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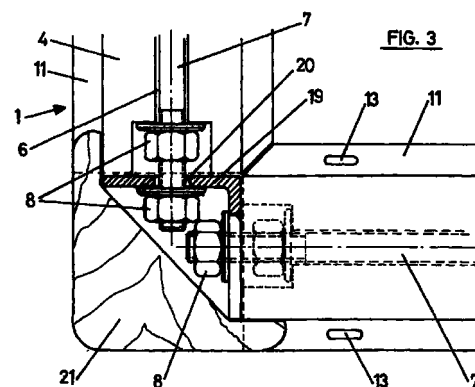
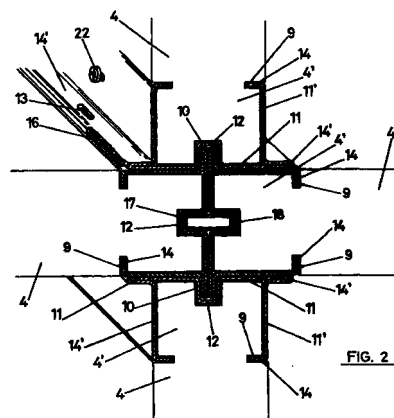
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(54) **MODULAR INTEGRAL CONSTRUCTION SYSTEM FOR SOLID WOOD BUILDINGS**

(57) The system is based on the use of modules which are repeated in frames for floor (2), walls (1) and roof, said modules comprising vertical arrangements of boards (4) joined together along their transversal edges by means of horizontal metallic brackets (11) and by means of stiffening rods housed in opposing holes in the boards (4) themselves, the ends of said rods being threaded for tightening by means of pertinent nuts. The boards (4) are prepared with tongue and groove arrangements (5), modules being produced with height equal to that between floor and ceiling. The horizontal fastening to the floor frames (2) is achieved by welding or other means of the horizontal brackets (11), while the vertical fastening between concurrent modules is implemented by screwing the ends of the stiffening rods (7) to the concurrent unit or to auxiliary L-shaped brackets (19). The modules for partitions, frames and roof, can be of different thickness in order to adapt to the criteria of the project being implemented.



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Description

OBJECT OF THE INVENTION

[0001] The invention concerns a modular system for the integral construction of buildings in solid wood, designed to permit the erection of one or more floors on a basis of modules which are repeated in frameworks, outside walls and indoor partitions, starting from a conventional footing or foundation adapted to be able to receive the pertinent modules vertically.

[0002] The object of the invention is to provide a modular system of building in which each module is formed by means of a number of wooden boards assembled alongside each other and joined together by fitting their outside edges into having a C-shaped sections, permitting said edges to be joined to others similar, in any type of intersection between modules, be this adjacent, perpendicular or at a corner.

BACKGROUND TO THE INVENTION

[0003] Different modular systems are known for building construction employing solid wood, based on boards suitably assembled and/or joined to each other to constitute, in some cases, walls and/or partitions, and in other cases, frames.

[0004] However, in all cases the modules are the result of boards laid in a horizontal position, whereby the resistance to vertical loading is very limited, implying a series of problems which it is attempted to overcome by means of supplementary elements and/or components, to which must be added the need to make use of a large number of piece parts and accessories (screws, plates, brackets, etc.), to permit the construction or erection of the building, which not only implies a penalty in assembly time with the consequent lengthening of the period required to complete the work, but also signifies a notable increase in cost, not forgetting that due to the great number of components and parts that have to be fixed to each other, the guarantees of maximum safety and quality in the finish are not total.

DESCRIPTION OF THE INVENTION

[0005] The system proposed herein was conceived to overcome all the problems outlined above and to achieve new and advantageous facilities in comparison with known systems.

[0006] More specifically, the system of the invention is based on the wooden boards being mounted vertically, whereby one achieves high resistive strength to both horizontal and vertical loads.

[0007] The modules that are produced shall have a height equal to that between the floor and ceiling frames, and in which the wooden boards from which the modules themselves are formed, are assembled to each other by tongue and groove matching or another

similar procedure, along the longitudinal edges while the transversal edges are all joined together, in each module, to a C-shaped section which clamp over said edges. The sections in question are metallic and have holes to permit screwing to the boards, with the particularity that the latter are provided with holes perpendicular to the longitudinal edges, which line up opposite each other to constitute a seating channel for respective rods with their projecting ends threaded to receive corresponding washers and lock nuts.

[0008] The length of each module shall be defined according to the parameters of each project, it being possible to use different thicknesses depending on the function they have in the building, in line with the project criteria for implementing frameworks, roofing, outside walls and indoor partitions.

[0009] With regard to the characteristics of the boards, the latter have the particularity that, in correspondence with the transversal edges or ends, they have a segment of less thickness which is precisely that which lodges in the channel defined by the C-shaped metallic sections, with the particularity that in those transversal edges the boards have an intermediate channel practised in them into which fits a projection resulting from an intermediate recess present on the central leg of the respective C-shaped metallic section, it having also been planned that the end segment of less thickness of these transversal edges of the boards is in each case delimited by respective side grooves in which are housed respective parts obtained by folding over the outside longitudinal edges of the side legs corresponding to the C-shaped metallic sections, the boards being thus perfectly attached by sliding over the metallic sections, with the added assistance of the pertinent screws in the side.

[0010] The side legs of the C-shaped metallic sections are equal in size to that of the less thick end segments of the boards. In addition, each of these metallic sections has, starting from the side legs and as an extension of the central leg, longitudinal coplanar flanges in which rows of oblong holes are likewise practised.

[0011] Both the central channel provided in the transversal edges of the boards, and the intermediate recess and corresponding projection inside the central branch of the C-shaped metallic sections, can be rectangular or square in cross section.

[0012] With respect to joining concurrent vertical modules with floor and ceiling frame modules, this is done by welding or other means of screw-fastening the actual metallic sections themselves, through the holes for this purpose in the coplanar longitudinal flanges pertaining to said sections, while the join between the concurrent vertical modules themselves is achieved by screwing nuts and washers to the rods which traverse the boards and which are terminated in projecting threaded segments, though it is preferred that an auxiliary L-shaped section be employed for these unions in

the case of an upright angular junction.

[0013] The coplanar modules employed as framework shall be fastened to each other by means of bead or tack welding of the longitudinal flanges of the adjacent sections, and by welding or by other bolted means to the foundation, the fastening of the floor frames being by means of welding or other means for the partition sections.

[0014] In accordance with all the foregoing, the arrangement of the modules on the site permits access to the rods which run through the opposing holes in the boards, said rods being termed "stiffeners", since they perform the tightening and adjustment between the boards in question in each module, said accessibility to the stiffener rods making it possible to control the stress in boards and modules both during erection and afterwards, to perform adequate maintenance.

