0021] Specifically, at least one plate of at least one hollow body of a modular element is facing and in contact with the plate of at least one hollow body of the adjacent modular element.

[0022] Lastly, the objects are also achieved by means of a method for making a structure according to one or more of claims 10 to 12 having one or more layers, comprising the step of a) arranging, for each layer, at least two modular elements according to one or more of claims 1 to 9 in contact one adjacent to the other, wherein the through holes of the first plurality of through holes of at least one hollow body of a modular element are facing the through holes of the first plurality of through holes of at least one hollow body of the adjacent modular element and have same orthogonal axis such that to have couples of through holes of two distinct adjacent modular elements; and the step b) of removably constraining said at least two modular elements lying on the same layer by means of said first removably constraining means which comprise a plurality of screws and respective nuts, wherein each screw operates within the holes of each one of said couple of first through holes of said at least two adjacent modular elements.

DESCRIPTION OF THE FIGURES

[0023] These and other aspects of the present invention will be made clearer by the following detailed description of a preferred embodiment provided herein by way of example only and not limiting, with reference to the attached figures, in which:

Figure 1A is an axonometric view of a modular element according to a first embodiment of the invention;

Figure 1B is a plan view of the modular element of Figure 1A;

Figure 1C is a sectional view of Figure 1B;

Figure 2A is an axonometric view of the modular element of Figure 1A without the cementitious structure;

Figure 2B is an axonometric view of the modular element of Figure 2A further without the central metal structure;

Figure 3A is an axonometric view of a modular element in accordance with an additional embodiment of the invention;

Figure 3B is a plan view of the modular element of

Figure 3A;

Figure 3C is a sectional view of Figure 3B;

Figure 4 is a sectional view of a modular element in accordance with an additional embodiment of the invention;

Figure 5A is an axonometric view of a structure having a single layer which is formed by means of modular elements according to the invention;

Figure 5B is a plan view of the structure of Figure 5A;

Figure 5C is a sectional view of the structure of Figure 5A;

Figure 5D is a detailed view of Figure 5C;

Figure 6A is an axonometric view of a modular element in accordance with a variation of the embodiment shown in Figure 4;

Figure 6B is a sectional view of the modular element of Figure 6A;

Figure 6C is an axonometric view of a modular element in accordance with a variation of the embodiment shown in Figures 3A-3C;

Figure 6D is a sectional view of the modular element of Figure 6C;

Figure 7A is an axonometric view of the structure according to the invention, in which there are two layers;

Figure 7B is a plan view of the structure of Figure 7A;

Figure 7C is a sectional view of the structure of Figure 7A.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE PRESENT INVENTION

[0024] With reference specifically to these figures, a modular element according to the invention in five distinct embodiments has been denoted by 1,1',1",1‴,1⁗.

[0025] As shown in figures 1A-1C, 2A, 2B, a modular element 1 for structure 100 (see figure 5A or figures 7A-7C) adapted for supporting a telecommunications station (herein not shown, but known to the skilled in the art) comprises a first lower planar surface 2 and a second upper planar surface 3 opposite and parallel to the first planar surface 2. In practice, the lower planar surface 2 serves as support for the modular element 1, whereas the upper planar surface 3 serves as support for an additional modular element. This modular element 1 further comprises a metal core 4 (see figure 2A) embedded, at least partly, in a cementitious structure 5. In practice, this modular element 1 is made of precast concrete. Still, the metal core 4 further comprises a perimeter metal structure 6 with a polygonal plan (see figure 2B) and a central metal structure 7 integrally constrained to the perimeter metal structure 6. Specifically, the central metal structure 7 is integrally constrained to the perimeter structure 6 by welding. It should be noted that "polygonal plan" means that the top view of this perimeter metal structure 6 has a polygonal shape, i.e. it has a plurality of sides.

[0026] More specifically, the perimeter metal structure 6 comprises at least one connecting metal body 10 having longitudinal axis X orthogonal to the first planar surface 2 (and thus also to the second planar surface 3) and provided with a first plurality of through holes 11 each having Y axis orthogonal to the longitudinal axis X. These holes 11 of the first plurality of through holes 11 are adapted for allowing the removable connection of the modular element 1 to an additional modular element 1, or additional modular elements 1',1",1‴,1⁗ which will be described further below.

[0027] It should be noticed that, in order to facilitate and clarify the description, the references 1, 1',1",1‴ and 1⁗ distinguish modular elements which fall within the present invention, but which are distinguished by specific characteristics which allow the various modular elements to be combined with each other both on the same plane (or layer) and on at least two distinct planes (or distinct layers).

[0028] According to the embodiment shown herein in the attached figures, the metal body 10 has a quadrilateral cross-section and is, moreover, hollow. Preferably, this metal body 10 has a square or rectangular cross-section.

[0029] Specifically, the metal body 10 comprises four plates 20 constrained two by two to the respective edges 20a, 20b parallel to said longitudinal axis X. This constraint is preferably achieved by welding. Two plates of the four plates 20, adjacent to one another and facing the outside of the modular element 1 (i.e. visible to an external observer), comprise the first plurality of holes 11. Specifically, each plate 20 is preferably arranged at 90° with respect to the adjacent ones. In practice, the hollow body 10 has a rectangular or square cross-section (in the embodiment shown herein the cross-section is square).

[0030] It should to be noticed that in the embodiment shown herein the number of first holes per plate 20 is six.

[0031] Even more specifically, the perimeter metal structure 6 has a quadrilateral plan, i.e. it has four sides, and comprises four hollow metal bodies 10 arranged at the four edges 6a, 6b, 6c, 6d of the perimeter metal structure 6. Each hollow metal body 10 is arranged so that the plates 20 of each hollow metal body 10 are either parallel or orthogonal to those of the remaining hollow metal bodies 10. This way, the two metal plates 20 facing the outside of each hollow metal body 10, and which are

adjacent to one another, define the edge of the modular element 1.

[0032] Still according to the embodiment described herein, each hollow metal body 10 of the perimeter metal structure 6 comprises a second plurality of through holes 12, each having Y axis orthogonal to the longitudinal axis. Two plates of the four plates 20, adjacent to one another and facing the inside of the modular element 1 (i.e. not visible to an external observer), comprise the second plurality of holes 12. In practice, these two plates 20 adjacent to one another and facing the inside of the modular element 1, i.e. not forming part of the side (or edge) of the modular element 1, are distinct from the additional two plates 20 which, on the contrary, are adjacent to one another and facing the outside of the modular element 1 (thus part of the side of the modular element 1). The perimeter metal structure 6 further comprises a plurality of connecting bars 13 constrained at the through holes of said second plurality of through holes 12 of two consecutive hollow metal bodies 10. In practice, a sort of cage is formed which, at the perimeter of the modular element 1, connects the various hollow metal bodies 10 which are located at the four edges 6a, 6b, 6c and 6d of the perimeter metal structure 6 by using, for each hollow metal body 10, the two plates 20 which are located inside the modular element 1 and the respective second holes 12 which are located on the two plates 20 facing the inside.

[0033] It should be noticed that in the embodiment shown herein the number of second holes per plate 20 is six.

[0034] This embodiment allows a highly compact modular element 1 to be formed, which is easily transportable and easily assembled with other modular elements 1, or similar ones arranged on the side of the modular element 1 or on top of it.

[0035] In accordance with the non-limiting preferred embodiment described herein, the element 1 further comprises a hooking pin 29 incorporated at least partially into the cementitious structure 5 and constrained to the central metal structure 7. This constraint of the pin 29 to the central metal structure 7 preferably occurs by welding. The modular element 1 further comprises a first blind cavity 30 provided with a first opening 31 placed at the second upper planar surface 3 and within which the hooking pin 29 is housed. This hooking pin 29, which partially protrudes from the cementitious structure 5 in which it is incorporated, is used for the transport and handling of the modular element 1.

[0036] In accordance with a second non-limiting preferred embodiment shown in figure 4, the modular element 1' comprises a plurality of second through cavities 33 between the first planar surface 2 and the second planar surface 3 which has axis parallel to the longitudinal axis X. These through cavities 33 are preferably arranged in an arc of circumference (as in the embodiment shown in figures 3A-3C). This embodiment further comprises a hooking pin 29 as mentioned above.

