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(54) **Prefabricated building unit**

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Elément de construction préfabriqué

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**US-A1- 3 196 993** **US-A1- 4 192 113**

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## Description

**[0001]** The present invention refers to a prefabricated building unit.

**[0002]** More in particular, the present invention refers to a unit comprised of an independent room entirely made off-site, lifted up inside a building and connected to the building's utilities such as, for example, power, water and gas supplies.

**[0003]** As known, such units are mainly used in bathrooms, however, these are increasingly used for other types of rooms, such as, for example, kitchens.

**[0004]** These units are commonly made of a structure entirely in concrete which ensures high strength and rigidity. This allows the manufacturer to make the unit fully equipped with furniture equipment such as lavatories, tiles as well as waterworks, etc., directly at his own factory. The builder must simply insert the unit into position, connect it to the building's utilities and does not need to have access inside it until the construction of the building is completed. At this stage, the risk of damaging things inside the unit, such as, for example, tiles or mirrors, is significantly reduced because the builder must only connect the utilities outside the unit. Work to be carried out on spot and its management are therefore considerably reduced.

**[0005]** However, the use of such concrete units to be inserted into buildings with numerous floors is not recommended because of the significant weight of the material used, which sometimes requires the reinforcement of the slabs on which the units are laid, with the resulting increase in costs.

**[0006]** Lighter units made of a tubular steel structure lined inside with light material, such as, for example, plasterboard panels, are known.

**[0007]** The tubular structure is made by welding together tubular steel section bar posts and beams, with a generally squared section, which form a cage. In particular, a plurality of posts is welded onto beams laid around the lower and upper perimeters, respectively corresponding to the ceiling and the floor.

**[0008]** The inside of the cage is lined with the panels on which the tiles are glued, and the sanitary installations, the lavatories and other equipment are fixed.

**[0009]** In practice, the panels constitute the walls of the prefabricated units, while the tubular structure fully remains outside.

**[0010]** One of the most important aspects to keep in mind during the panel assembly stage is the need that these be assembled in a precise manner so that the final measurements of the lateral walls respect the project dimensions, or in any case that they have extremely small dimensional tolerance.

**[0011]** This is necessary because of the fact that the furniture to be inserted inside the units to make, for example, a full bathroom, is made of fixed-measurement modular components, in order to reduce production costs.

**[0012]** One of the greatest difficulties encountered when assembling the panels in the tubular structures is to actually respect the allowed dimensional tolerance, that is, the difficulty to carry out a precise assembly.

**[0013]** Such problem arises from the fact that the posts and beams are fixed together by welding. This technique causes deformations localised on the spots where work was carried out, therefore making the space designed to receive the panels not precise.

**[0014]** In particular, we have seen how at the tubular structure's angles, where the angular posts are located, the deformations caused by welding create the greatest problems, resulting in the loss of the required squareness and consequent difficulties in the panel assembly, which is not precise as requested instead.

**[0015]** In addition to such problem, taking into consideration that, in order to reduce the overall dimensions, the cables and pipes related to the components to be installed inside the units are let pass inside special holes made directly on the posts, the panels must not obstruct said holes.

**[0016]** Unfortunately, such obstruction easily occurs and practically exclusively on posts placed at the angles of the tubular structures of the known art, given that the holes are made, in reference to a squared section of the tubular element, not on the opposed sides but on the two internal adjacent faces, placed at 90°, to allow cables to go around the structure.

**[0017]** The panel assembly at the angles may be carried out in two different modes. The first mode provides for making, on each pair of panels forming the dihedral angle, a 45° notch on the vertical edges to be coupled at the angle. In such case, the panels will have the thus formed vertex ledged against the corner of the angular post. In this manner, the obstruction of the holes is always avoided, however, such mode is scarcely followed because it is difficult to achieve with precision and mostly because it turns out to be hardly reliable due to the lack of a real support for the panel edges. The second, usually

used, panel assembly mode at the angles provides for the assembly of one of the two panels with one of the two opposed vertical edges resting on a face of the squared tubular structure of the angular post and, subsequently, the assembly of the remaining panel, necessary to form the angle, with one of the two vertical edges ledged against the first panel, near the corner. In this second assembly mode, the portion of the first panel near the edge, which leans directly on the angular post, may go beyond the holes found on the supporting face. Therefore, the assembly according to this second mode also presents disadvantages.