[0015] Among the most important advantages which can be mentioned and which stem from the modular construction system referred to, are the following:

- The configuration of the boards that constitute the modules or facings, is vertical with respect to the plane of the framework, meaning that each of the boards works as a pillar, endowing the partitioning with a high compressive strength under load.
- The modules formed on a basis of the system of the invention, are suitable for use as load-bearing elements in floor and ceiling frames.
- The particular geometry of the metallic sections employed in forming said modules permits a solid junction between frame constructional elements and wall constructional elements.
- The configuration of the modules, as has already been mentioned, permits access to the board stiffening rods, permitting the stress to be controlled in the modules both during erection of the building and after assembly has been completed.
- A notable reduction in production costs, through standardising of elements and parts for a single floor-to-ceiling height.
- An optimum static and dynamic strength under load and with respect to natural forces.
- A great number of finishing pieces and elements are eliminated in partitioning junctions.
- Possibility of using different thicknesses in outside walls, partitioning and frames, in order to adapt to project needs and requirements, for reasons of mechanical strength, thermal insulation, etc.
- Reduced assembly times for building, being considerably shortened while maintaining optimum building quality.

DESCRIPTION OF THE DRAWINGS

[0016] To complete the description being made and with the objective of assisting in a better understanding of the features of the invention, in accordance with a preferred embodiment of the same, a set of drawings is attached as an integral part of said description, in which drawings, by way of illustration and in no way limiting, the following is shown:

Figure 1.- Shows a top view and a side view of the C-shaped metallic section employed for joining boards to form modules.

Figure 2.- Shows a vertical sectional view in perspective of the junctions between two floor frame modules and two intervening partitions, one for the ground floor and the other for the first floor.

Figure 2.- Shows a top view of a vertical junction between two corner partitions and the corresponding means for stiffening.

Figure 4.- Shows a view in perspective of a vertical section of the junctions corresponding to a lower outside wall, frame module assembly and fastening of an upper outside wall, in which can also be seen the projecting ends of the board stiffening rods.

Figure 5.- Shows a sectional view in perspective of a ground floor in which can be appreciated the foundation footing and the manner of proceeding to commence erecting the frame modules, as well as distribution partitions, it being possible to observe one possible manner of collocating the frames on the foundation footing, from the numerous approaches that can be adopted.

Figure 6.- Shows a view in perspective of a horizontal section of a corner of a building in which can be appreciated the horizontal fastening to a frame module, the ends of the rods prepared to receive an auxiliary L-shaped section, for vertical positioning by means of washers and nuts, and the addressing of an indoor partitioning module against the side, as well as the arrangement for vertical fastening using washers and nuts.

Figure 7.- Shows a view in perspective of a vertical section of upright distribution modules, in which can be observed the addressing of two corner modules, the corner-anchoring bracket and an inside module, as well as the positioning of the upper and lower horizontal sections which delimit the height between the floor and ceiling framework, also being visible the arrangement of horizontal holes for housing the stiffening rods.

Figure 8.- Shows a partial vertical sectional view of a building with two floors and loft, in which can be seen the distribution of the partitioning on the frame modules for ground floor, first floor, as well as the loft and roof frames.

Figure 9.- Shows a partial vertical sectional view, in this case an elevation, of a building in which can be

seen the assembly of the outside wall units on the floor and roof frames.

Figure 10.- Shows, finally, a drawing corresponding to a partial vertical side section, which defines the junction of a floor framework module with a thickness greater than that of the lower dividing partition, and the latter, in turn, having a greater thickness than the upper dividing element, a representation which corresponds to an example having of a non-limiting nature with regard to the possibilities for resolving situations with different module thicknesses.

PREFERENTIAL EMBODIMENT OF THE INVENTION

[0017] In the light of the reference figures, it can be seen how the system of the invention has the particular feature whereby both the walls (1), and frames (2) and partitions (3) are modular, each module being formed by a series of solid wood boards (4) arranged vertically in walls (1) and partitions (3) and horizontally in frames (2).

[0018] In all cases the boards (4) are joined together at the sides, i.e. longitudinally, by means of a groove and tongue arrangement (5) provided for the purpose in the side or longitudinal edges of the boards, holes (6) also being practised which line up with each other to permit the stiffening rods (7) to pass through, said rods having their ends threaded for tightening, by means of nuts and corresponding washers (8), in order to achieve a perfect fit and/or strength between the boards (4) of each module.

[0019] At the ends or transversal edges, the boards (4) are finished with a segment (4') of less thickness, delimited by a pair of lateral grooves (9), i.e. in their larger faces, while in the centre of the edge there is a longitudinal channel (10) of greater size than the lateral ones mentioned. Both the grooves (9) and the channel (10) shall preferentially be of a rectangular or quadrangular shape, without discarding others which are suitable.

[0020] The referenced boards (4) of each module, the latter consisting of a plurality of boards, are duly assembled by seating or clamping their transversal edges into respective metallic sections (11), the latter being shaped in the form of a "C", in which the intermediate leg is equal in size to the less thick segment (4') at the edge of the boards (4), said intermediate leg having practised longitudinally in it an intermediate rectangular recess (12) which determines the respective projection towards the inside of the section itself, said projection facing and having the same size as the channel (10) in the transversal edge of the boards (4).

[0021] The side legs (11') of the metallic sections (13) come with a line of oblong holes (13), the length of the former being equal to that of the less thick segments (4') of the boards (4), each being finished in folds (14) at right angles towards the inside, having the same depth

as the grooves (9) which delimit said less thick segments (4'), and into which they are inserted.

[0022] The central leg of these metallic sections (11) is extended in coplanar segments (14') which project perpendicular to the sides (11'), said segments also having oblong holes (13) to permit the insertion of set-screws (22).

[0023] In this manner each module is determined by the respective collection of boards (4) joined together by means of the sections (11), said modules being self-supporting and of equal height to the separation existing between floor and ceiling, i.e. between each consecutive frame (2), all in such a fashion that said modules can be factory-built, transported and mounted on site by means of grabs that adapt to the profile of the upper edge of the module, without discarding its positioning being achieved by any other system or means.

[0024] Clearly the modules can be produced with internal openings to form windows and/or doorways, upwards from the lower metallic section.

[0025] When assembling the modules when constructing the floor frames, they shall be laid horizontally so that they rest on a footing (15), as can be seen in figure 5, continuous over its full length, in which can be seen auxiliary sections (15') for fastening purposes, it being possible to effect the assembly in the respective intermediate recesses (12) of the sections (11) pertaining to the ground floor walls (1) and partitions (3), being joined to each other by means of a welding bead (16) or other means of fastening.

[0026] For assembling the modules corresponding to the partitions (3), the horizontal sections (11) are fastened to the guide facilitated by the sections of the frame modules (2), being fixed rigidly to these by welding or other means, and to each other by means of the horizontal stiffening rods (7), employing nuts and washers, with the interposition of auxiliary sections.

