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(54) **A PREFABRICATED MODULAR UNIT FOR THE CONSTRUCTION OF BUILDINGS**

(57) A floor assembly structure is formed by joining a prefabricated wooden ceiling (12) and floor (11), overlapping and coupled to one another. The floor and the ceiling have respective flat horizontal panels (11a, 12a), rectangular in plan, from one side of which a series of parallel beams (11c, 12c) protrude. The floor is superimposed on the ceiling, in such a way that the floor beams (11c) rest along the ceiling beams (12c) and are secured thereto. The ceiling and floor, joined together, co-operate in terms of statics, creating a floor assembly structure having an optimal structural strength and weight.

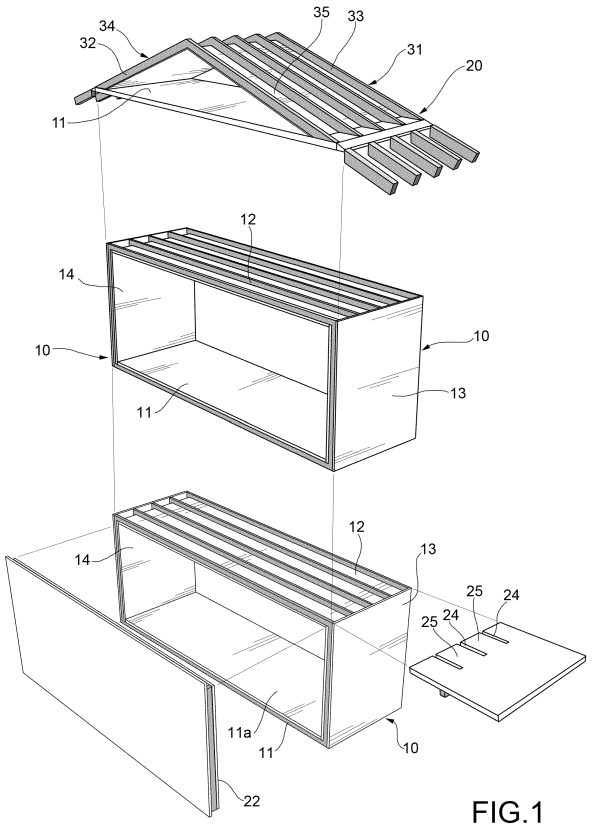


FIG.1

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Description

Technical field

[0001] The present invention relates to a floor assembly structure formed by joining two prefabricated wooden units. The invention also relates to prefabricated wooden modular units for the construction of buildings.

Prior art

[0002] The benefits of wooden houses are known. These eco-friendly structures have beneficial effects on the environment and on the health and well-being of persons using them: wood is a renewable raw material, is free of allergens, and contributes to balancing the humidity of the air within an environment; finally, it can enable high-level energy performance to be achieved.

[0003] There are known conventional floor assemblies made of structural wood, which are of considerable thickness and require beams having a substantial cross section to support the weight of floor assemblies of particularly large rooms.

[0004] An object of the present invention is to provide a modular unit enabling the construction of wooden buildings to be industrialized to a greater extent. In particular, an object of the present invention is to provide structures having high design standards and greater constructional precision, and with reduced construction times and costs. It is desirable to provide structures formed from prefabricated modular units which allow greater flexibility or freedom of design of the internal spaces of the building, thus increasing the options for customization beyond those of the modular structures known hitherto.

[0005] Another object of the invention is to provide wooden floor assemblies with reduced thickness and weight compared with conventional structural wood floor assemblies.

[0006] A particular object of the invention is to provide a prefabricated modular unit which is easily transportable, and which enables the static properties of the structure to be optimized.

Summary of the invention

[0007] The aforesaid objects, together with other advantages that will be evident from the following description, are achieved by a prefabricated floor assembly structure having the characteristics defined in Claim 1.

[0008] According to one aspect of the invention, a floor assembly structure is formed by joining a prefabricated wooden ceiling and floor, overlapping and coupled to one another. The ceiling and floor have respective horizontal flat panels, rectangular in plan, from one side of which there protrude a series of beams extending parallel to the long sides of the rectangles of the flat panels. The floor is superimposed on the ceiling, in such a way that the floor beams rest along the ceiling beams and are secured thereto. The ceiling and floor, joined together, co-operate in terms of statics, creating a floor assembly structure having an optimal structural strength and weight.

[0009] Preferred aspects and embodiments of the invention are stated in the attached claims.

[0010] According to a further aspect, the invention proposes a prefabricated modular unit for the construction of a pitched roof.

Brief description of the drawings

[0011] A number of preferred, but non-limiting, embodiments of a prefabricated modular unit according to the present invention will now be described; reference is made to the attached drawings, in which:

Figure 1 is an exploded perspective view which illustrates schematically a building comprises two prefabricated modular units according to an embodiment of the invention;

Figure 2 is a perspective view which illustrates the facing parts of two modular units in a step preceding their coupling;

Figure 3 is a partially cut-away perspective view which illustrates schematically a vertical wall of one of the modular units of Figure 1;

Figure 4 is a partial perspective view of a detail of a modular unit according to an embodiment of the invention;

Figure 5 is a view in longitudinal vertical section of two modular units coupled together;

Figure 6 is a view in vertical transverse section taken along the line VI-VI in Figure 5;

Figure 7 is an exploded perspective view which illustrates schematically the top part of a building comprising two different prefabricated modular units according to another embodiment;

Figure 8 is a view in longitudinal vertical section which illustrates schematically a part of a building comprising two different prefabricated modular units according to a further embodiment;

Figure 9 is a view in longitudinal vertical section of two modular units coupled together, according to yet another embodiment; and

Figure 10 is a view in vertical transverse section taken along the line X-X in Figure 9.