**[0018]** In practice, the references that were ensured by the same concrete structure walls, which did not have the above-mentioned problems, are lacking.

**[0019]** DE 16 84 544 discloses a system for building a prefabricate structure using a plurality of posts and beams. In order to build the structure, a plurality of panels are connected to respective tubular angular posts. In cor-

respondence of the tubular angular post, respective angular section bars are connected to the panels are also connected, by means of screws and bolts, in order also to connect two adjacent panels tighter, the angular section bars being placed towards the interior of the structure. However, in such structure, the respective arrangement of the angular section bars and the lining panels is such that the lining panels are in abutment against the surfaces of the angular section bars, these latter having the function of pressing and blocking the panels themselves against suitable abutment surfaces of the posts. Therefore the sides of the angular section bars are always covered by the panels not allowing for the passage of cables and pipes related to the components to be installed inside the unit.

**[0020]** Document D2: US 4 192 113 discloses a system for building a prefabricate structure in which the angular section bars are connected to respective tubular angular post. The angular section bars faces towards the interior of the structure and cooperates with the tubular angular post in the building of the structure by means retaining in position between them the lining panels of the structure. Also in this case the lining panels are in abutment against the surfaces of the angular section bars, these latter having the function of pressing and blocking the panels themselves against suitable abutment surfaces of the posts. Therefore, also in this case, the presence and position of the panels do not allow for the passage of cables and pipes related to the components to be installed inside the unit.

**[0021]** Therefore, there is a strongly felt need to have a prefabricated building unit comprising a tubular structure formed by posts and beams that allows for a fast and precise assembly of the internal lining side panels, in the scope of a cost-efficient, simple and rational solution.

**[0022]** The aim of the present invention is to provide a prefabricated building unit having structural and functional characteristics such as to meet the above-mentioned requirements and to solve the drawbacks mentioned in reference to the known art.

**[0023]** Such aim is achieved by means of a prefabricated building unit according to claim 1.

**[0024]** The dependent claims outline preferred and particularly advantageous embodiments of the prefabricated building unit according to the invention.

**[0025]** Further characteristics and advantages of the invention will be more obvious from the reading of the following description provided by way of example and not limitation, with the help of the figures depicted in the accompanying drawings, in which:

- figure 1 shows a plan view, with the roofing removed, of a prefabricated unit according to the present invention;
- figure 2 shows an enlarged view of an angle, without any flange, of the unit of figure 1;
- figure 3 shows a perspective view of a portion of the

angle of figure 2, with a flange;

- figure 4 shows a perspective view of a portion of a reinforcement post;
- figure 5 shows the V-V section of figure 1.

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**[0026]** Referring to the above-mentioned figures, a prefabricated building unit according to the present invention is globally indicated by 1.

**[0027]** The unit 1 comprises a rigid cage-like structure 10 internally lined with panels 100 and comprising a plurality of posts 2, of equal height, fixed on the top and at the bottom to beams 3, to which the floor 10 and the ceiling 11 are fixed, respectively (Fig. 5).

**[0028]** The structure presents a prismatic configuration with the perimeters of the opposed bases defined by the upper and lower beams 3, respectively.

**[0029]** In particular, in the example, the structure is a parallelepiped with four squared- or rectangular-section posts, arranged at the angles, which for simplicity we will 20 call angular posts 2a and the rest of the posts 2, with an H-shaped section, placed equidistantly and having the function of reinforcement of the walls formed by the panels 100.

**[0030]** According to an embodiment of the present invention, a flat spacing element 4, to which an angular section bar 5 formed by two wings 51 placed at 90° is fixed, is fixed in a cantilevered manner to each angular post 2a, for example by welding, from an edge 2b facing the inside of the structure.

**[0031]** The assembly formed by the spacing element 4 and by the corresponding angular section bar 5 presents a fork or "Y" section configuration (Fig. 2).