[0027] In forming the modules, the sections (11) are fitted by sliding them over the edges of the boards (4), the projection produced by the intermediate recess (12) of the central leg of the respective section (11) being housed in the vertical channel (10) of the edges of the boards (4), while the end segments (14) of the side legs (11') of said sections (11) are housed in the side grooves (9) of the boards (4) themselves.

[0028] In forming the frames, the consecutive and coplanar modules lie adjacent to the joining sections (11), the flanges or side legs (11') of these being back to back, as can be seen in figure 2, and with the holes (13) of both lying opposite each other in order to permit the fixing elements, such as screws (22), to pass through. In addition, each pair of adjacent sections (11) determines a horizontal space (17) delimited by the opposing recesses (12) of the two sections (11), said space serving for the possible insertion of a web (18) having a section approximately equal to that of the former, functioning as a guide and stiffening element.

[0029] It must also be pointed out that the coplanar,

adjacent and longitudinal legs (11') of the sections (11) corresponding to the frames (2) serve to guide the modules forming the partitions (3), being housed in the space of the outside channel of the central horizontal leg of the actual partition-forming modules.

[0030] With regard to the upright junctions at the corners, in these an auxiliary L-shaped section (19) is employed, on the side faces of which rest the partitions (3) that meet in the corner, said section (19) being provided with holes (20) to permit passage for the horizontal stiffening rods (7) of the corner modules themselves, being finally fixed in position by means of the corresponding washers and nuts (8).

[0031] Figure 3 clearly shows said junction, complete with a finishing angle iron (21) which constitutes the actual corner piece.

[0032] It is not considered necessary to extend this description further for any expert in the matter to comprehend the scope of the invention and the advantages stemming therefrom.

[0033] The materials, shape, size and arrangement of the elements shall be capable of modification, insofar as this does not alter the essential nature of the invention.

[0034] The terms in which this description has been written must be taken always in the broadest sense and not as a limitation.

Claims

1. **Modular system for integral construction of buildings in solid wood** which, permitting the erection of buildings having one or more floors, in which the walls, the partitioning and the floor and ceiling frames are constituted by means of modules based on solid wooden boards, is characterised in that each module comprises a plurality of boards (4) assembled to each other along their longitudinal edges and fitted together along their transversal edges by means of metallic joining pieces (11), C-shaped; with the peculiarity that the boards (4) come with holes (6) which are situated opposite each other for housing stiffening rods (7) having their ends threaded and projecting from the boards corresponding to each module, on to which are screwed respective tightening nuts (8); it also having been foreseen that the metallic sections (11) have an intermediate and longitudinal recess (12) in their central leg, determining an internal projection which is housed in and slides in a guided fashion during assembly along a channel (10) of the same dimensions provided for this purpose in the transversal edges of the boards (4).

2. **Modular system for integral construction of buildings in solid wood**, in accordance with claim 1, characterised in that each module includes a variable module of boards (4), variable in length,

according to the size of the module to be produced and the height or separation between floors in the building to be erected.

3. **Modular system for integral construction of buildings in solid wood**, in accordance with above claims, characterised in that the boards (4) are capable of being of variable thickness permitting the fabrication of walls (1), partitions (3) and frames (2) of different thickness, while the size of the metallic brackets (11) shall correspond in each case to the thickness of the boards (4).

4. **Modular system for integral construction of buildings in solid wood**, in accordance with above claims, characterised in that the boards (4) have in correspondence with their transversal edges a segment of less thickness (4'), which is the segment that is housed in the metallic bracket (11), each of said segments of less thickness (4') being delimited by corresponding side grooves (9) in which are lodged corresponding folds (14) inwards at right angles and pertaining to the side legs (11') of the metallic brackets (11).

5. **Modular system for integral construction of buildings in solid wood**, in accordance with above claims, characterised in that each of the side legs (11') of the metallic brackets (11) comes with a line of oblong holes (13) through which pass transversal fastening elements, such as screws (22), into the boards (4); with the particularity that the size of said side legs (11') is equal to that of the end segments of less thickness (4') on the transversal edges of the boards (4).

6. **Modular system for integral construction of buildings in solid wood**, in accordance with above claims, characterised in that the metallic brackets (11) have, starting from each of their side legs (11') and as an extension of their intermediate leg, extensions (14') determining longitudinal and coplanar flanges, each of which is provided with a row of oblong holes (13).

7. **Modular system for integral construction of buildings in solid wood**, in accordance with above claims, characterised in that the central channel (10) provided in the transversal edges of the boards (4), as well as the intermediate recess (12) in the central leg of the metallic brackets (11), are preferentially of rectangular or square cross section, said recess (12) defining externally a channel extending along the horizontal edges of the modules.

8. **Modular system for integral construction of buildings in solid wood**, in accordance with above claims, characterised in that the join between con-

current upright panels constituting walls (1) and/or partitions (3), is implemented in the floor and ceiling frame modules (2) by welding (16) or other means for screwing together the horizontal metallic brackets, through the oblong holes (13) provided for this purpose in the coplanar side legs pertaining to said metallic brackets (11). 5

9. Modular system for integral construction of buildings in solid wood, in accordance with above claims, characterised in that the join between concurrent upright modules is made by screwing respective nuts (8) onto the threaded ends of the rods (7) passing through the boards (4) of the respective module, with the inclusion of an auxiliary L-shaped bracket (19), for the case of an upright angular junction. 10 15

10. Modular system for integral construction of buildings in solid wood, in accordance with claims 8 and 9, characterised in that the end parts of the stiffening rods (7) intervene in the vertical joining of two modules corresponding to partitions (3), either by screwing on nuts and washers through the auxiliary L-shaped metallic bracket (19), when it is a matter of joining two corner partitions, or through the holes practised in the concurrent module when it concerns T-junctions between two partitioning modules. 20 25 30