Detailed description

[0012] Before the detailed explanation of a plurality of embodiments of the invention is given, it must be made clear that the invention is not limited in its application to the details of construction and the configuration of the components presented in the following description or illustrated in the drawings. The invention can be applied with the use of modular units having formats other than those of the embodiments described below. It should also

be understood that the phraseology and terminology are used purely for descriptive purposes and are not to be interpreted as limiting. The use of "include", "comprise", or variations thereof are to be understood as incorporating the elements listed after them and their equivalents, together with additional elements and equivalents thereof.

[0013] With initial reference to Figure 1, the number 10 indicates the whole of a prefabricated modular unit for the construction of buildings, in particular, but not exclusively, for the construction of buildings for residential use. The unit 10 has the general shape of a parallelepipedal box with a rectangular base, open on two opposed vertical sides along the long sides of the base rectangle, in a closed-loop structural configuration when viewed in a vertical section plane parallel to the long sides of the rectangle.

[0014] The modular unit 10 is composed of a floor 11, rectangular in plan and horizontal when in use, joined securely to a rectangular ceiling 12 by a pair of opposed vertical walls 13, 14 which link the short sides of the floor 11 and the ceiling 12.

[0015] The modular unit 10 is made of wood, as specified below.

[0016] The floor 11 comprises a flat floor panel 11 a and a series of wooden floor beams 11 c, integral with the panel 11 a.

[0017] According to a preferred embodiment, the floor panel 11a is a multi-layer wooden panel made of cross-laminated layers of dried timber glued together, known by the trade name XLAM or CLT. Flat panels similar to those indicated by 11a *per se* are known, being used for eco-friendly wood construction. According to an alternative embodiment, the floor panel 11a may be selected from chipboard panels, such as oriented strand panels (or OSB panels), particle board panels, particle board panels bonded with cement, and laminated wood fibre (LSL or Intrallam, Laminated Strand Lumber) panels.

[0018] The floor panel 11 a has a lower horizontal surface 11b from which the floor beams 11c protrude downwards; these beams extend parallel to the long sides of the floor rectangle 11.

[0019] The floor beams 11c are spaced apart transversely, that is to say perpendicularly to the direction of the long sides of the floor. Preferably, the floor beams 11c are distributed at regular, or equally spaced, intervals on the floor panel 11a along the whole of its shorter dimension.

[0020] In the example illustrated here, five rectangular section floor beams 11c are provided, two of these beams extending along the long sides of the floor 11, with three intermediate beams.

[0021] The ceiling 12 advantageously has a structure which substantially mirrors that of the floor 11, with a flat ceiling panel 12a and a series of wooden ceiling beams 12c, integral with the panel 12a, and protruding downwards from a lower surface 12b of the ceiling panel 12a.

[0022] In the floor 11 and in the ceiling 12, the panels 11a, 12a are firmly joined to the respective beams 11c, 12c by a structural adhesive and/or by mechanical connection elements, such as screws, distributed along the length of the beams.

[0023] In all the embodiments described herein, the number, shape, dimensions and density of distribution of the beams and panels are not to be considered limiting, but may vary according to design requirements.

[0024] Each of the vertical walls 13, 14 comprises at least one wooden vertical panel 13a, 14a and a respective series of struts or vertical wooden load-bearing elements 13c, 14c, integral with the vertical panels 13a, 14a. In the preferred embodiment, each of the vertical walls 13, 14 is formed by a pair of parallel facing flat vertical panels 13a, 13b and 14a, 14b, joined together by respective struts or intermediate vertical load-bearing elements 13c, 14c. The struts are spaced apart laterally or in a horizontal direction, and are distributed at regular intervals over the whole of the vertical wall 13 or 14. The vertical panels 13a, 13b, 14a, 14b and the intermediate struts 13c, 14c are all made of wood.

[0025] According to one embodiment, the vertical panels 13a, 13b, 14a, 14b are multi-layer wooden panels with cross-laminated layers of dried timber glued together (e.g. XLAM or CLT), similar to the panels 11 a, 12a of the floor and the ceiling.

[0026] According to an alternative embodiment, the vertical panels 13a, 13b, 14a, 14b may be chipboard panels, such as oriented strand panels (or OSB panels), particle board panels, particle board panels bonded with cement, or laminated wood fibre (LSL or Intrallam, Laminated Strand Lumber) panels.

[0027] In each vertical wall, the pair of facing panels defines a cavity divided by the struts 13c, 14c into a plurality of empty chambers 16 which preferably extend along the whole vertical dimension of the vertical wall. The empty chambers 16 can conveniently be used to contain thermally and/or acoustically insulating materials and for the passage of cables and conduits of various systems (e.g. the plumbing or heating system).

[0028] In each vertical wall, the flat panels 13a, 13b are firmly joined to the struts 14a, 14c, for example by a structural adhesive and/or by mechanical connection elements, such as screws or bolts, distributed along the length of the struts.

[0029] The pairs of vertical panels, joined by the struts, give the vertical walls a high carrying capacity for vertical loads, as well an adequate thickness for effective attachment to the floor assemblies.

[0030] In each modular unit 10, the floor 11 and the ceiling 12 are rigidly joined to the two vertical walls 13, 14 by mechanical joining elements 15.

[0031] In an exemplary embodiment, as illustrated schematically in Figure 4, the mechanical joining elements can comprise a plurality of L-shaped brackets 15 which help to ensure perpendicularity between each vertical wall and the floor or the ceiling.

[0032] Additionally or alternatively, the joints or nodes

between the vertical walls and the ceiling or floor can be reinforced by other mechanical connecting elements other than the brackets, such as screw attachments or bolts which can be used to adjust the tensile force between the floor or ceiling and the vertical wall. The node created in this way provides good rigidity and robustness, highly appropriate for the movement of the modular unit. In the example of Figure 5, the mechanical connecting elements are made in the form of screws 15a which pass through the respective floor 11a and ceiling 12a panels, respectively, and are fixed in lower and upper edge areas, respectively, of the vertical panel 13b.