**[0032]** In particular, the spacing element 4 is placed with respect to the angular post 2a to which it is fixed, in 35 such a way that the vertical plane lying on the spacing element 4 itself crosses the angular post 2a preferably passing through its diagonal, while the wings 51 are always parallel to the sides of the post 2a.

**[0033]** Essentially, the spacing elements 4 form four 40 cantilevered ribs facing the central area of the structure and each angular section bar 5 presents an "L" configuration with a 90° dihedral angle facing the inside of the structure.

**[0034]** Therefore, the overall structure of the example 45 presents, at the four angles, the four angular section bars 5 arranged to receive in abutment the internal lining panels 100, whose assembly is shown in figure 1, ensuring high assembly precision.

**[0035]** In order to ensure greater resistance and stability, a reinforcement plate 6 is fixed to each angle near the upper end (Fig. 3), horizontally arranged, which holds together, according to a fixed arrangement, the angular post 2a, the spacing element 4 and the angular section bar 5.

**[0036]** According to the preferred embodiment and in 55 order to optimise the overall dimensions, each spacing element 4 arranged at the angles is provided with a plurality of slots 7 to allow for the passage of various cables

and/or pipes to be connected to the building's utilities where the unit 1 has to be inserted. This slot 7 arrangement allows for leaving the angular posts 2a untouched, further easing the passage of cables and pipes compared to the known art.

**[0037]** Of course, the wall reinforcement posts 2, that is those that are not placed at the angles, are located with the support plane of the panels 100, formed by one of the two parallel elements of the H-shaped section bar, coplanar with the arms of the angular section bar 5 and furthermore they are provided with crossing slots 7 placed on the central transversal element of the H-shaped section bar.

**[0038]** In order to ease the lifting of the unit 1, an internally threaded sleeve 8 (Fig. 2) to screw a hook, not shown, for the passage of support cables, is fixed to each angular post 2a, near the upper end. When the positioning of the unit is completed, the hooks may be unscrewed, reestablishing the levelness of the upper surface.

**[0039]** The posts 2,2a and the beams 3 are made of metal, steel for example, according to the known art and subsequently undergo cold galvanising in order to improve their resistance to corrosion.

**[0040]** The panels are made of plaster fibre (Fermacell), in order to have greater mechanical strength and be mostly resistant to humidity compared to plasterboard panels.

**[0041]** In alternative to the above-described embodiment, it is possible to fix the angular section bar 5 directly onto the angular post 2a without the help of a spacing element 4.

**[0042]** As may be understood from what has been described, the prefabricated building unit according to the present invention allows for meeting the requirements and overcoming the drawbacks mentioned in the introduction of the present description with reference to the prior art.

**[0043]** In fact, the prefabricated unit according to the present invention, thanks to the presence of L-shaped angular section bars fixed to the angular beams through the spacing elements, allows for the precise and fast assembly of the panels.

**[0044]** Furthermore, the location of the slots on the spacing elements considerably facilitates the dislocation of the cables and pipes on the external side of the panels.

**[0045]** Obviously, one skilled in the art may make numerous modifications and changes to the above-described prefabricated building unit, all of which fall under the protection scope of the invention as defined in the following claims, in order to meet specific and incidental requirements.

## Claims

1. A prefabricated building unit (1) comprising a rigid structure formed by tubular posts (2, 2a) and beams (3) making a cage which is internally lined with panels

(100), at least part of said posts (2a) being arranged at the angles of said structure, wherein an angular section bar (5) configured to define a dihedral angle facing the inside of the structure is associated with each tubular post (2a) arranged at the angle, **characterised in that** said angular section bars (5) are arranged inside the cage and receive in abutment the internal lining panels (100) in the respective dihedral angle facing the inside of the structure.