[0037] In accordance with a third non-limiting preferred embodiment shown in Figures 3A-3C, the modular element 1" comprises a threaded clutch 35 incorporated within the cementitious structure 5 and constrained, by welding, to the central metal structure 7. The modular element 1" further comprises a plurality of third blind cavities 36, each provided with a second opening 37 placed at the second upper planar surface 3 and within which the threaded clutch 35 is housed. These blind cavities 36 are preferably arranged in an arc of circumference. This embodiment also comprises a hooking pin 29 of the type mentioned above, placed at the geometric center of the modular element 1".

[0038] In Figures 6A and 6B, a modular element 1‴ is shown in accordance with a fourth embodiment of the invention similar to the modular element 1' described above and shown in figure 4, but which differs from the latter in that it only has one through cavity 33 and two hooking pins 29. In this case, the through cavity 33 is arranged at the geometric center of the modular element 1‴, whereas the two hooking pins 29 are arranged in symmetrical position with respect to the through cavity 33, along one of the two diagonals of the modular element 1‴, which has a substantially square plan.

[0039] In Figures 6C and 6D, a modular element 1⁗ is shown in accordance with a fifth embodiment of the invention similar to the modular element 1" described above and shown in figures 3A-3C, but having a single blind cavity 36 and two hooking pins 29, wherein said blind cavity 36 is arranged at the geometric center of the module 1"", whereas the two hooking pins 29 are arranged in symmetrical position with respect to the blind cavity 36, along one of the two diagonals of the modular element 1"", having a substantially square plan.

[0040] The embodiments of a modular element 1,1', 1",1‴ and 1⁗ as described above can be used in combination with each other for making structures 100 for supporting a telecommunications station (not shown herein but known to the skilled in the art).

[0041] For example, the structure 100 shown in Figures 5A-5D comprises a single layer 30. This layer 30 comprises, in turn, modular elements 1 (shown in Figures 1A-1C, 2A-2B) and 1" (variation shown in Figures 3A-3C) which combine with each other. In this case, the layer 30 comprises thirty-six modular elements 1, 1". Specifically, the number of modular elements 1 in accordance with the first embodiment is thirty-two, the number of modular elements 1" in accordance with the third embodiment is four.

[0042] The modular elements 1,1" are arranged in contact one adjacent to the other, wherein the through holes of the first plurality of through holes 11 of a metal connecting body 10 of a modular element 1 or 1" are facing the through holes of the first plurality of through holes 11 of at least one additional metal connecting body 10 of the adjacent modular element 1 or 1" and have the same orthogonal axis Y in such a way to have couples of through holes 11 of two distinct adjacent modular ele-

ments 1 or 1". In the case described herein, there are at least two metal connecting bodies 10 of a modular element 1 or 1" facing the same number of metal connecting bodies 10 of another modular element 1 or 1".

[0043] The structure 100 further comprises first means 80 for removably constraining two modular elements of the type 1, 1" or type 1,1 or type 1",1" lying on the same layer 30, to one another. These first removably constraining means 80 comprise a plurality of screws and respective nuts, wherein each screw operates within the holes of each of said couple of first through holes 11 of two adjacent modular elements of the type 1, 1" or type 1,1 or type 1",1".

[0044] Specifically, at least one plate 20 of the hollow metal body 10 of a modular element 1 or 1" is facing and in contact with the plate 20 of a hollow metal body 10 of the adjacent modular element 1 or 1". As it can be seen in figure 5B, a generic modular element 1 can be in contact with a minimum of three modular elements 1, if it is located at the edge of the structure 100, and a maximum of eight modular elements 1 and 1", if it is located near the center of the modular structure 100.

[0045] A modular element 1 can also be in contact with five modular elements 1 if it is located along the perimeter of the structure 100.

[0046] In case of modular elements 1 which are located on the edge, the number of plates 20 of these modular elements 1, which are facing other plates 20 of other modular elements 1 (or 1") and which are connected by means of the removably constraining means 80, is four.

[0047] In case of modular elements 1 which are located at the center of the structure 100, the number of plates 20 of this modular element 1 which are facing other plates 20 of other modular elements 1 and/or 1" and which are connected by the constraining means 80, is eight.

[0048] Lastly, in case of modular elements 1 which are located at the periphery of the structure 100, the number of plates 20 of these modular elements 1 which are facing other plates 20 of other modular elements 1 and which are connected by the constraining means 80, is six.

[0049] The structure 100 shown in figures 7A-7C provides two layers 30 and 40, wherein each layer 30, 40 comprises at least two modular elements of various types such as, for example, 1', 1", 1‴ and 1⁗ according to the description provided above and, anyway, according to one or more of claims 1 to 9. In the specific case, the number of modular elements 1",1⁗ constituting the lower layer 30 is thirty-six, of which four modular elements 1" and thirty-two modular elements 1⁗. The number of modular elements 1',1‴ constituting the upper layer 40 is thirty-six, of which four modular elements 1' and thirty-two modular elements 1‴. For each layer 30 and 40, the modular elements 1',1‴ and 1" and 1⁗ are arranged in contact one adjacent to the other, wherein the through holes of the first plurality of through holes 11 of a metal connecting body 10 of any one of the modular elements 1', 1‴ and 1",1⁗ are facing the through holes of the first plurality of through holes 11 of a metal connecting body 10 of one or more adjacent modular elements 1',1‴ and 1" and 1⁗ and have the same orthogonal axis Y in such a way to have couples of through holes 11 of two distinct adjacent modular elements 1',1‴ and 1", 1⁗.

[0050] The structure 100 further comprises first means 80 for removably constraining two modular elements of the type 1',1‴ or 1',1' or 1‴,1‴ and the type 1",1"" or 1",1" or 1"",1"" lying on the same layer 30 or 40, to one another. These first removably constraining means 80 comprise a plurality of screws and respective nuts, wherein each screw operates within the holes of each of said couple of first through holes 11 of two adjacent modular elements.

[0051] Specifically, at least one plate 20 of the hollow metal body 10 of a modular element 1",1⁗ or 1',1"' is facing and in contact with the plate 20 of a hollow metal body 10 of the adjacent modular element. Actually, in the embodiment described herein, depending on the position of the modular elements 1",1⁗ or 1',1‴, the number of plates 20 for each hollow metal body 10 in contact with an even number of plates 20 of one or more adjacent modular elements is one or two. As it can be seen in figures 7A-7C, a generic modular element 1" can be in contact with a minimum of three modular elements 1", if it is located at the edge of the structure 100, to a maximum of eight modular elements 1",1⁗ if it is located near the center of the modular structure. A modular element 1" may also be in contact with five modular elements 1⁗ if it is located along the perimeter of the structure 100.

[0052] In case of modular elements 1⁗ (or 1‴ for the upper layer 40) which are located on the edge, the number of plates 20 of these modular elements 1⁗ (or 1"'), which are facing other plates 20 of other modular elements and which are connected by the constraining means 80, is four.

[0053] In case of modular elements 1"" (or 1‴) which are located at the center of the structure 100, the number of plates 20 of these modular elements, which are facing other plates 20 of other modular elements 1⁗ and/or 1" and which are connected by the constraining means 80, is eight.

[0054] Lastly, in case of modular elements 1 which are located at the periphery of the structure 100, the number of plates 20 of these modular elements 1 which are facing other plates 20 of other modular elements 1 and which are connected by the constraining means 80, is six.

[0055] In practice, in order to make a layer 30 or 40, two or more modular elements 1',1",1‴,1⁗ are brought close together in contact with each other such that, depending on the position of the modular element 1',1",1‴,1⁗ to be constrained, four or six or eight plates 20 of multiple hollow metal bodies 10 of distinct modular elements 1',1",1⁗,1⁗ are facing and in contact with each other and the respective pluralities of first holes 11 of each plate 20 have the same orthogonal axis Y.

[0056] This connection between the various modular elements 1', 1", 1‴, 1⁗ occurs in an extremely quick way, thus speeding up the construction of structure 100.

Furthermore, the layer 30 or 40 is highly strong and capable of supporting the loads to which the structure 100 is subjected, once the telecommunications station is installed on it. Indeed, the strength of winds and atmospheric agents can generate on the structure 100 strong stresses, which, anyway, are overcome thanks to the modular elements 1', 1", 1‴, 1⁗ and the methods used to fasten them together.

[0057] Moreover, these modular elements 1',1",1‴,1⁗ are highly lightweight and can be easily transported individually to any area, even by helicopter or other means of transportation.