[0033] The parallelepipedal box configuration, open on two opposed vertical sides, in a closed-loop structural system, makes the modular unit particularly strong, thereby facilitating its transport in a prefabricated condition. It will be appreciated that this enables the modular units to be constructed in an industrial plant with high constructional precision, thus optimizing the manufacturing times and costs.

[0034] Preferably, but not necessarily, the modular unit 10 has the following maximum dimensions, in order to fall within the load size limits for road transport in ordinary conditions: width: 2.55 m; height: 3.2 m; length: 10 m.

[0035] Figure 2 shows schematically a step in the construction of a building with the superimposition of two modular units 10. The floor beams 11c projecting downwards from the floor 11 of the overlying modular unit 10 are aligned in an ordered way in vertical planes parallel with the ceiling beams 12c which project upwards from the ceiling 12 of the underlying modular unit 10.

[0036] Preferably, the ceiling beams 12c of the lower modular unit and the floor beams 11c of the overlying modular unit are arranged in a mirror configuration above a horizontal geometrical plane of symmetry P.

[0037] The floor beams 11c of the overlying modular unit are therefore made to bear along the ceiling beams 12c of the underlying modular unit and are fixed thereto.

[0038] The floor beams of the overlying modular unit and the ceiling beams of the underlying modular unit can be fixed together, for example, by applying a structural adhesive to the interface of the beams of the two superimposed modular units.

[0039] In one embodiment, additionally or alternatively to the application of a structural adhesive, the beams 11c and 12c of two superimposed modular units can be fixed together by for mechanical interconnection means.

[0040] In the example of Figure 2, the mechanical interconnection means provided are metal inserts or brackets 27 partially inserted in seats 28, 29 positioned both in the floor beams 11c of the overlying modular unit and in the ceiling beams 12c of the underlying modular unit. Preferably, the mechanical connection means 27 are distributed in a discrete way, being spaced longitudinally along the various beams.

[0041] The mutual fixing between the beams of the two superimposed modular units is required to oppose the relative sliding of the beams in the longitudinal direction which tends to occur as a result of a vertical load acting on the floor assemblies, among other factors. The mutual fixing of the beams, and therefore of the floor of the overlying unit and the ceiling of the underlying unit, produces a floor assembly structure which advantageously makes use of a synergic effect by which the floor and the coupled ceiling contiguous thereto and the corresponding beams interact together to resisting external loads as well as their own weight.

[0042] The floor assembly structure comprising the floor and the ceiling coupled and fixed together exhibits a static behaviour comparable with that of a composite beam formed by joining a series of H (or "double T" or "I") beams, having a series of ribs or webs, each consisting of two coupled beams 11c and 12c, and two enlarged flanges, of which the upper flange is formed by the floor panel 11 a and the lower flange is formed by the ceiling panel 12a. The aforesaid configuration has a high load-bearing capacity, particularly in respect of bending loads, compared with a load applied to the floor and the ceiling separately. The complex beam formed by joining the floor and the ceiling concentrates the material in the flanges (that is to say, in the panels 11a and 12a), which are the parts most distant from the centre of gravity of the cross section of the floor assembly structure beam.

[0043] The optimization of the bending rigidity reduces the weight and thickness compared with conventional structural wood floor assemblies.

[0044] Experimental tests conducted by the applicant have revealed particularly satisfactory static' performance. A floor assembly structure comprising a ceiling and floor formed by coupling two superimposed modular units, having a span of 8 m, exhibited a deflection of $\leq$ 1/400 under a distributed static load of 4 kN/m^2.

[0045] The floor assembly structure provided by the coupling of a floor and a ceiling as described above forms between the floor and the ceiling a cavity divided by the coupled beams 11c and 12c into a plurality of elongated empty chambers 18, extending in parallel horizontal directions, which can conveniently be used to contain thermally and/or acoustically insulating materials and for the passage of cables and conduits.

[0046] According to an embodiment which is not shown, at least some of the facing beams of two superimposable modular units can have congruent non-plane interface surfaces, in order to facilitate the correct positioning of the overlying modular unit and to strengthen the effect of attachment or fixing of the two modular units. For example, the interface surfaces may have respective interacting recesses and projections.

[0047] Two or more modular units may be placed adjacently on their long sides, so as to form internal environments of the desired size.

[0048] Further optional structural elements, such as a parapet and a balcony, are illustrated schematically in Figure 1. A parapet 22 can be made in a similar way to the load-bearing vertical walls of the modular unit 10. A balcony 23 can advantageously be applied at the short

sides of two modular units, by forming in the base of the balcony a series of lateral slots 24 which can be fitted on to the beams 11c, 12c. The slots 24 of the balcony define edge portions 25 of the balcony which are enclosed between the upper floor assembly of the underlying modular unit and the lower floor assembly of the overlying modular unit.

[0049] A floor assembly structure which makes use of the properties described above can be provided by coupling a ceiling and a floor which are not necessarily included in, or do not necessarily form part of, modular units such as those indicated by 10 in the previous example.

[0050] Figures 1 and 7 show a modular covering unit or pitched roof unit 20, made of wood and having a floor 11 which is rectangular in plan, similar to the floor of the modular unit 10. The floor 11 comprises a flat floor panel 11a and a series of wooden floor beams, integral with the panel 11 a and protruding downwards therefrom. The floor beams extend parallel to the long sides of the floor rectangle 11. The beams 11c are spaced apart transversely, that is to say perpendicularly to the direction of the long sides of the floor. Preferably, the floor beams 11c are distributed at regular, or equally spaced, intervals on the floor panel 11a along the whole of its smaller dimension.