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innen mit Paneelen (100) ausgekleidet ist, worin mindestens ein Teil der Pfosten (2a) in den Ecken der Struktur angeordnet ist, worin eine Winkelprofilstange (5), die dazu ausgestaltet ist, um einen der Innenseite der Struktur zugewandten Flächenwinkel zu definieren, jedem in der Ecke angeordneten, rohrförmigen Pfosten (2a) zugeordnet ist, **dadurch gekennzeichnet, dass** die Winkelprofilstangen (5) im Inneren des Käfigs angeordnet sind und die inneren Verkleidungspaneelle (100) im jeweiligen, der Innenseite der Struktur zugewandten Flächenwinkel anliegend aufnehmen.

2. Einheit (1) nach Anspruch 1, worin der Flächenwinkel etwa 90° beträgt.
3. Einheit (1) nach Anspruch 1, worin die Winkelprofilstange (5) eine L-förmige Konfiguration im Querschnitt aufweist.
4. Einheit (1) nach Anspruch 1, worin die Winkelprofilstange (5) direkt am entsprechenden Pfosten (2a) durch Verschweißen befestigt ist.
5. Einheit (1) nach Anspruch 1, worin die Winkelprofilstange (5) mit dem entsprechenden Pfosten durch Einfügen eines Distanzstücks (4) verbunden ist, das bezogen auf den Pfosten (2a) auskragt.
6. Einheit (1) nach Anspruch 5, worin das Distanzstück (4) eine flache Konfiguration aufweist.
7. Einheit (1) nach Anspruch 6, worin die aus der Winkelprofilstange (5) und dem Distanzstück (4) gebildete Gruppe eine Gabelkonfiguration im Querschnitt aufweist.
8. Einheit (1) nach Anspruch 7, worin die Pfosten (2,2a), die Distanzstücke (4) und die Winkelprofilstange (5) dieselbe Höhe aufweisen.
9. Einheit (1) nach Anspruch 8, worin Verstärkungsplatten (6) an den oberen Enden der Distanzstücke (4) der in den Ecken angeordneten Pfosten (2a) und der Winkelprofilstangen (5) befestigt sind.
10. Einheit (1) nach Anspruch 5, worin das Distanzstück (4) mit mindestens einem Kabelführungsschlitz (7) versehen ist.
11. Einheit (1) nach Anspruch 1, worin eine Innengewindehülse (8) zum Einschrauben eines Hakens zum Anheben der Struktur an jedem, in der Ecke, am oberen Ende angeordneten, rohrförmigen Eckpfosten (2a) befestigt ist.

## Revendications

1. Unité de construction préfabriquée (1) comprenant une structure rigide formée par des poteaux tubulaires (2, 2a) et des poutres (3) formant une cage qui est revêtue intérieurement de panneaux (100), au moins une partie desdits poteaux (2a) étant disposée aux angles de ladite structure, où une barre de section angulaire (5) configurée afin de définir un angle dièdre orienté vers l'intérieur de la structure est associée à chaque poteau tubulaire (2a) disposé à l'angle, **caractérisée en ce que** lesdites barres de section angulaire (5) sont disposées à l'intérieur de la cage et reçoivent en appui les panneaux de revêtement interne (100) dans l'angle dièdre respectif orienté vers l'intérieur de la structure.
2. Unité (1) selon la revendication 1, où ledit angle dièdre est égal à environ 90°.
3. Unité (1) selon la revendication 1, où ladite barre de section angulaire (5) présente une configuration en forme de L si elle est vue en coupe.
4. Unité (1) selon la revendication 1, où ladite barre de section angulaire (5) est fixée directement sur le poteau correspondant (2a) par soudage.
5. Unité (1) selon la revendication 1, où ladite barre de section angulaire (5) est associée au poteau correspondant par le biais d'un élément d'espacement interposé (4) en saillie par rapport au poteau (2a).
6. Unité (1) selon la revendication 5, où ledit élément d'espacement (4) présente une configuration plate.
7. Unité (1) selon la revendication 6, où l'ensemble de ladite barre de section angulaire (5) et dudit élément d'espacement (4) présente une configuration en fourche, s'il est vu en coupe.
8. Unité (1) selon la revendication 7, où les poteaux (2, 2a), les éléments d'espacement (4) et les barres de section angulaire (5) ont la même hauteur.
9. Unité (1) selon la revendication 8, où des plaques de renfort (6) sont fixées à l'extrémité supérieure des éléments d'espacement (4) des poteaux (2a) placés aux angles et des barres de section angulaire (5).
10. Unité (1) selon la revendication 5, où ledit élément d'espacement (4) est muni d'au moins une fente de passage de câbles (7).
11. Unité (1) selon la revendication 1, où un manchon fileté intérieurement (8) pour visser un crochet pour le levage de la structure est fixé à chaque poteau angulaire tubulaire (2a) disposé à l'angle, près de

l'extrémité supérieure.