[0058] Furthermore, the upper layer 100 comprises the modular elements 1' and 1‴ which are arranged on modular elements 1" and 1⁗ in such a way that the second through cavities 33 of each upper modular element 1', 1‴ are aligned with the third blind cavities 36 of the lower modular element 1" and 1"". The structure 100 further comprises second removably connecting means for two modular elements arranged one on top of the other. These second removably constraining means comprise a plurality of threaded bars 91 at their two ends 91a, 91b and a corresponding plurality of nuts 92. Each bar 91 is inserted into the respective second through cavity 33 of the upper modular element 1',1"' and into the respective third blind cavity 36 of the lower modular element 1",1⁗ in which an end 91a of the bar 91 is constrained by screwing to the threaded clutch 35 housed within the third blind cavity 36 and the nut 92 is screwed to the other end 91b of the threaded bar 91, above the upper modular element 1',1‴.

[0059] It should be noticed that, in other embodiments not shown herein, the structure 100 can also comprise a number of layers greater than two. A structure 100 comprising two layers, of which the lower one is identical to the one shown in Figure 5A and the upper one comprises only four modular elements of type 1', for example, arranged at the center of the structure and superimposed on the modular elements 1", falls within the protection scope of the present invention. In this case, the second constraining means operate as in the case of the embodiment described and shown in Figures 7A-7C.

[0060] Finally, the method for making a structure 100 for supporting a telecommunications station as described above and, anyway, according to one or more of claims 10 to 12, in which there are one or more layers (in the embodiment shown herein there are only two layers 30 and 40), is described below. This making method comprises the step a) of arranging, for each layer 30, 40, at least two modular elements of the type described above, i.e. the type 1',1", 1‴ and 1⁗, and anyway according to one or more of claims 1 to 9, in contact one adjacent to the other, wherein the through holes of the first plurality of through holes 11 of at least one hollow body 10 of a modular element are facing the through holes of the first plurality of through holes 11 of at least one hollow body 10 of the adjacent modular element and have the same orthogonal axis Y such that to have couples of through holes 11 of two distinct adjacent modular elements; and the step b) of removably constraining at least two modular elements lying on the same layer 30, or 40, by first removably constraining means 80 which comprise a plurality of screws and respective nuts, wherein each screw operates within the holes of each of said couple of first through holes 11 of two adjacent modular elements.

[0061] Furthermore, since the structure 100 comprises two layers 30, 40, the method comprises step c) of arranging two or more modular elements 1", 1' and 1⁗,1‴ on top of each other such that the second blind cavities 33 of the upper modular element 1',1‴ are aligned with the third blind cavities 36 of the lower modular element 1",1⁗ and the step d) of removably constraining the modular elements 1',1‴ and 1",1⁗ arranged on top of each other by means of second removably constraining means comprising a plurality of threaded bars 91 at the two ends 91a, 91b and a respective plurality of nuts. Each bar 91 is inserted into the respective second through cavity 33 of the upper modular element 1',1"' and into the respective third blind cavity 36 of the lower modular element 1",1⁗ in which an end 91a of the bar 91 is constrained by screwing to the threaded clutch 35 housed within the third blind cavity 36 and the nut is screwed to the other end 91b of the bar 91, above the upper modular element 1',1‴.

Claims

1. Modular element (1,1',1",1‴,1⁗) for structure (100) adapted for supporting a telecommunications station, said modular element comprising a first lower planar surface (2) and a second upper planar surface (3) opposite and parallel to said first planar surface (2), said modular element (1) further comprising a metal core (4) embedded, at least partly, in a cementitious structure (5), said metal core (4) further comprising a perimeter metal structure (6) having polygonal plan and a central metal structure (7) integrally constrained to said perimeter structure, said perimeter metal structure (6) comprising at least one connecting metal body (10) having longitudinal axis (X) orthogonal to said first planar surface and provided with a first plurality of through holes (11) each having axis (Y) orthogonal to said longitudinal axis (X) and which are adapted for allowing the removable connection of said modular element (1) to a further modular element (1,1',1",1‴,1⁗).

2. Element according to claim 1, **characterized in that** said at least one metal body (10) has quadrilateral cross-section.

3. Element according to claim 1 or 2, **characterized in that** said at least one metal body (10) is hollow.

4. Element according to claim 3, **characterized in that** said at least one metal body (10) comprises four plates (20) welded two by two to the respective edges (20a,20b) parallel to said longitudinal axis (X), two plates of said four plates (20), adjacent to one another and facing outside said modular element, comprising said first plurality of holes (11), each plate (20) preferably being arranged at 90° with respect to the adjacent ones.

5. Element according to claim 4, **characterized in that** said perimeter metal structure (6) has quadrilateral plan and comprises four hollow metal bodies (10) arranged at the four edges of said perimeter metal structure (6), each hollow metal body (10) being arranged in such a way that the plates (20) of each hollow metal body (10) are either parallel or orthogonal to those of the remaining hollow metal bodies (10).

6. Element according to claim 5, **characterized in that** each hollow metal body (10) of said perimeter metal structure (6) comprises a second plurality of through holes (12) each having axis (Y) orthogonal to said longitudinal axis (X), two plates of said four plates (20), adjacent to one another and facing inside said modular element, comprising said second plurality of holes (12), said perimeter metal structure (6) further comprising a plurality of connecting bars (13), said connecting bars being constrained at the through holes of said second plurality of through holes (12) of two consecutive hollow metal bodies (10).

7. Element according to one or more of claims 1 to 6, **characterized by** comprising at least one hooking pin (29) incorporated, at least partly, within said cementitious structure (5) and constrained to said central metal structure (7), said modular element (1) further comprising at least one first blind cavity (32) provided with a first opening (31) placed at said second upper planar surface and within which said at least one pin (29) is at least partly housed.

8. Element according to one or more of claims 1 to 7, **characterized by** comprising at least one second through cavity (33) between said first surface (2) and said second surface (3) and having axis parallel to said longitudinal axis (X).

9. Element according to one or more of claims 1 to 8, **characterized by** comprising at least one threaded clutch (35) incorporated, at least partly, within said cementitious structure and constrained to said central metal structure, said modular element (1) further comprising at least one third blind cavity (36) provided with a second opening (37) placed at said second upper planar surface and within which said threaded clutch (35) is housed.

10. Structure (100) for supporting a telecommunications station (100), comprising one or more layers (30,40), each layer (30,40) comprising at least two modular elements (1,1',1",1‴,1⁗) according to one or more of claims 1 to 9, said at least two modular elements (1,1',1",1‴,1⁗) being arranged, for each layer, in contact one adjacent to the other, wherein the through holes of the first plurality of through holes (11) of at least one hollow body (10) of a modular element are facing the through holes of the first plurality of through holes (11) of at least one hollow body of the adjacent modular element and have the same orthogonal axis (Y) so that to have couples of through holes (11) of two distinct adjacent modular elements, said structure further comprising first means (80) for removably constraining said at least two modular elements lying on the same layer (30,40) to one another, said first removably constraining means (80) comprising a plurality of screws and respective nuts, wherein each screw operates within the holes of each of said couple of first through holes of said at least two adjacent modular elements.

11. Structure (100) according to at least claim 10, **characterized in that** at least one plate (20) of at least one hollow body (10) of a modular element is facing and in contact with the plate of at least one hollow body of the adjacent modular element.

12. Structure (100) according to claim 10 or 11, **characterized by** comprising at least two layers (30,40), wherein at least two modular elements (1,1',1",1‴,1⁗) are arranged one on top of the other in such a way that said at least one second through cavity (33) of the upper modular element (1',1‴) is aligned with said at least one third blind cavity (36) of the lower modular element (1",1⁗), said structure further comprising second removably connecting means for connecting said at least two modular elements arranged one on top of the other, said second removably constraining means comprising at least one threaded bar (91) at their two ends (91a,91b) and at least one nut, said at least one threaded bar being inserted into said at least one second through cavity (33) of said upper modular element and into said at least one third blind cavity (36) of said lower modular element, wherein an end (91a) of said at least one threaded bar (91) is constrained by screwing to said clutch (35) housed within said at least one third blind cavity (36) and said nut is screwed to the further end (90b) of said at least one bar (90), above said upper modular element.