[0051] The roof unit 20 comprises two inclined roof sections 30, 31, comprising a series of inclined supporting beams 32, 33. The inclined beams are joined in pairs at the peak or ridge line of the roof. The inclined beams of each pair have their lower ends secured to the opposite ends 11d, 11e of a respective floor beam 11c with which the beams form a triangular frame structure.

[0052] Each inclined roof section 30, 31 comprises a respective flat inclined panel 34, 35 to each of which all the inclined beams 32, 33 of the respective roof section are fixed. The inclined beams 32, 33 and the respective inclined panels 34, 35 can be fixed together, for example, by using a structural adhesive, and/or by means of mechanical connecting elements such as screws, bolts, nails or brackets.

[0053] As a whole, the roof unit 20 has a box or triangular prism configuration, open on two opposed vertical sides, in a closed-loop structural system.

[0054] Preferably, the inclined panels 34, 35 are fixed to the respective inclined beams along the lower inclined sides thereof, so as to cover the inside of the roof unit 20.

[0055] The inclined panels 34, 35 and the floor panel 11a may be structural wood panels, for example chipboard panels, such as oriented strand panels (or OSB panels), particle board panels, particle board panels bonded with cement, or laminated wood fibre (LSL or Intrallam, Laminated Strand Lumber) panels. Alternatively, other structural wood panels, for example XLAM or CLT multi-layer wood panels, may be selected.

[0056] The inclined panels 34, 35 also act advantageously to secure and maintain the mutual transverse spacing between the inclined beams 32, 33.

[0057] The prism configuration, open on two opposed vertical sides, in a closed-loop structural system, makes the roof unit particularly strong, thereby facilitating its transport in a prefabricated condition. It will be appreciated that the roof, prefabricated with precision in an industrial plant, can be installed rapidly on the top of the construction.

[0058] It will be appreciated that the advantages mentioned in the preceding paragraph can be obtained regardless of the form of coupling to an underlying ceiling. Therefore the pitched roof unit 20 can advantageously be installed on an underlying construction without the formation of a floor assembly structure as described previously.

[0059] The fixing of the floor beams of the roof unit 20 to the ceiling beams of an underlying modular unit 10 is optional and is preferred. This fixing, if provided, can be carried out by means of a structural adhesive and/or mechanical interconnection means, as described for the joining of two superimposed modular units 10.

[0060] The modular units that can be produced according to the present invention can have various shapes and sizes. Figure 8 shows a variant of a modular unit having a floor 11 with a floor panel 11 a and beams 11c similar to those described above herein, a pair of opposed vertical wooden walls 13, 14, each joined rigidly to one of the two short sides of the floor 11 a, and two inclined roof sections 30, 31. Each roof section comprises a series of inclined support beams 32, 33 (only two inclined beams are visible in Figure 8), joined in pairs at a peak or ridge line. Each of the inclined beams of each pair has its lower end secured to the top of one of the vertical walls 13, 14. Each roof section comprises a flat inclined panel 34, 35 to which the inclined beams 32, 33 of the respective inclined roof section 30, 31 are fixed.

[0061] Figures 9 and 10 show a modular covering unit or pitched roof unit 40, made of wood and having a floor 11 which is rectangular in plan, with a flat floor panel 11a and floor beams 11c, similar to those of the floor of the modular unit 10 or of the pitched roof unit 20. The flat roof unit 40, to be used as an alternative to the pitched roof unit 20, has a perimetric wooden parapet 41.

[0062] Various aspects and embodiments of floor assembly structures and prefabricated modular units have been described. It is to be understood that each embodiment may be combined with any other embodiment. Furthermore, the invention is not limited to the embodiments described, but may be modified within the scope defined by the attached claims.

Claims

1. A floor assembly structure comprising a prefabricated wooden ceiling (12) and floor (11), overlapping and coupled to one another, wherein

the ceiling (12) comprises

a horizontal flat wooden ceiling panel (12a), rectangular in plan, having two short sides and two long sides opposed in pairs, with a horizontal upper surface (12b) and
a plurality of wooden ceiling beams (12c) which are integral with the ceiling panel (12a), protrude upward from the horizontal upper surface (12b) and extend parallel to said long sides;

the floor (11) comprises

a horizontal wooden floor panel (11a), rectangular in plan, with a lower horizontal surface (11b) and
a plurality of wooden floor beams (11c) which are integral with the panel (11a), protrude downward from the horizontal lower surface (11b) and extend parallel to said long sides;

and wherein the floor (11) is superimposed on the ceiling (12), and the floor beams (11c) rest along the ceiling beams (12c) and are secured thereto.

2. A floor assembly structure according to claim 1, wherein the beams (11c, 12c) are firmly joined to the respective panels (11a, 12a) by a structural adhesive and/or by mechanical connection elements distributed along the beams.

3. A floor assembly structure according to claim 1 or 2, wherein the floor beams (11c) of an overlying floor (11) are secured to the ceiling beams (12c) of an underlying ceiling (12) by a structural adhesive and/or mechanical connection elements distributed along the beams.

4. A floor assembly structure according to claim 1 or 2 or 3, wherein between the ceiling panel (12a) of an underlying ceiling (12) and the floor panel (11a) of an overlying floor (11) there is defined a cavity which is divided by the ceiling beams (12c) and the floor beams (11c) joined in pairs so as to form a plurality of elongate, horizontal and parallel chambers (18).

5. A floor assembly structure according to any one of the preceding claims, wherein the panels (11a, 12a) are wooden panels comprising cross-laminated layers of dried timber glued together.

6. A floor assembly structure according to claim 3, wherein the elements for mechanical connection between the floor beams and the ceiling beams comprise metal inserts or brackets (27) partially inserted in seats or pockets (28, 29) arranged and spaced longitudinally both in the overlying floor beams (11c) and in the underlying ceiling beams (12c).