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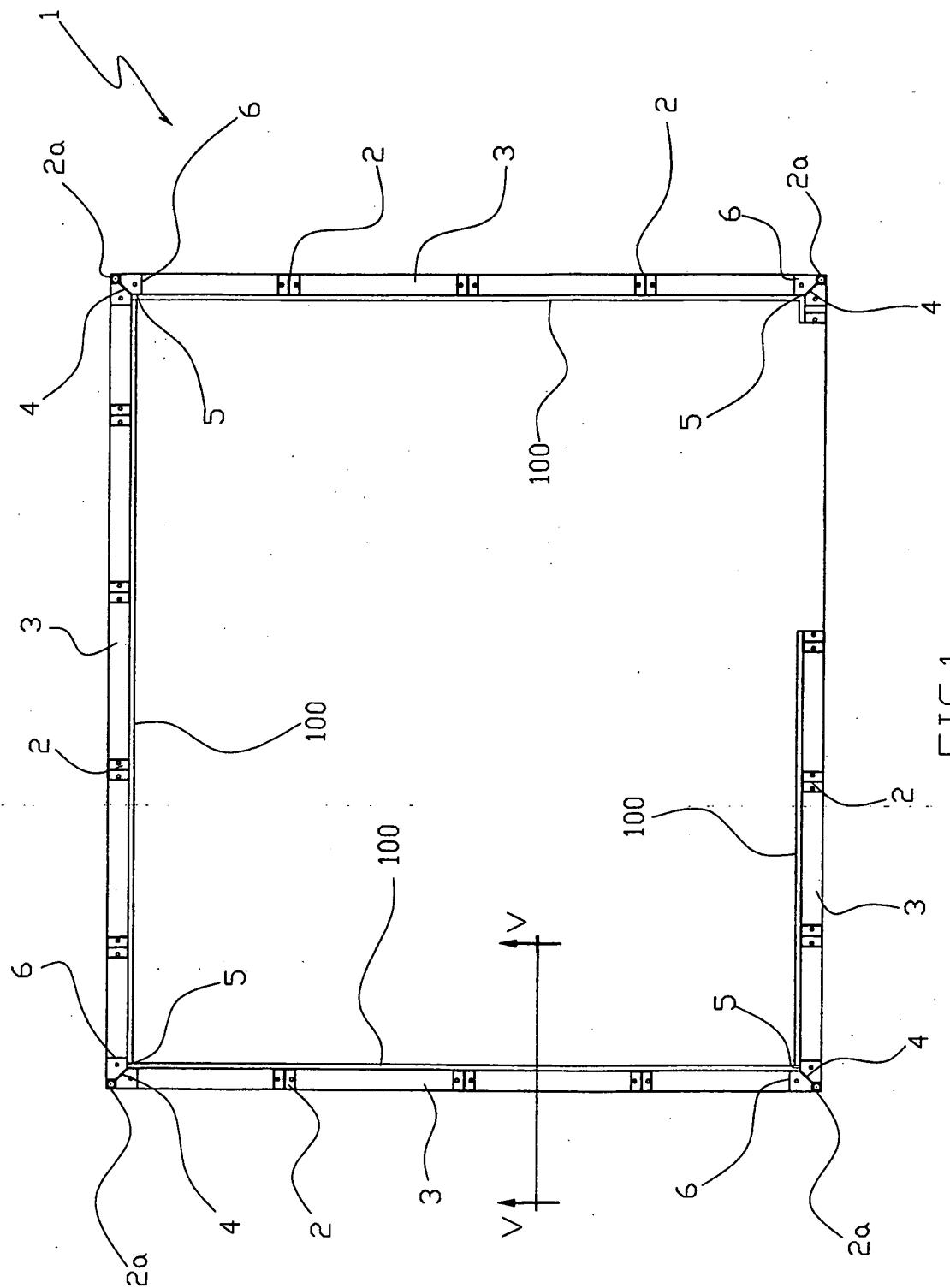