13. Method of making a structure (100) according to one or more of claims 10 to 12 having one or more layers, comprising the step of a) arranging, for each layer, at least two modular elements (30,40) according to one or more of claims 1 to 9, in contact one adjacent to the

other, wherein the through holes of the first plurality of through holes (11) of at least one hollow body (10) of a modular element (1,1',1",1‴,1⁗) are facing the through holes (11) of the first plurality of through holes of at least one hollow body (10) of the adjacent modular element (1,1',1",1‴,1⁗) and have the same orthogonal axis (Y) such that to have couples of through holes of said at least two adjacent modular elements; and the step b) of removably constraining said at least two adjacent modular elements (1,1',1",1‴,1⁗) lying on the same layer by means of said first removably constraining means (80) which comprise a plurality of screws and respective nuts, wherein each screw operates within the through holes of each of said couple of first through holes of said at least two adjacent modular elements (1,1',1",1‴,1⁗).

14. Method according to claim 13, wherein said structure (100) comprises at least two layers (30,40), said method comprising the step c) of arranging at least two modular elements (1', 1",1‴,1⁗) one on top of the other such that said at least one second through cavity (33) of the upper modular element (1',1‴) is aligned with said at least one third blind cavity (36) of the lower element (1",1⁗), and the step d) of removably constraining said at least two modular elements (1',1",1‴,1⁗) arranged one on top of the other by means of said second removably constraining means (90) which comprise at least one threaded bar (91) at their two ends (91a,91b) and at least one nut, said at least one threaded bar being inserted into said at least one second through cavity (33) of said upper modular element (1',1‴) and into said at least one third blind cavity (36) of said lower modular element (1",1⁗), wherein an end (91a) of said at least one threaded bar (91) is constrained by screwing to said clutch (35) housed within said at least one third blind cavity (36) and said nut is screwed.