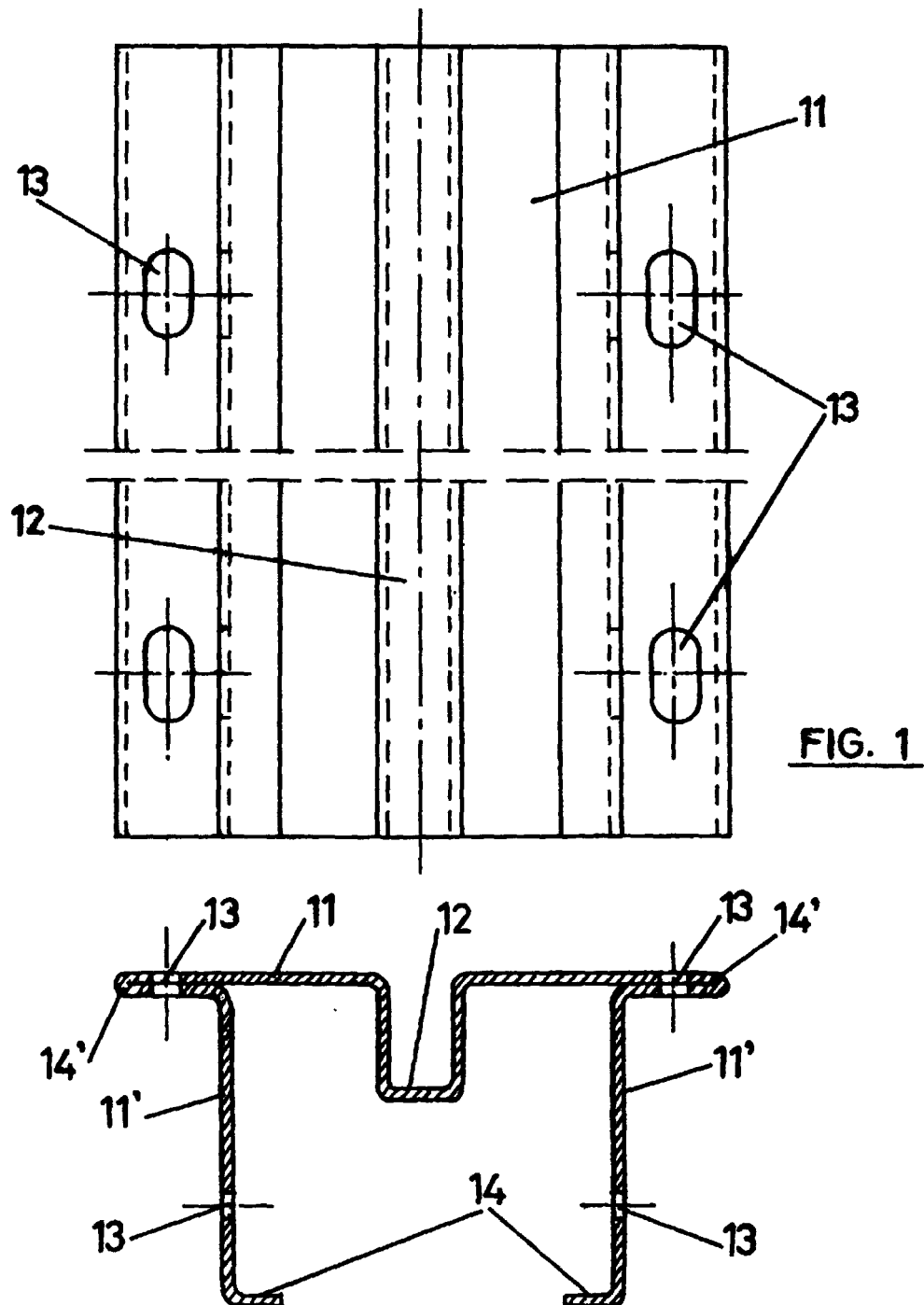
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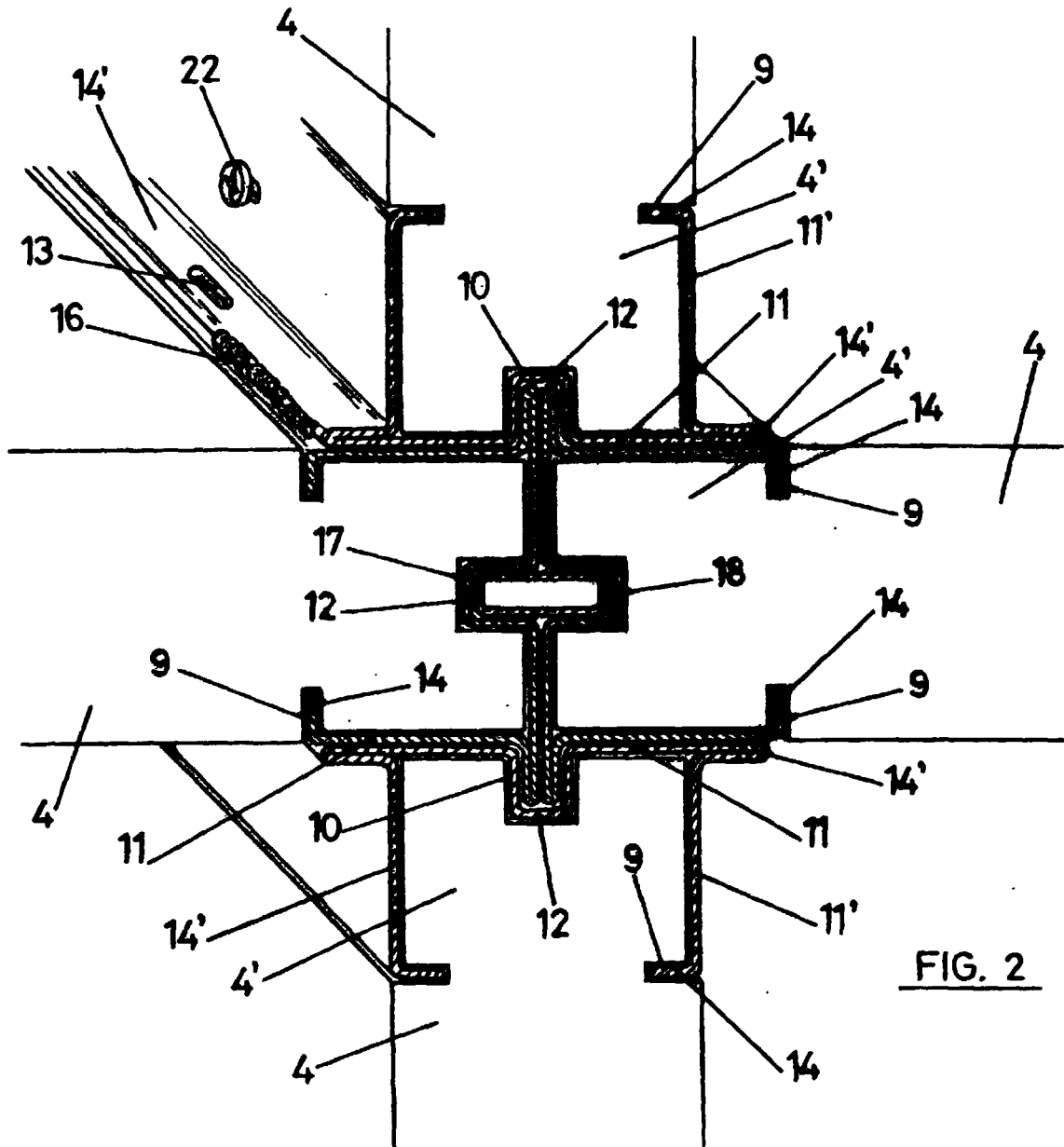