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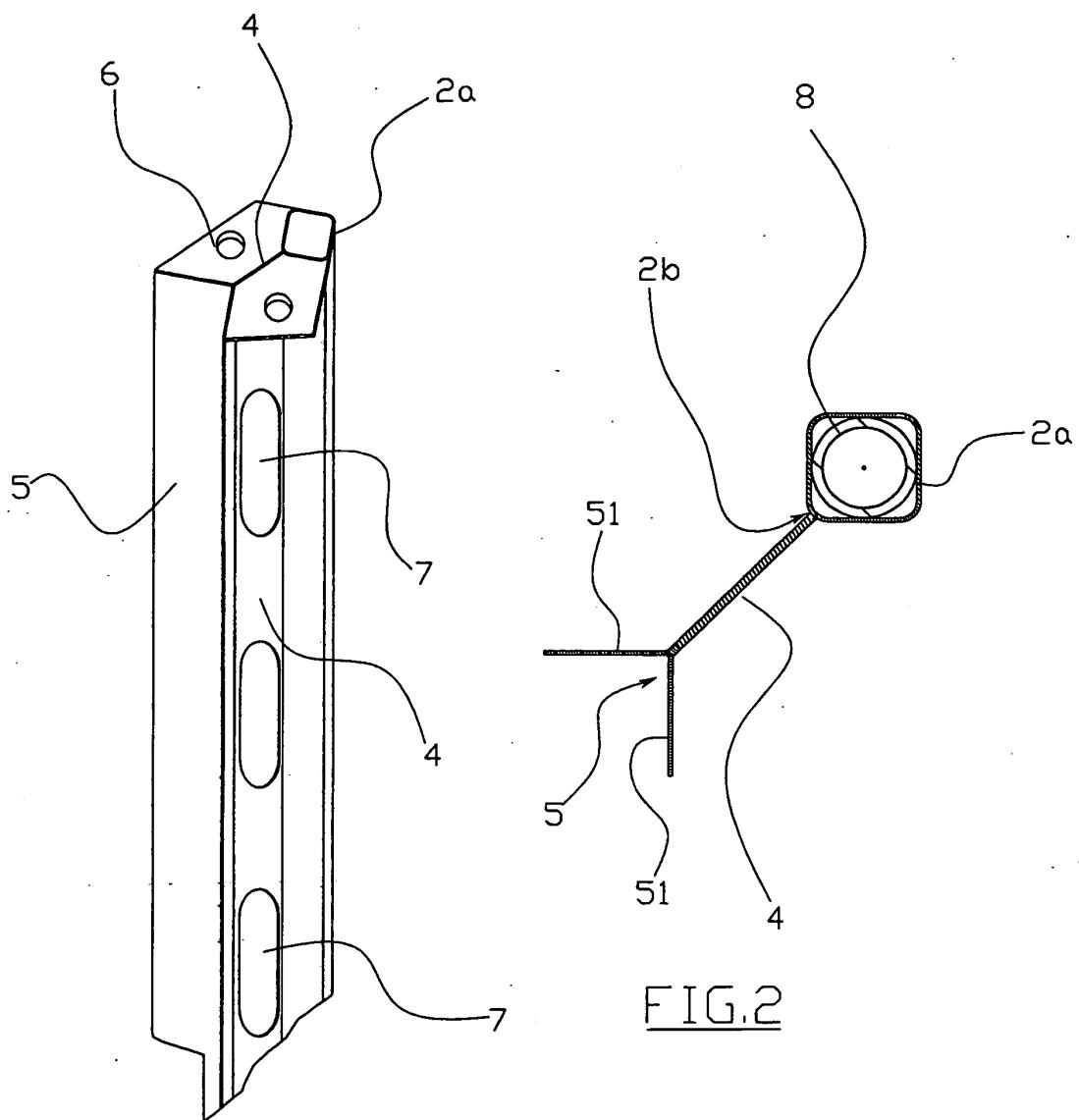