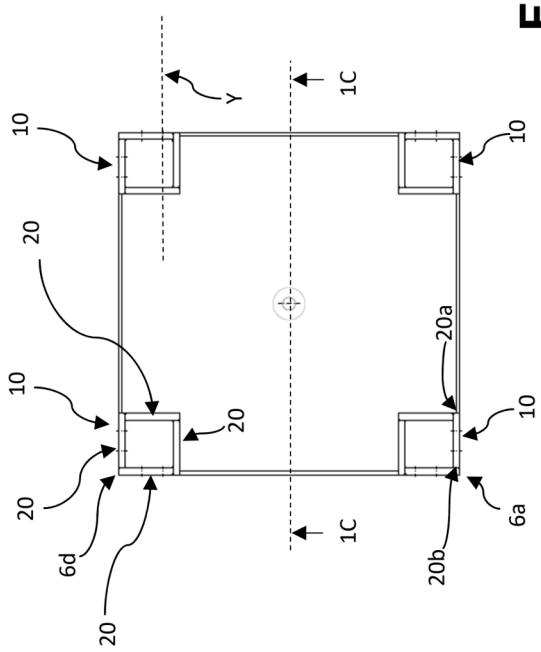


FIG.1B

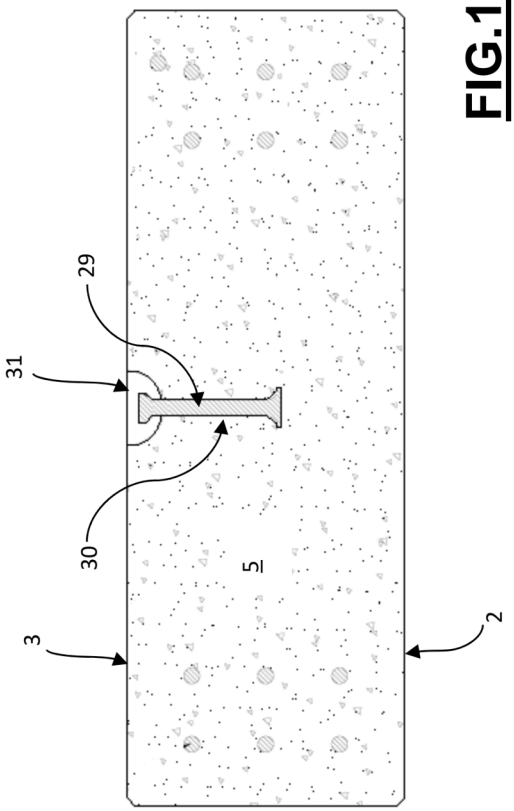


FIG.1C

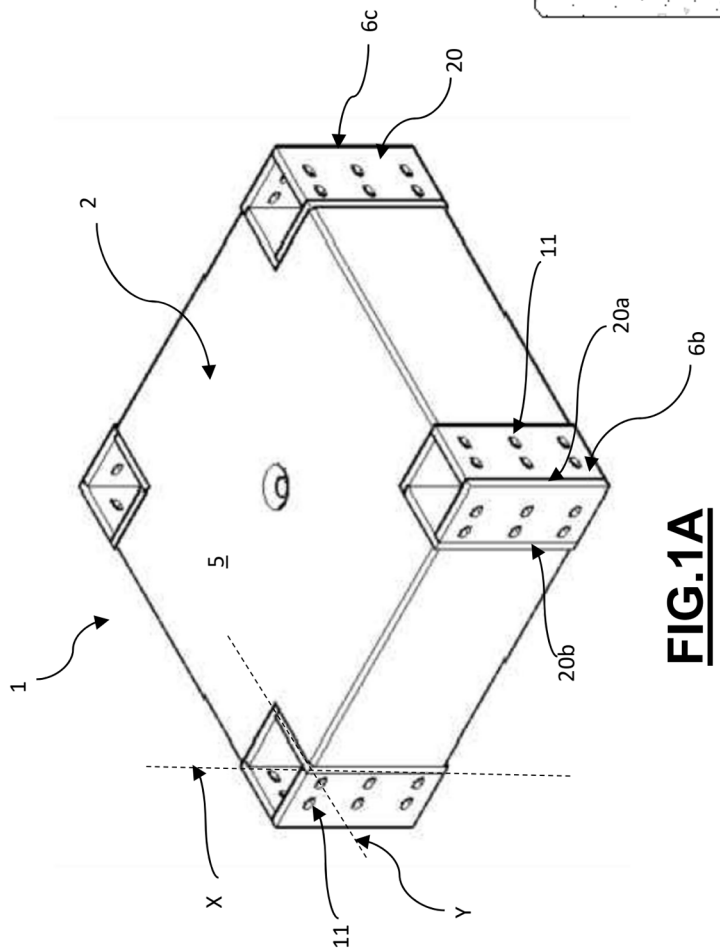


FIG.1A

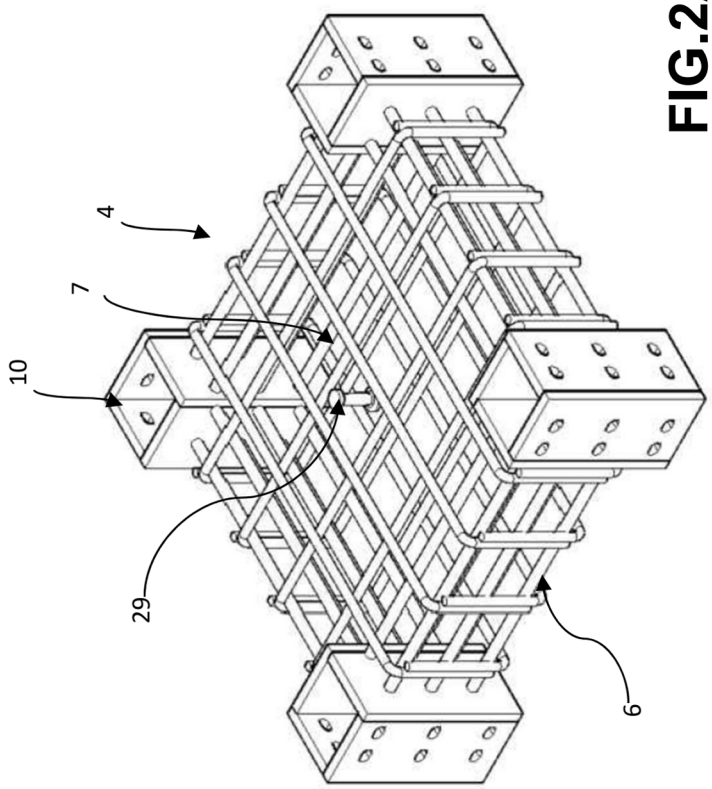


FIG.2A