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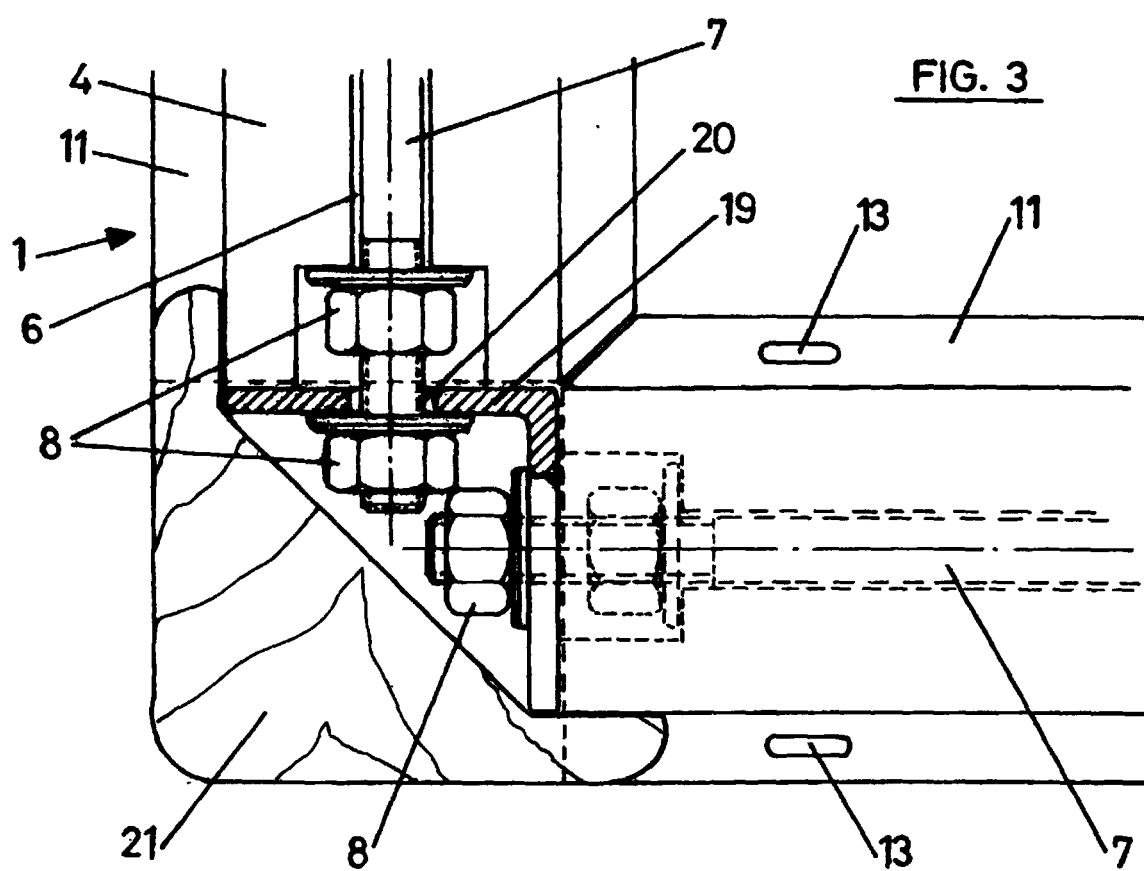