7. A floor assembly structure according to any of claims 1 to 6, wherein the ceiling (12) and the floor (11) are part of two respective prefabricated modular units (10) for the construction of buildings, wherein each modular unit comprises

- an upper ceiling (12), comprising
a horizontal flat wooden ceiling panel (12a), rectangular in plan, having two short sides and two long sides opposed in pairs, with a horizontal upper surface (12b) and
a plurality of wooden ceiling beams (12c) which are integral with the ceiling panel (12a), protrude upward from the horizontal upper surface (12b) and extend parallel to said long sides;
- a lower floor (11), comprising
a horizontal wooden floor panel (11a), rectangular in plan, with a lower horizontal surface (11b) and
a plurality of wooden floor beams (11c) which are integral with the floor panel (11a), protrude downward from the horizontal lower surface (11b) and extend parallel to said long sides;
- a pair of opposed vertical wooden walls (13, 14), each rigidly joined to short sides of the floor panel (11a) and of the ceiling panel (12a).

8. A floor assembly structure according to claim 7, wherein each of the vertical walls (13, 14) comprises at least one wooden vertical panel (13a, 14a) and a respective plurality of vertical wooden load-bearing elements (13c, 14c), integral with the vertical panels (13a, 14a).

9. A floor assembly structure according to claim 7, wherein each of the vertical walls (13, 14) comprises a pair of vertical, parallel facing panels (13a, 13b, 14a, 14b), secured by respective intermediate vertical wooden load-bearing elements (13c, 14c) spaced from one another in a horizontal direction, whereby in each vertical wall (13, 14), the pair of facing panels defines a cavity divided by the vertical load-bearing elements (13c, 14c) into a plurality of chambers (16) which extend along the whole vertical dimension of the vertical wall.

10. A floor assembly structure according to any of claims 7 to 9, wherein the panels (13a, 13b, 14a, 14b) are wooden panels comprising cross-laminated layers of dried timber glued together.

11. A floor assembly structure according to any one of claims 1 to 6, wherein the floor (11) is part of a prefabricated modular pitched roof unit (20) for the construction of buildings, each pitched roof unit (20) comprising

- a lower floor (11), comprising

  a horizontal flat wooden floor panel (11a), rectangular in plan, having two short sides and two long sides opposed in pairs, and a lower horizontal surface (11b), and
  a plurality of wooden floor beams (11c) which are integral with the floor panel (11a), protrude downward from the horizontal lower surface (11b) and extend parallel to said long sides;

- two inclined roof sections (30, 31), each comprising

  a plurality of inclined support beams (32, 33) joined in pairs at a peak or ridge line, the inclined beams of each pair having lower ends secured to opposite ends (11d, 11e) of a respective floor beam (11c) with which the beams form a triangular frame structure;
  a flat inclined panel (34, 35) to which the inclined beams (32, 33) of the respective inclined roof section (30, 31) are fixed.

12. A floor assembly structure according to claim 11, wherein the flat inclined panels (34, 35) are fixed to the inclined beams (32, 33) along the downwardly facing inclined sides of the beams.

13. A floor assembly structure according to claim 12, wherein the flat inclined panels (34, 35) and the floor panel (11a) are selected from the following: chipboard panels, oriented strand boards (OSB), particle boards, particle boards bonded with cement, and laminated strand lumber (LSL) panels.

14. A floor assembly structure according to any one of claims 1 to 6, wherein the floor (11) is part of a prefabricated modular flat roof unit (40) for the construction of buildings, wherein each modular flat roof unit (40) comprises

- a lower floor (11), comprising

  a horizontal flat wooden floor panel (11a), rectangular in plan, having two short sides and two long sides opposed in pairs, and a lower horizontal surface (11b), and
  a plurality of wooden floor beams (11c) which are integral with the floor panel (11a), protrude downward from the horizontal lower surface (11b) and extend parallel to said long sides; and

- a perimetric wooden parapet (41) protruding upward from a peripheral edge of the floor panel (11a).

15. Prefabricated modular unit (10, 20, 40) for the construction of buildings, according to any one of claims 7 to 14, comprising:

- an upper ceiling (12), comprising

  a horizontal flat wooden ceiling panel (12a), rectangular in plan, having two short sides and two long sides opposed in pairs, with a horizontal upper surface (12b) and
  a plurality of wooden ceiling beams (12c) which are integral with the ceiling panel (12a), protrude upward from the horizontal upper surface (12b) and extend parallel to said long sides;

- a lower floor (11), comprising

  a horizontal wooden floor panel (11a), rectangular in plan, with a lower horizontal surface (11b) and
  a plurality of wooden floor beams (11c) which are integral with the floor panel (11a), protrude downward from the horizontal lower surface (11b) and extend parallel to said long sides;

- a pair of opposed vertical wooden walls (13, 14), each rigidly joined to short sides of the floor panel (11a) and of the ceiling panel (12a).

16. Prefabricated modular pitched roof unit (20) for the construction of buildings, comprising

- a lower floor (11), comprising

  a horizontal flat wooden floor panel (11a), rectangular in plan, having two short sides and two long sides opposed in pairs, and a lower horizontal surface (11b), and
  a plurality of wooden floor beams (11c) which are integral with the floor panel (11a), protrude downward from the horizontal lower surface (11b) and extend parallel to said long sides;

- two inclined roof sections (30, 31), each comprising

  a plurality of inclined support beams (32, 33) joined in pairs at a peak or ridge line, the inclined beams of each pair having lower ends secured to opposite ends (11d, 11e) of a respective floor beam (11c) with which the beams form a triangular frame structure;
  a flat inclined panel (34, 35) to which the inclined beams (32, 33) of the respective inclined roof section (30, 31) are fixed.