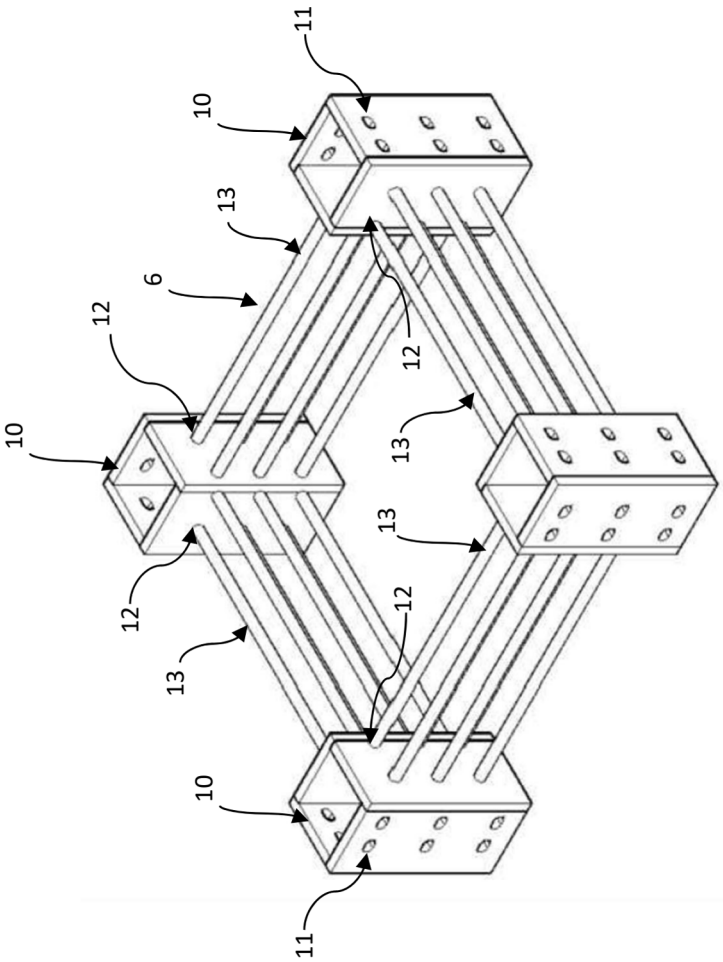


FIG.2B

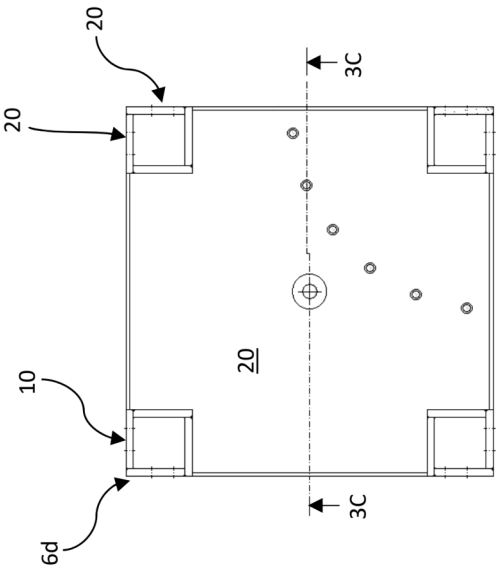


FIG.3B

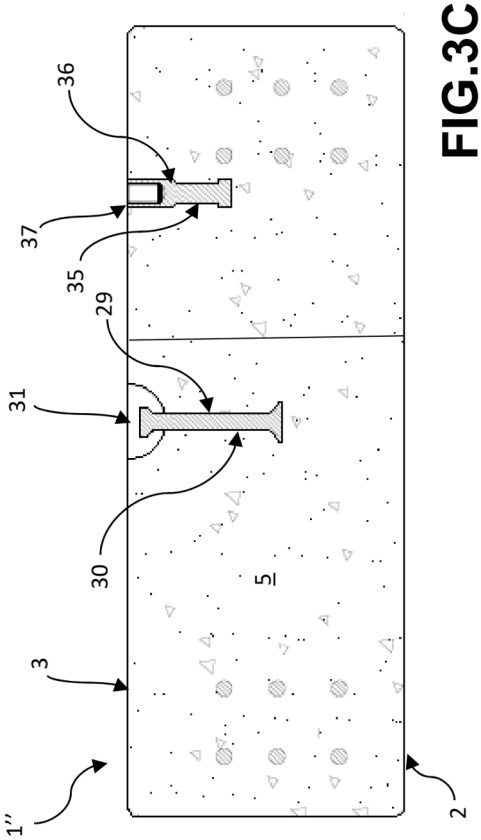


FIG.3C

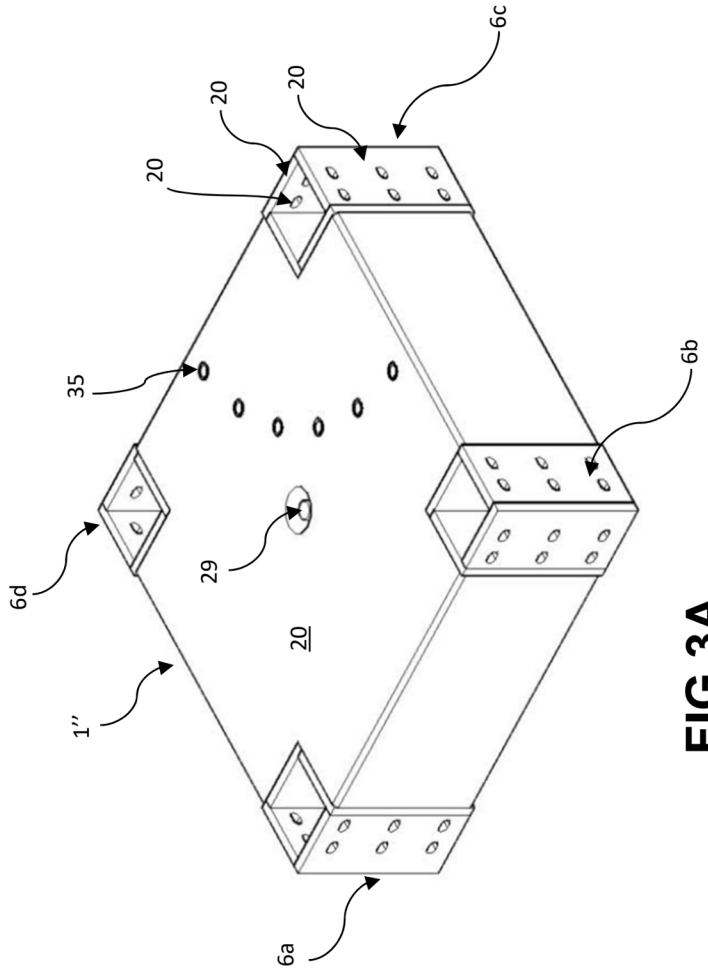


FIG.3A

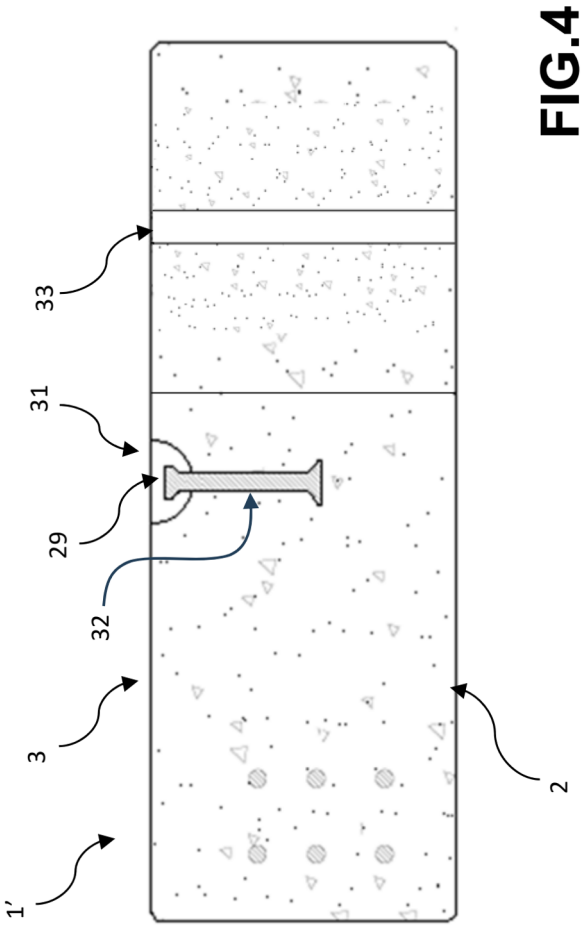