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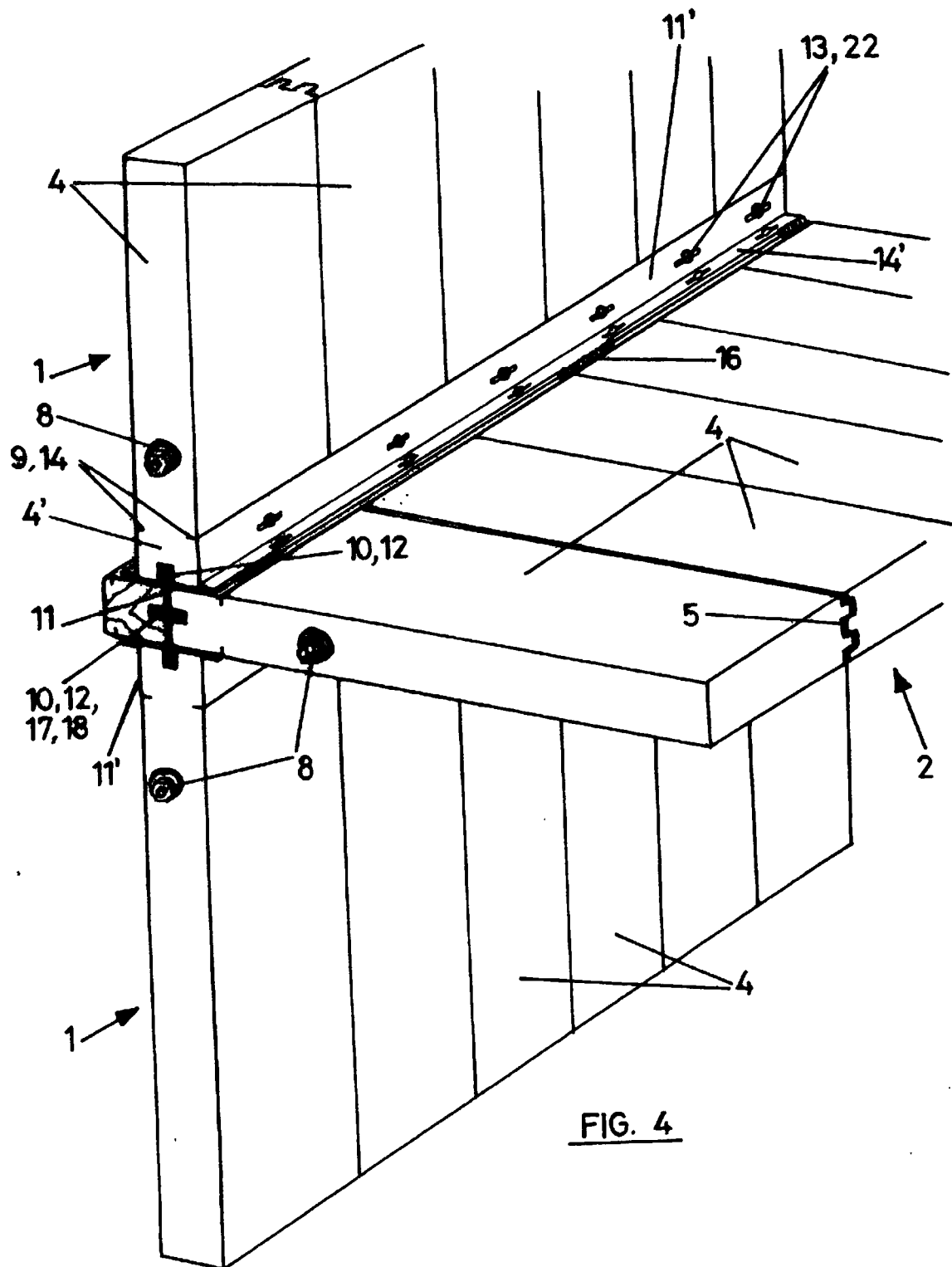
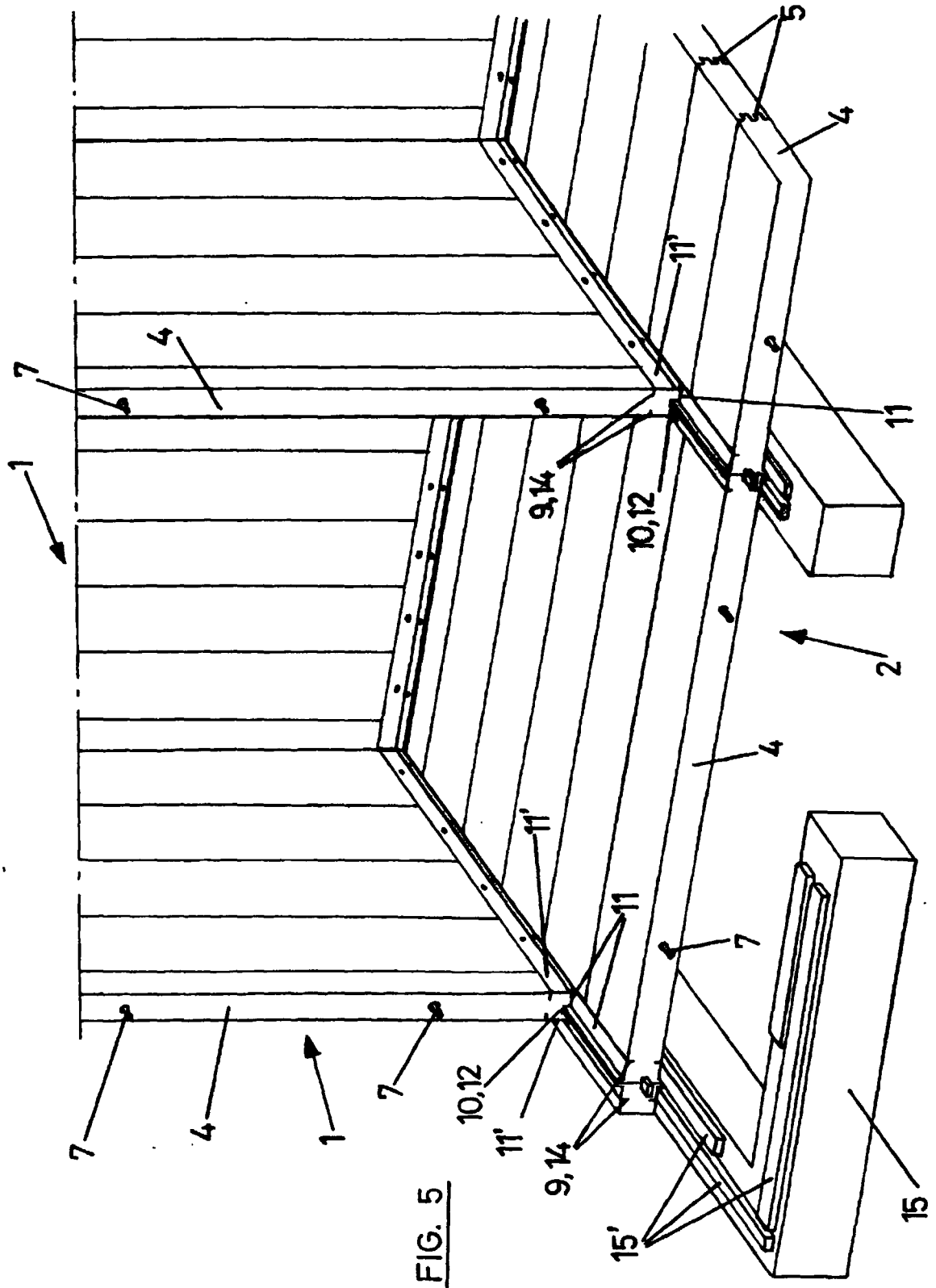