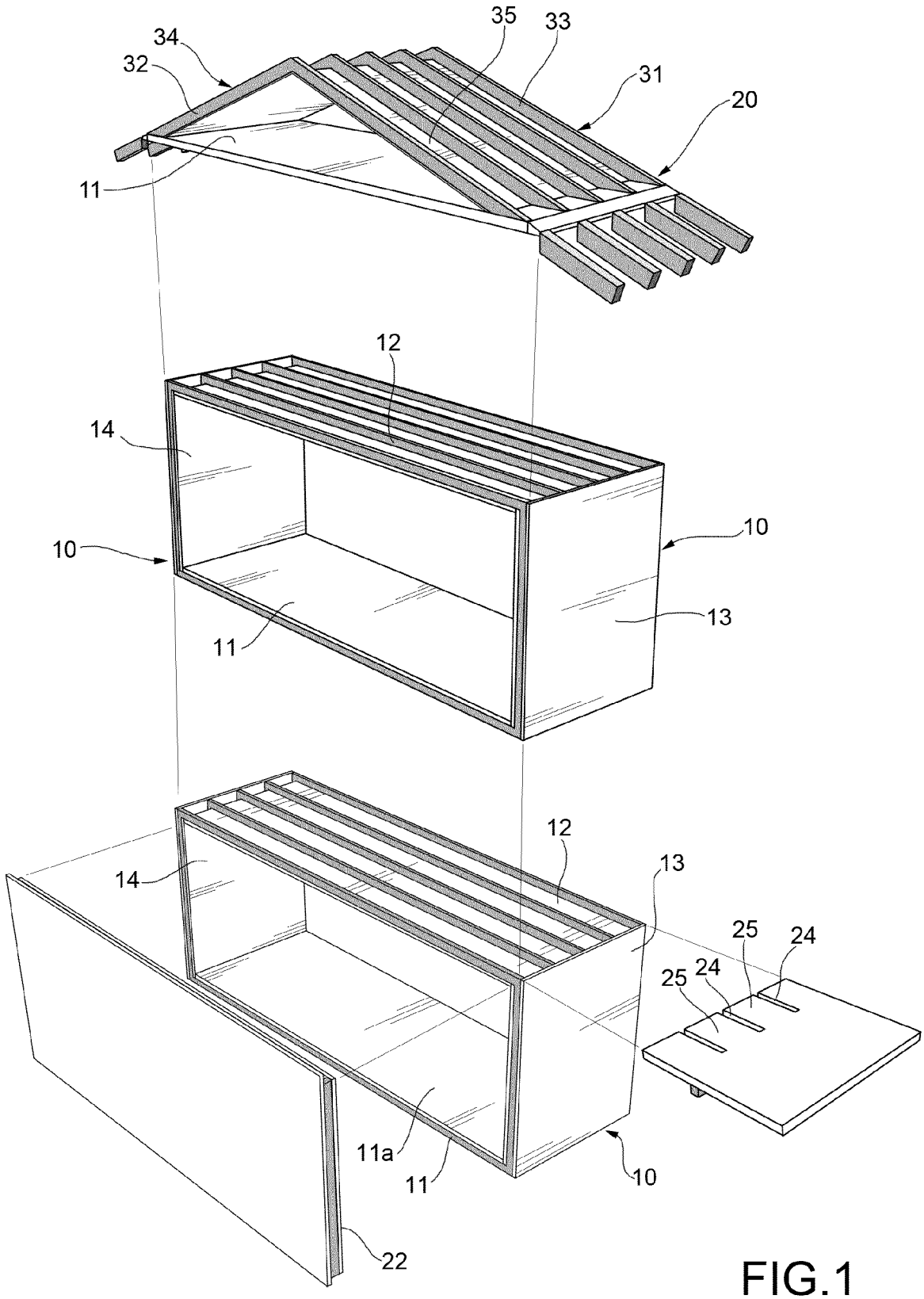


FIG.1

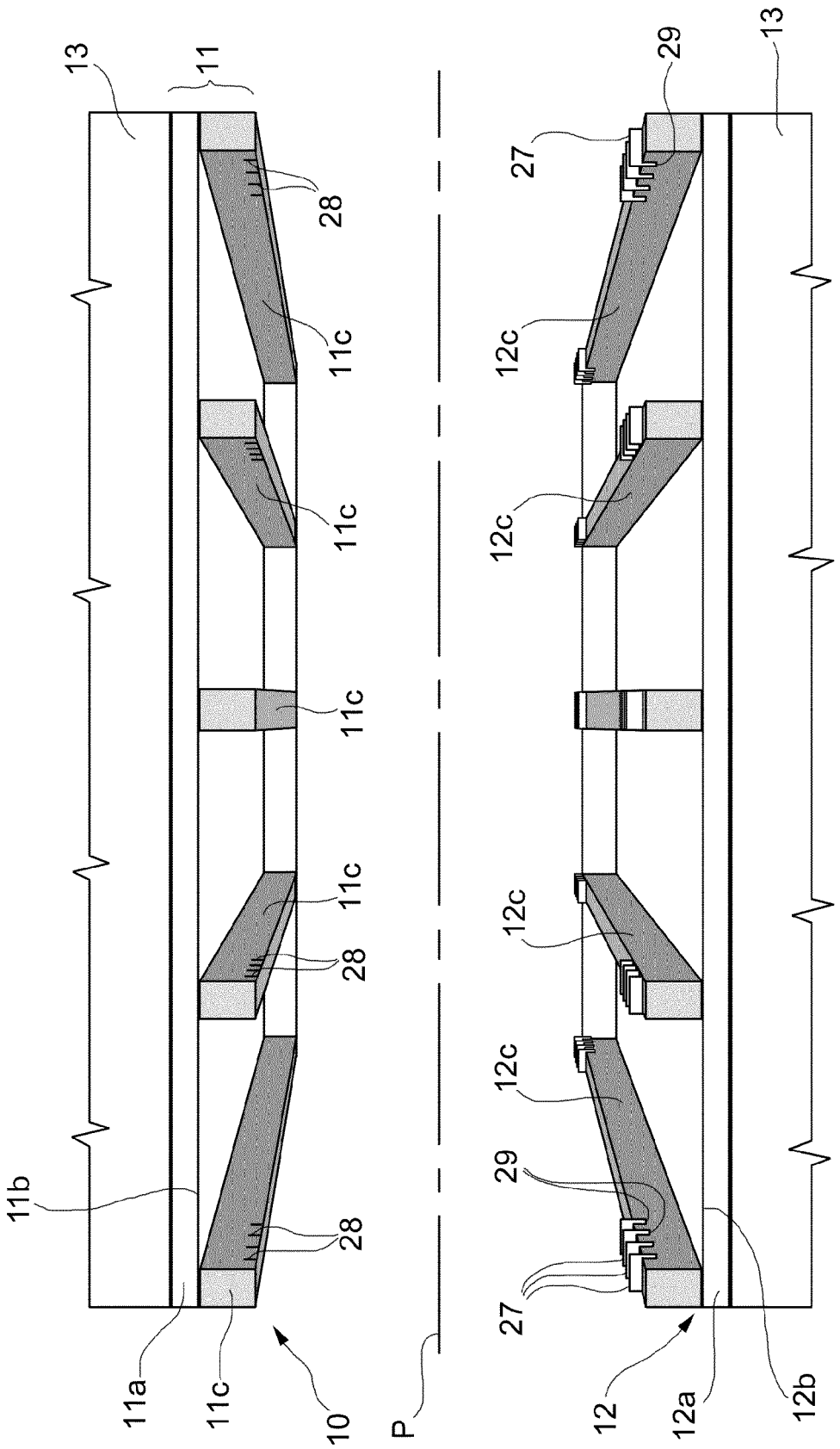

13
11
28
11c
11c
11c
11c
28
28
11b
11a
11c
10
P
27
29
13
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12c
12c
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29
27
12
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FIG.2