FIG.4

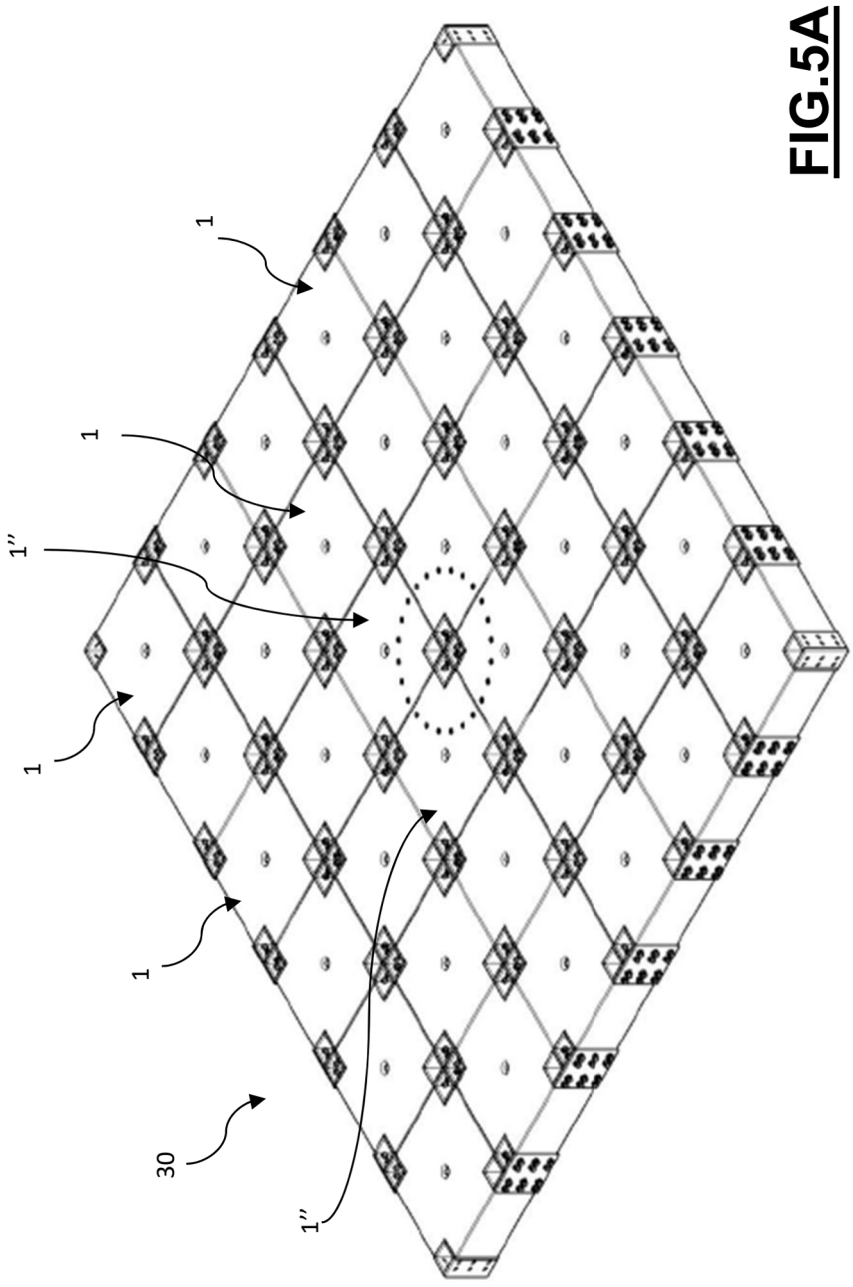


FIG.5A

FIG.5B

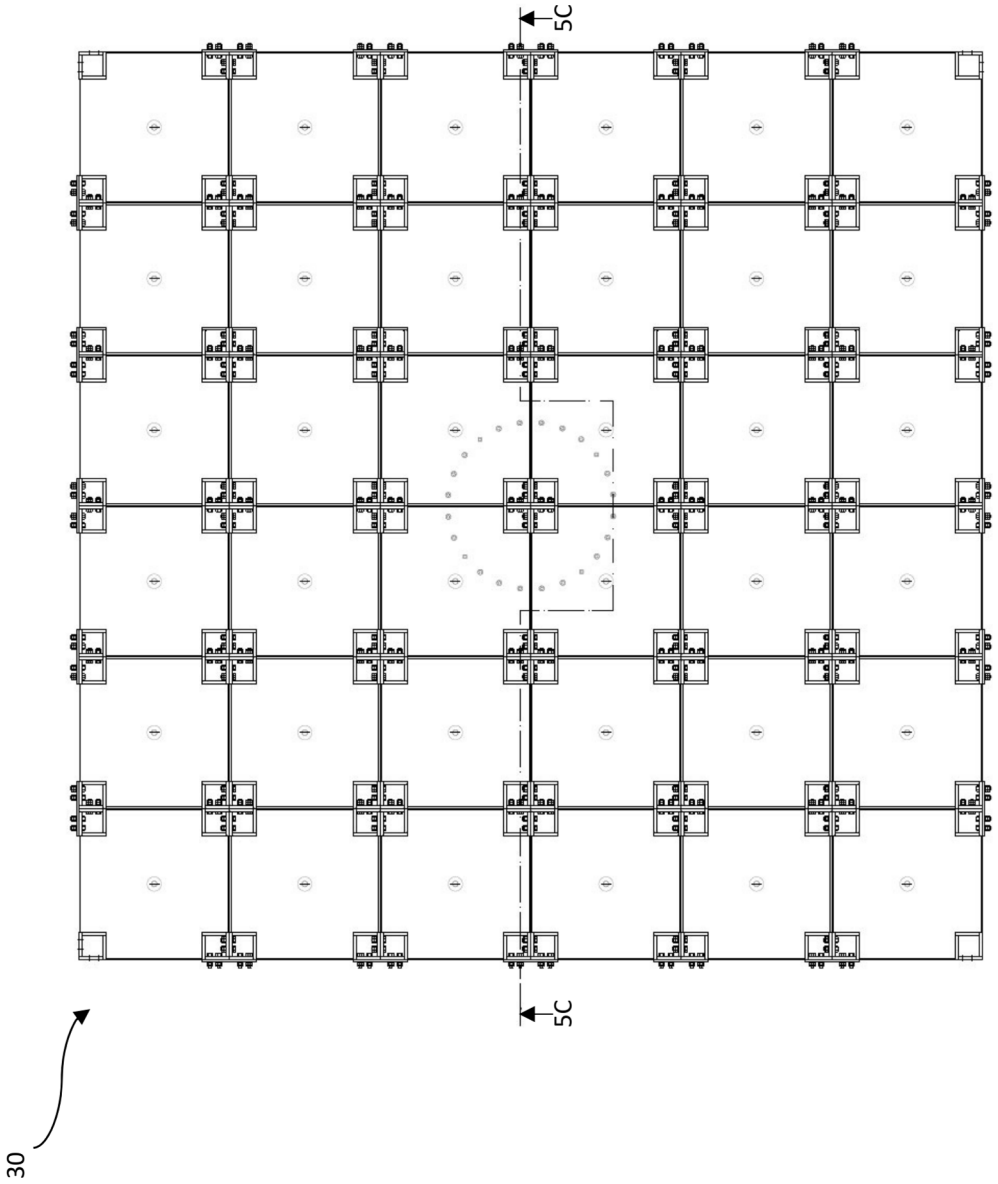


FIG.5C

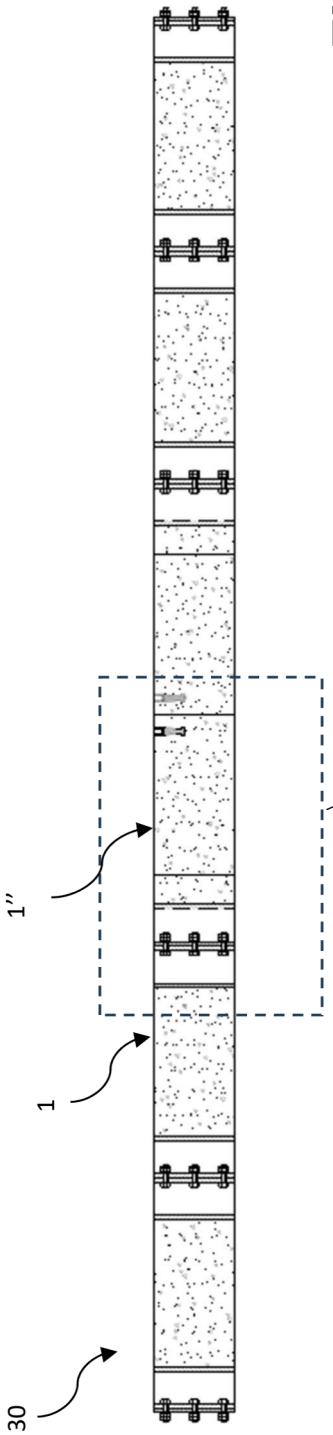
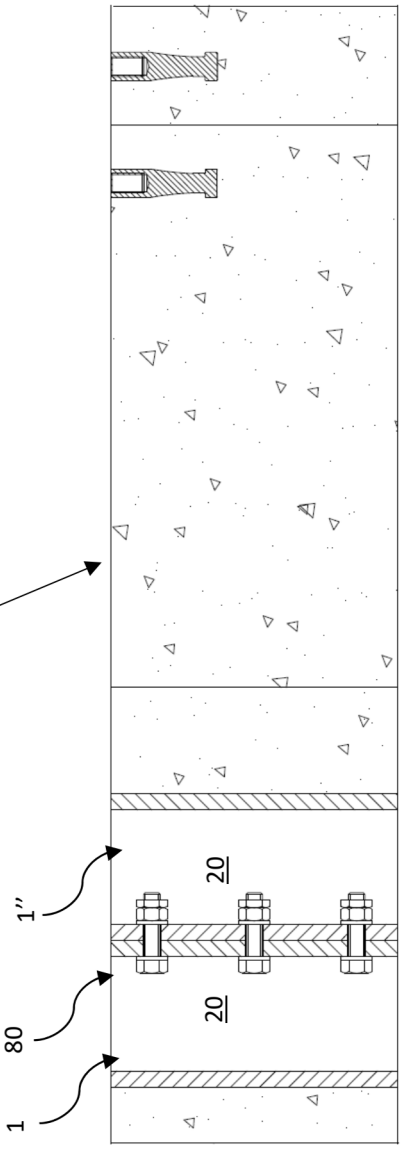