FIG. 4



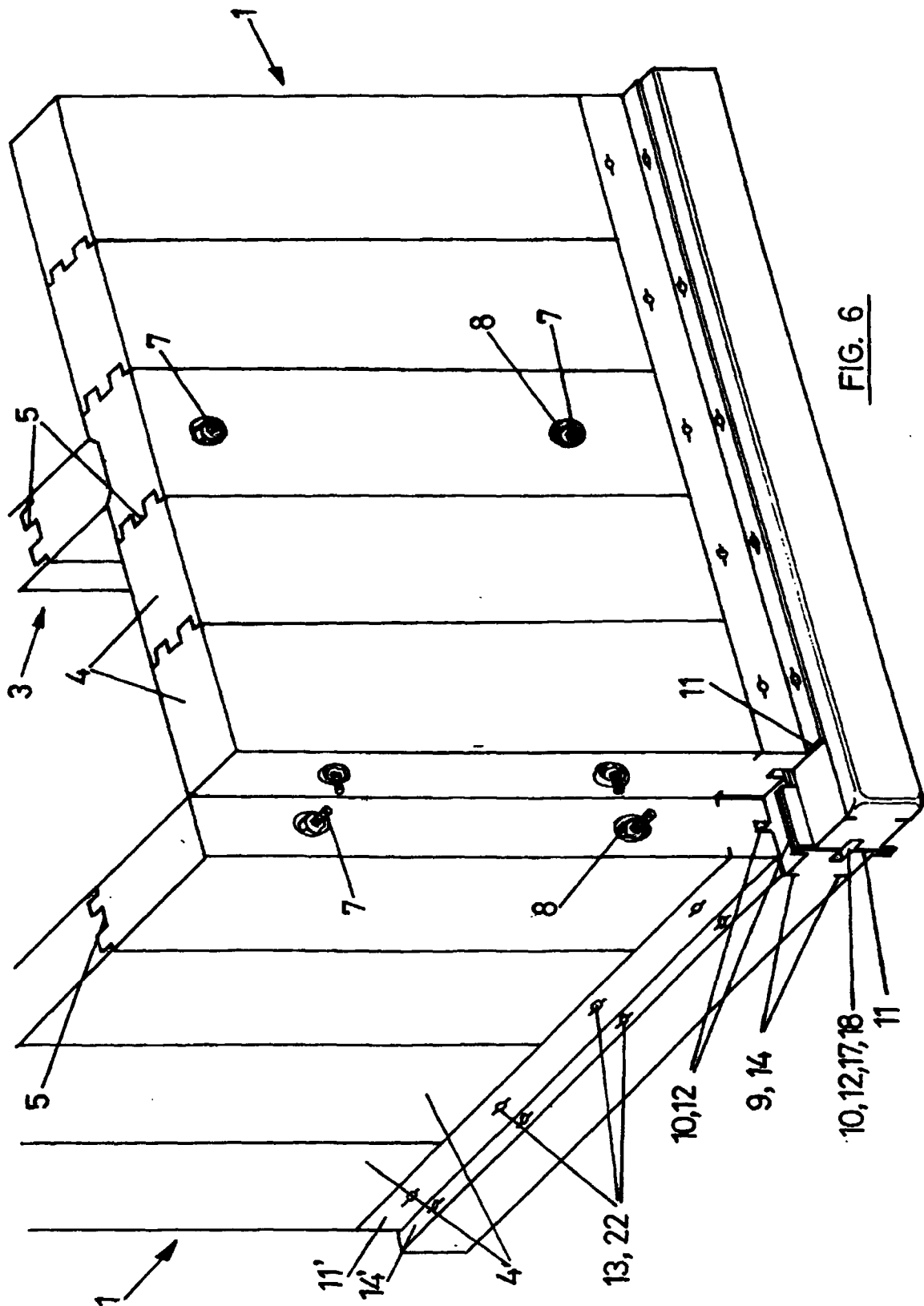


FIG. 6

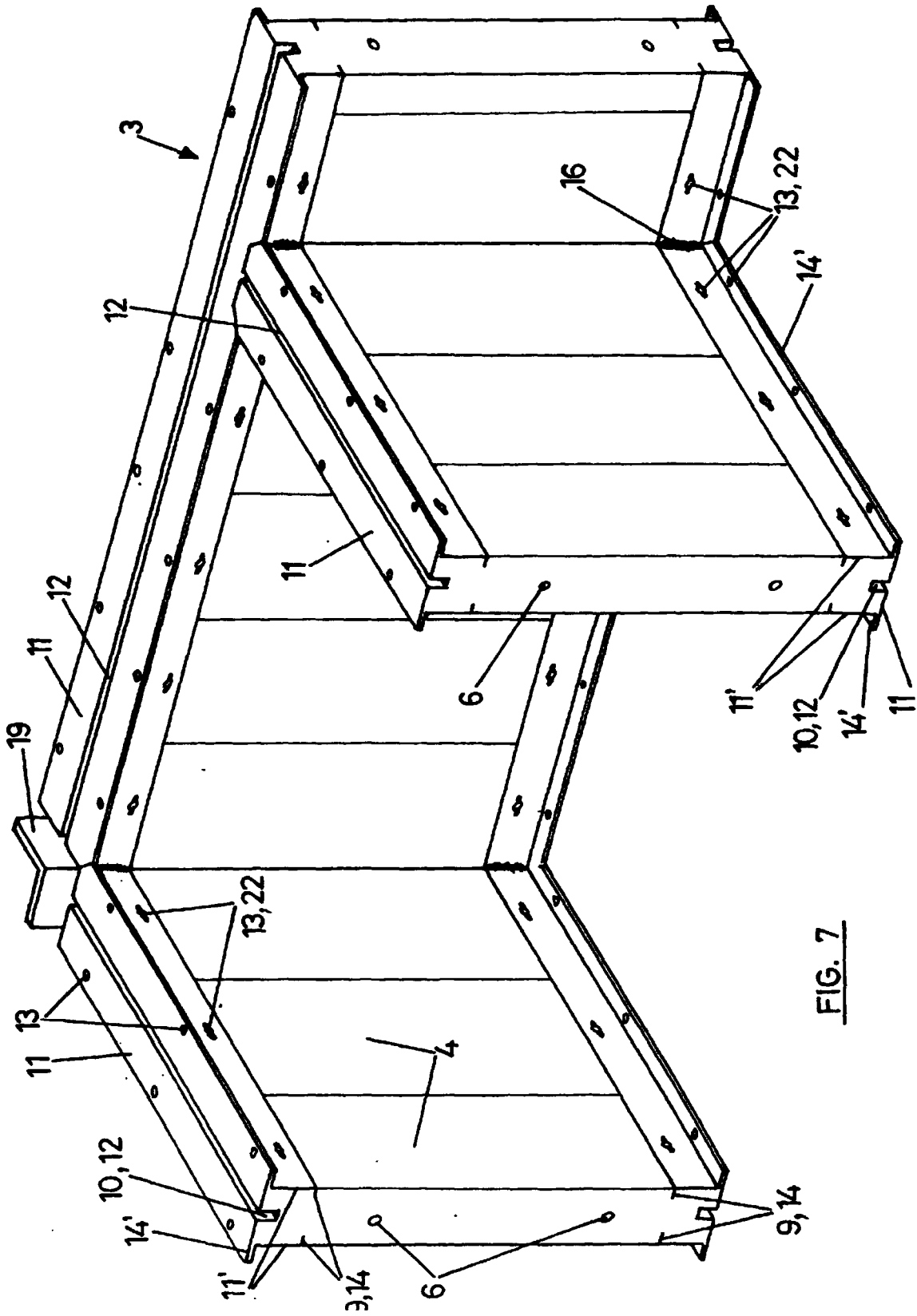
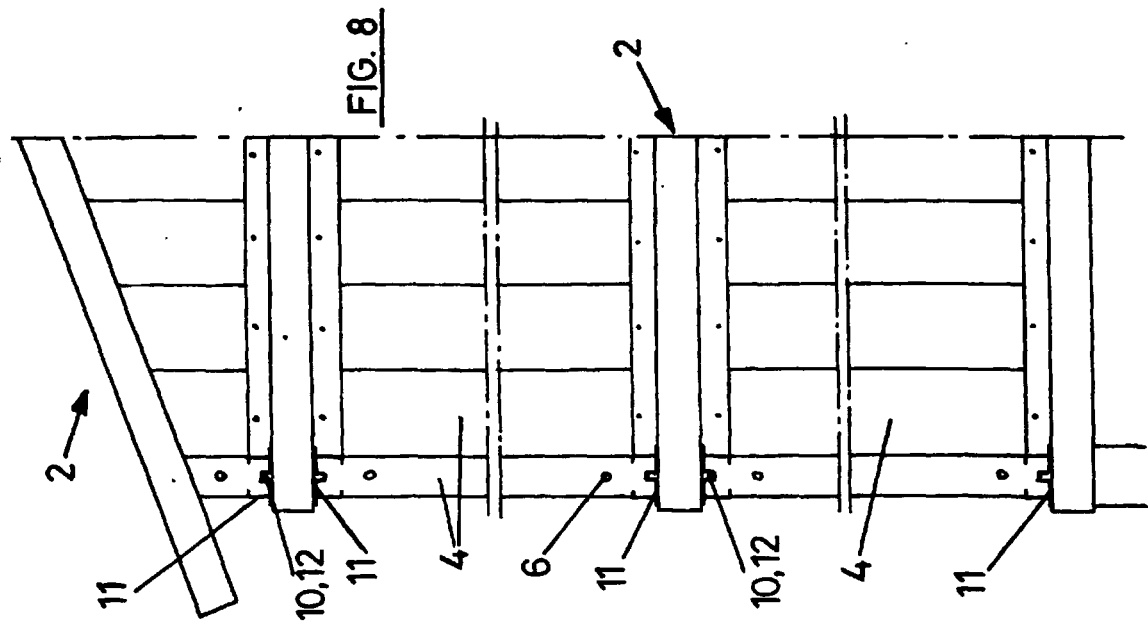
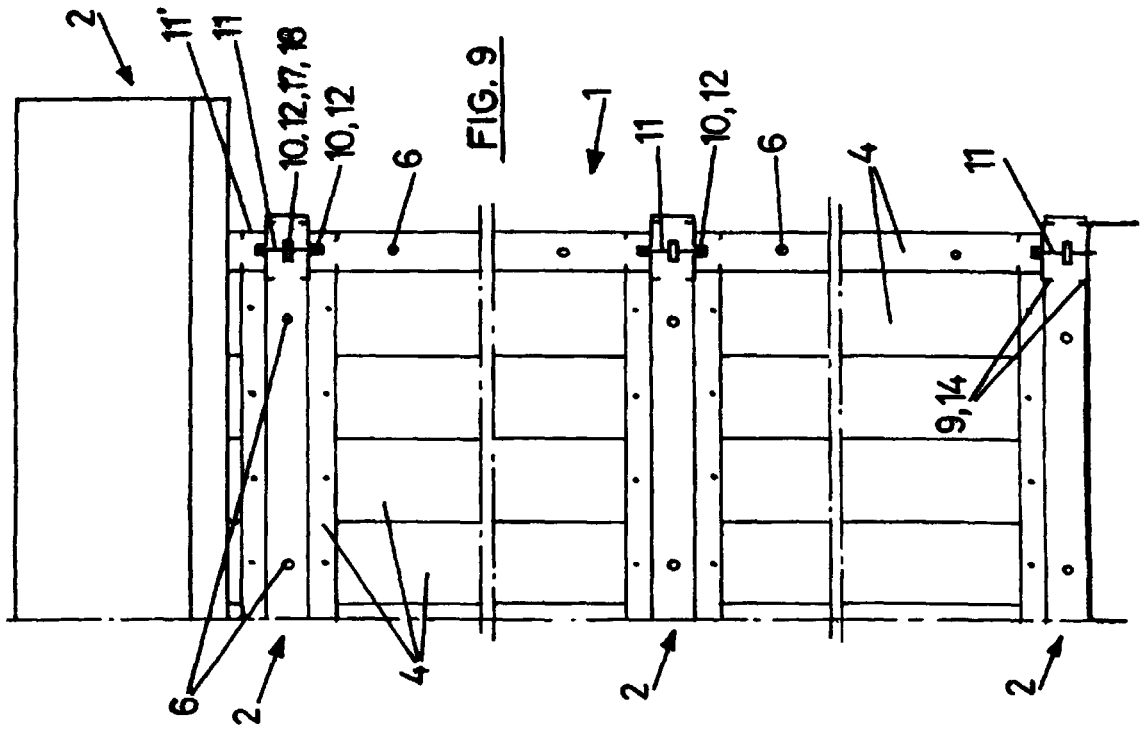
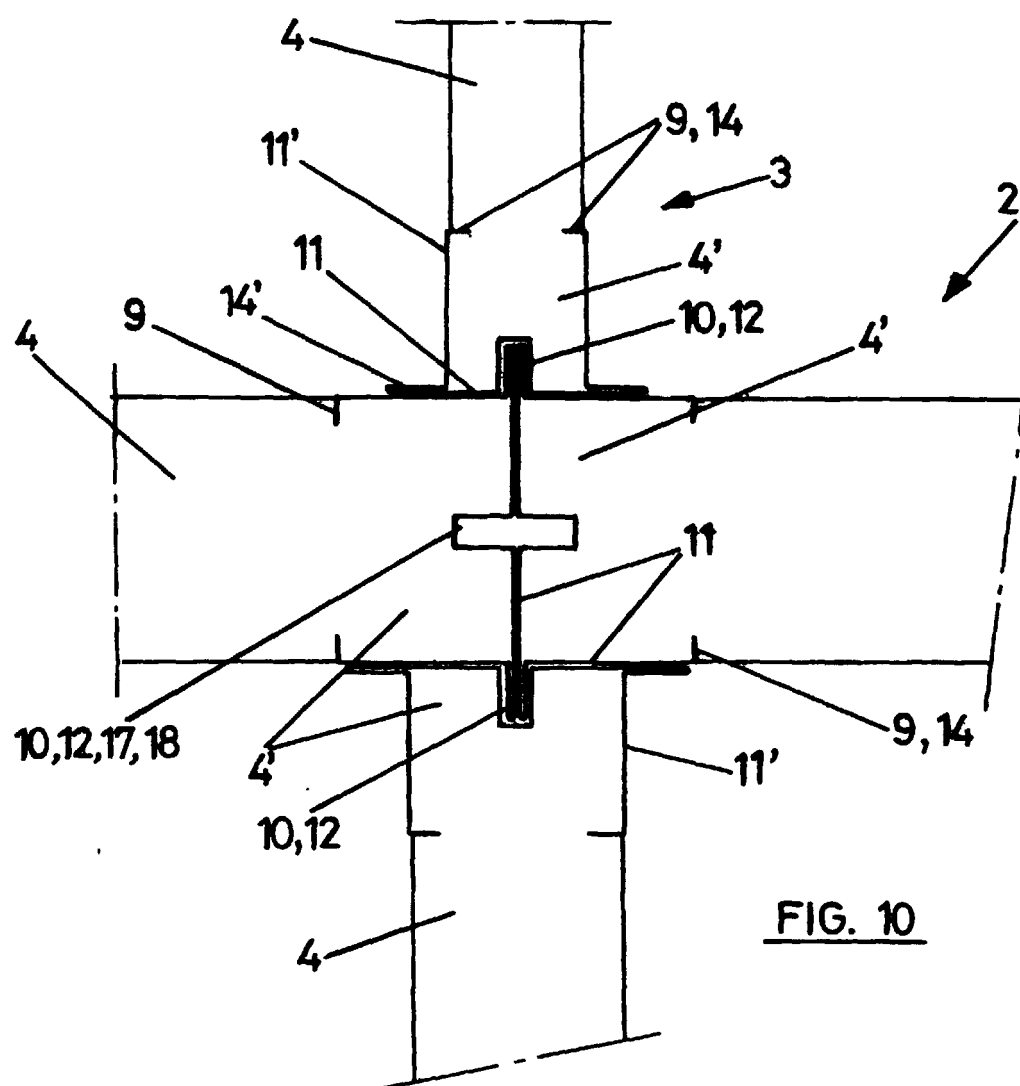


FIG. 7





INTERNATIONAL SEARCH REPORT

International Application No.

PCT, S 99/00395

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E04C2/14 E04C2/40 E04B1/10 E04B2/70

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E04C E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal WPIL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	---	7
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

19 April 2000

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24.05.00

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INTERNATIONAL SEARCH REPORT

International Application No

PCT S 99/00395

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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