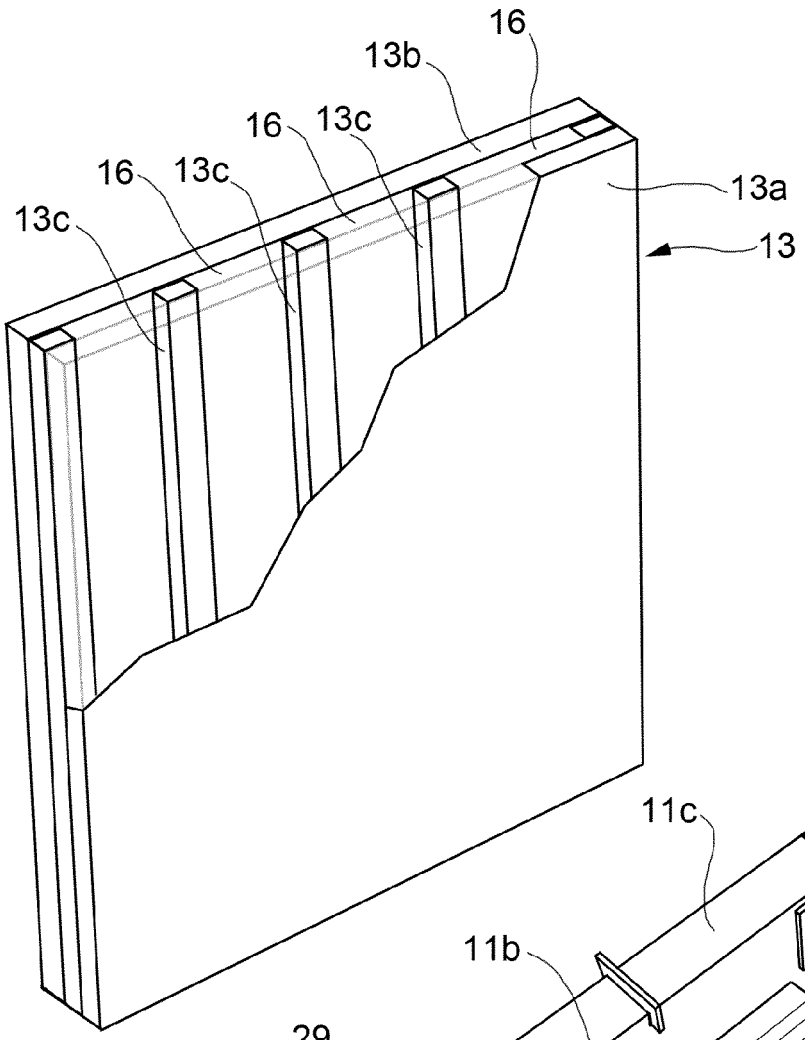


FIG.3

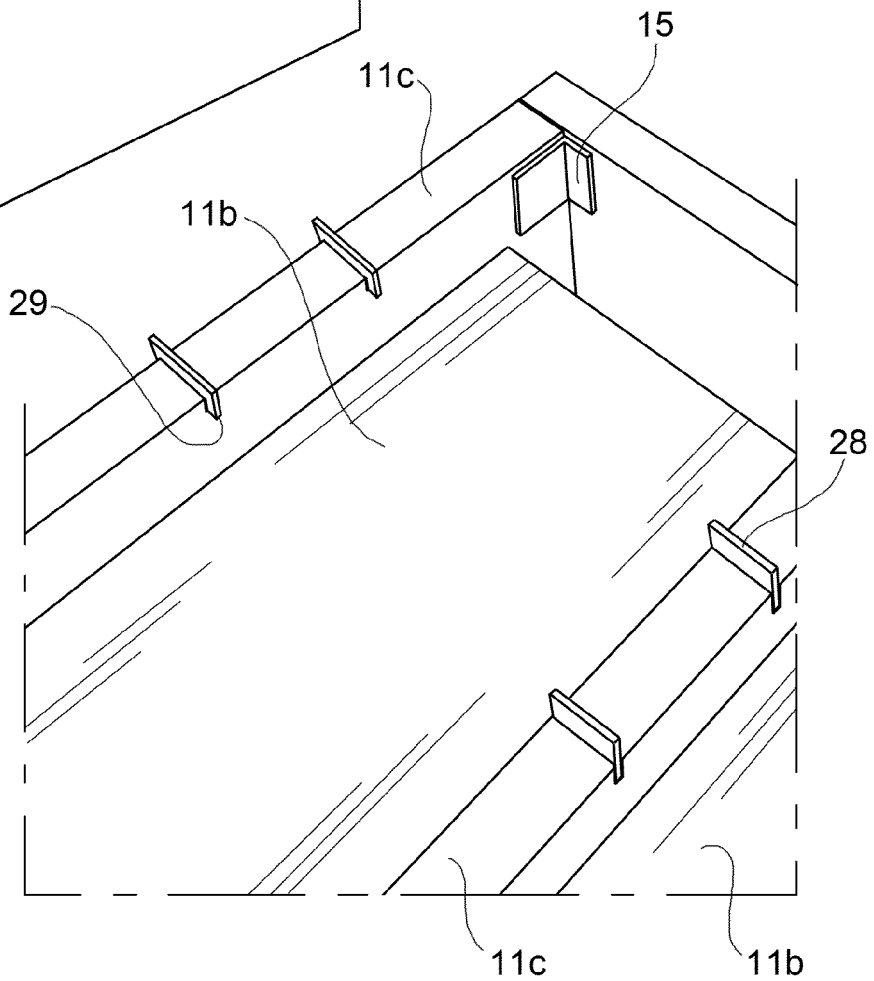


FIG.4