FIG.5D



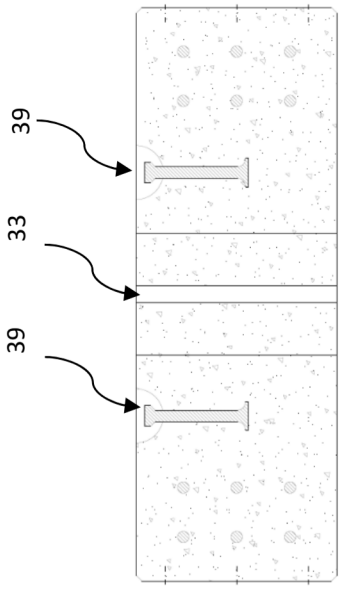


FIG.6B

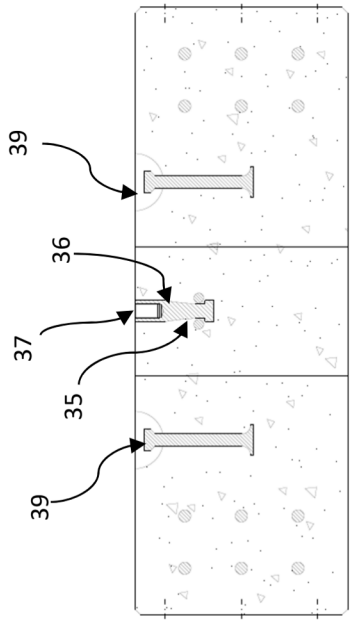


FIG.6D

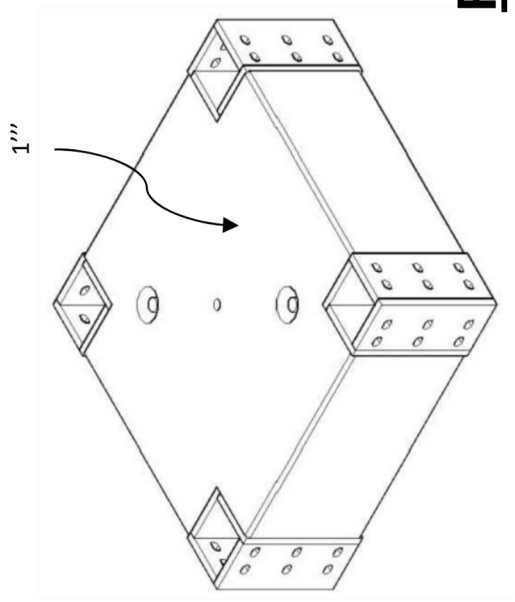


FIG.6A

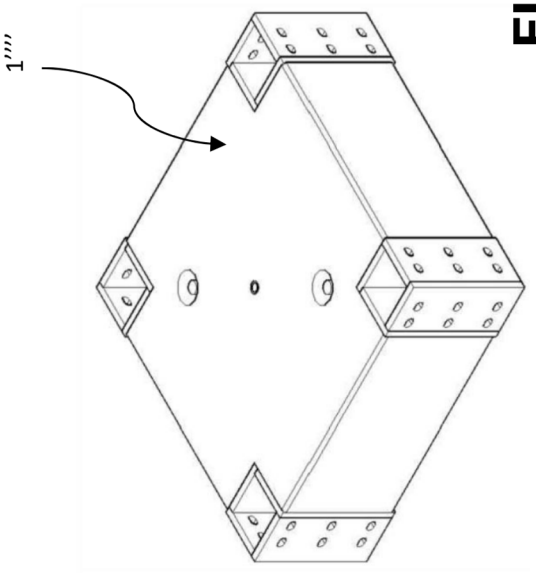


FIG.6C

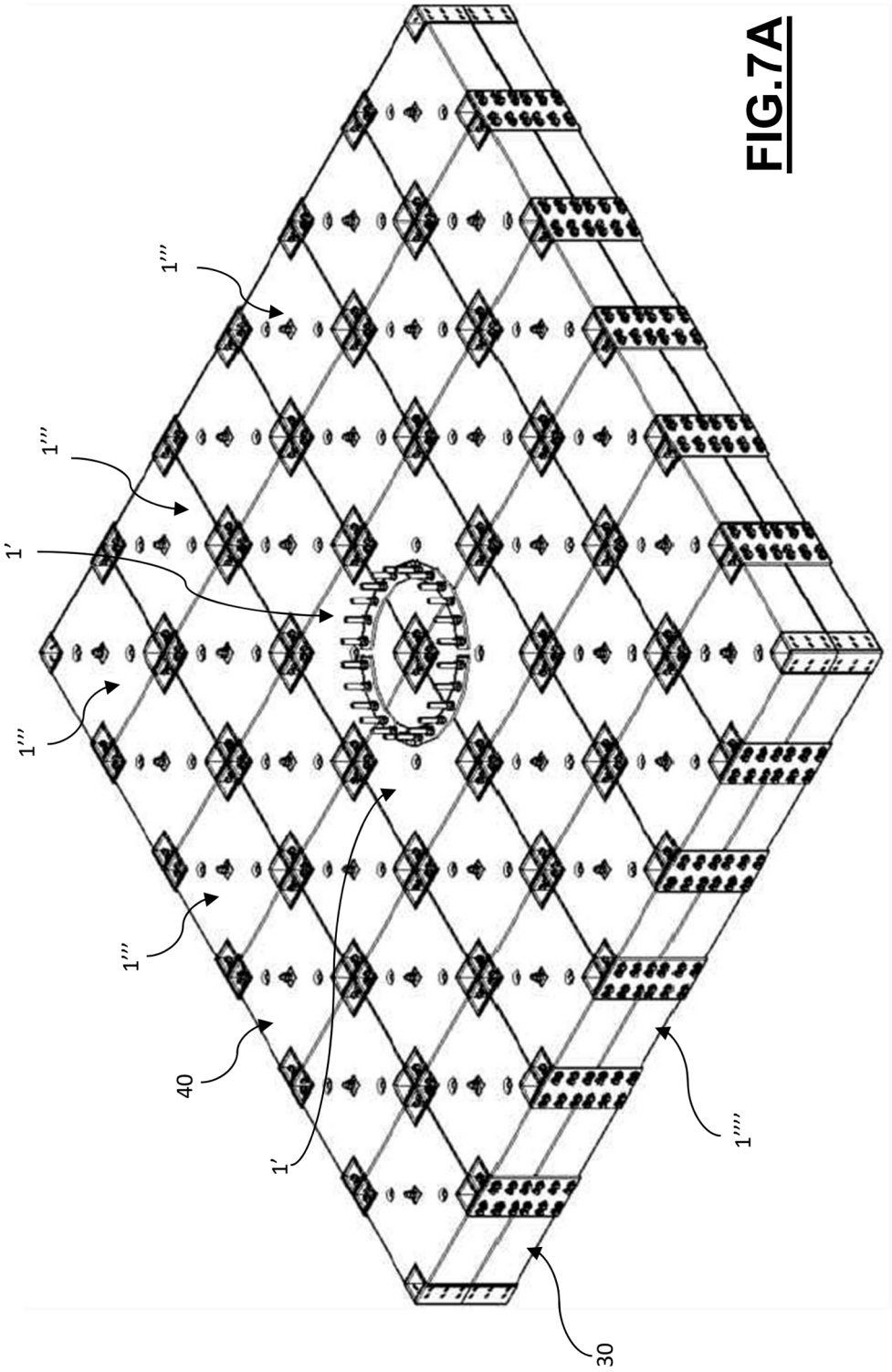
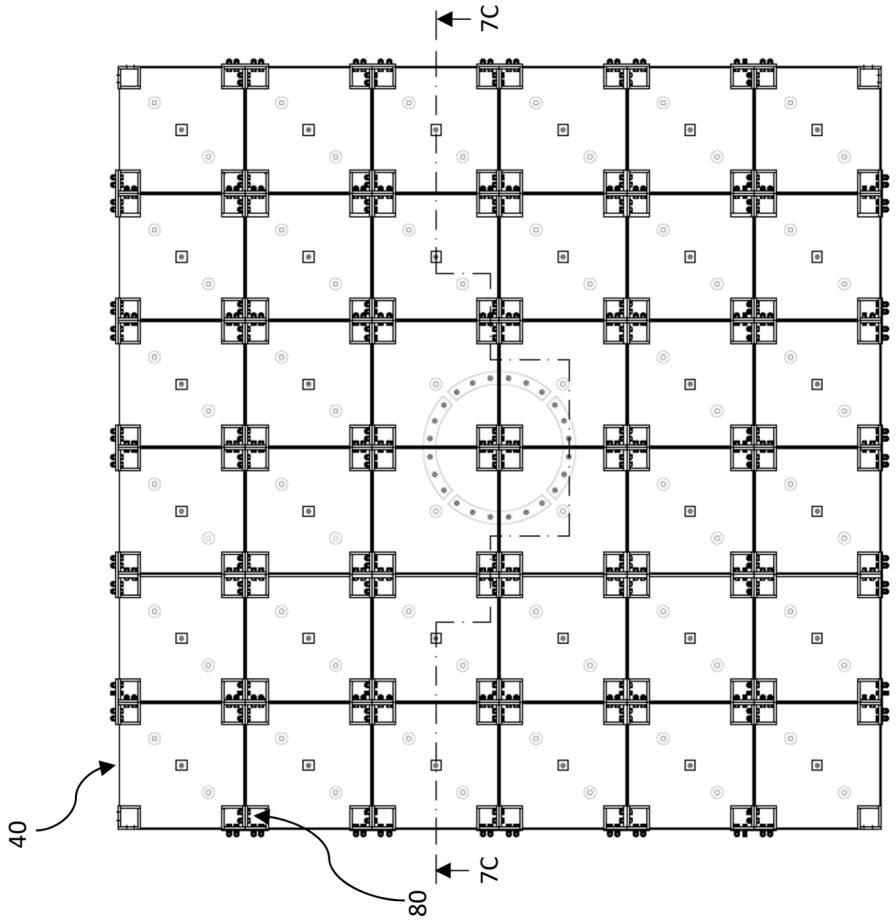


FIG.7A

FIG.7B



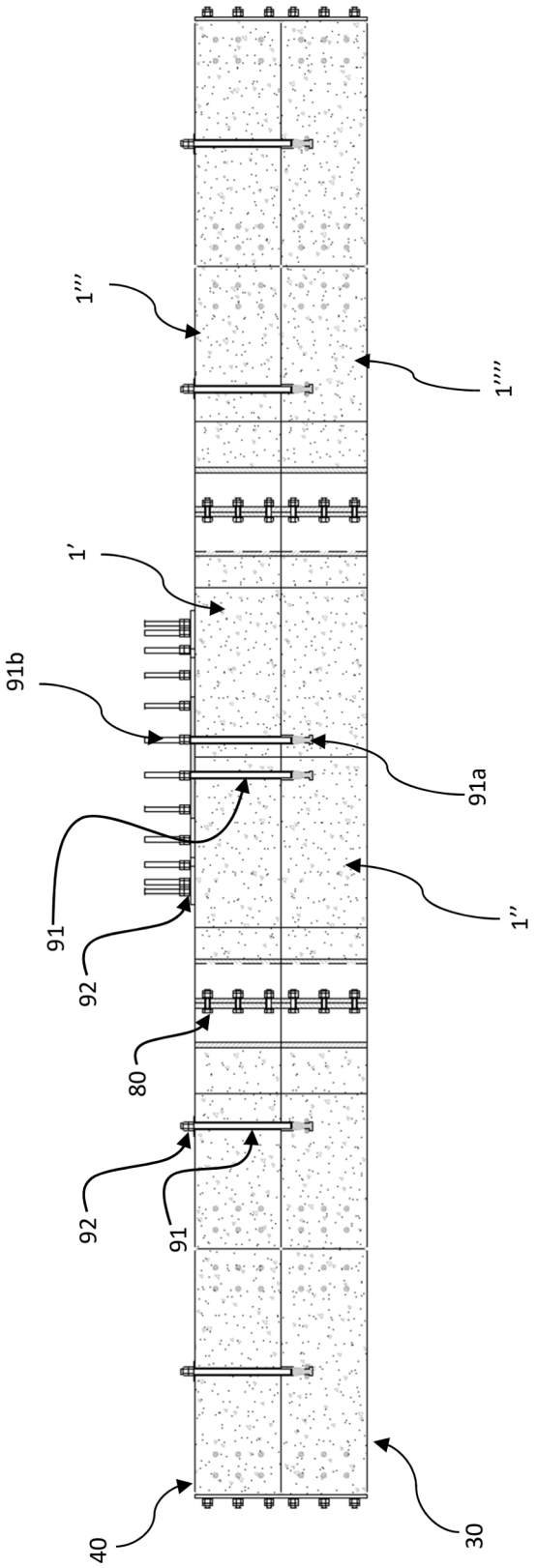


FIG.7C

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EUROPEAN SEARCH REPORT

Application Number
EP 25 21 3887

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	EP 4 194 613 A1 (Q EVO GMBH & CO KG [DE]) 14 June 2023 (2023-06-14)	1-5,7, 10,11	INV. E04H12/22
Y	* paragraph [0001]; figures 1,2,10-15 *	8,9	E02D27/01
A	* paragraph [0068] - paragraph [0071] *	6,12-14	E02D27/42 E04H5/00
X	CA 2 142 383 C (DION RICHARD [CA]) 8 February 2005 (2005-02-08)	1-5	
A	* page 4, paragraph second - page 7, paragraph third; figures 1,3,4 *	6,12-14	
X	JP 2012 127050 A (MITSUBISHI ELEC BUILDING TECHN) 5 July 2012 (2012-07-05)	1	
Y	* claim 3; figures 1,2 *	8,9	
X	IT MC20 060 023 A1 (ELETTROMONTAGGI S R L) 28 August 2007 (2007-08-28) * claim 3; figure 3 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

E04H
E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 March 2026	Valenta, Ivar

CATEGORY OF CITED DOCUMENTS

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02-03-2026

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

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