FIG.3

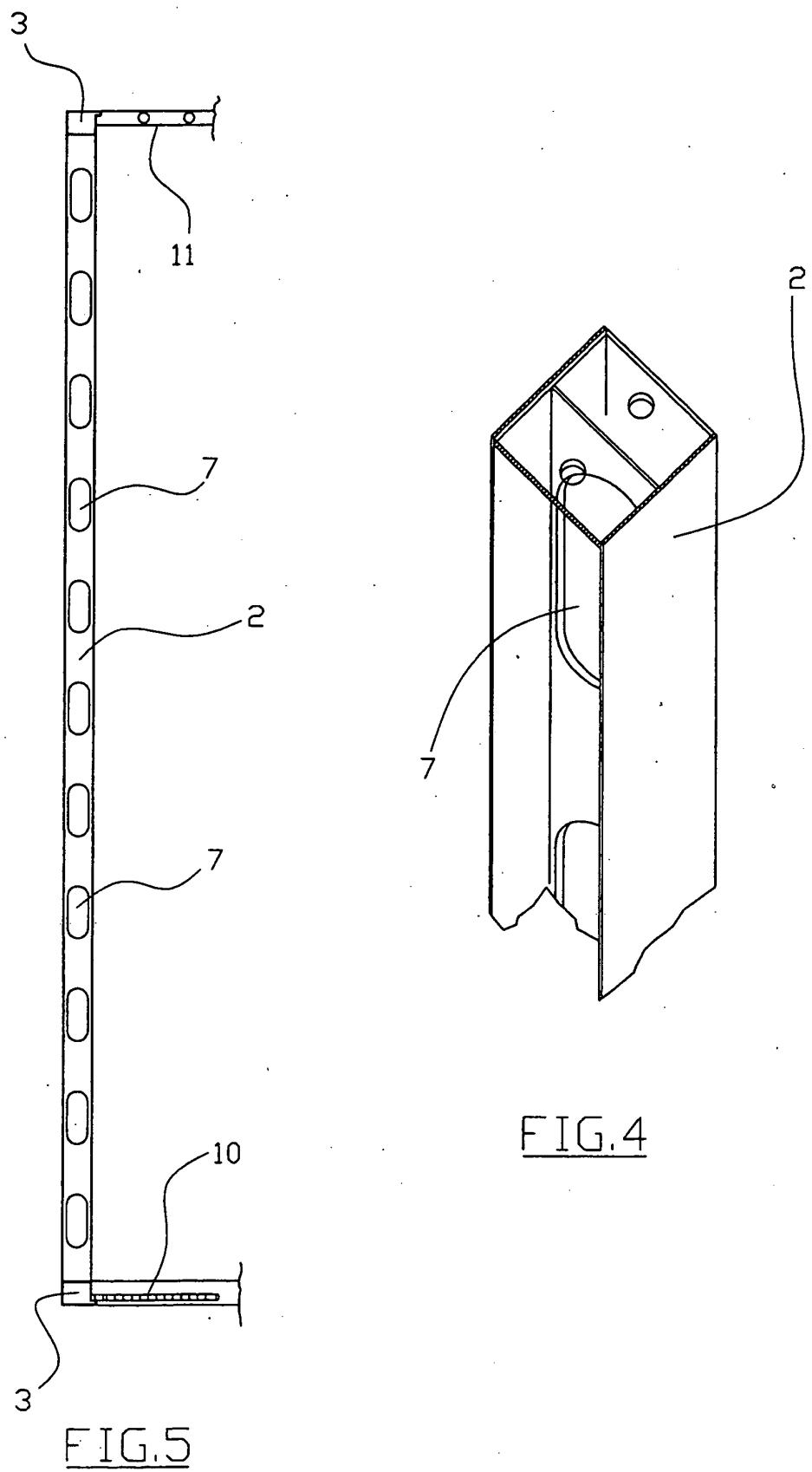


FIG.4

FIG.5

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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