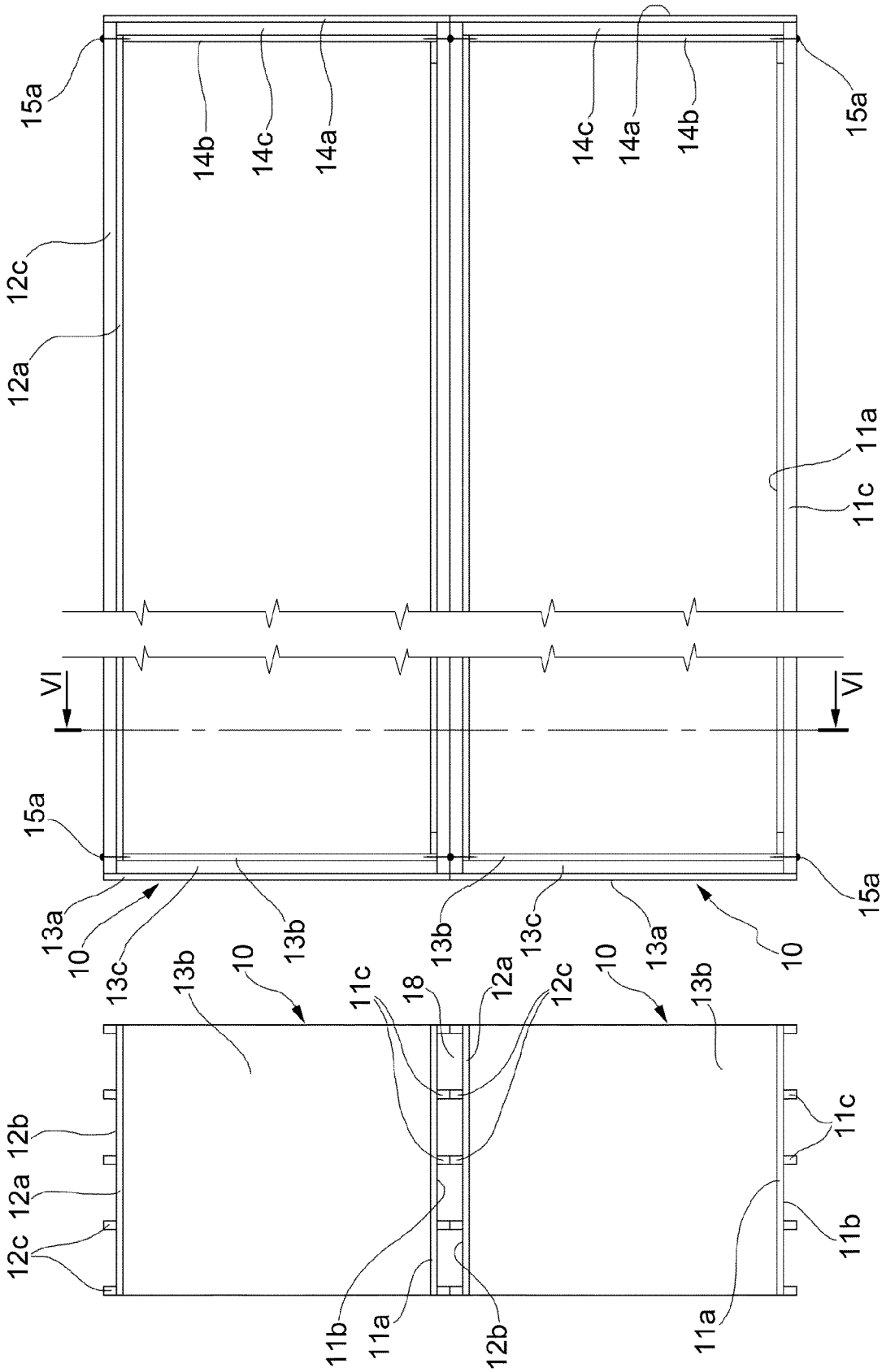

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14b
14c
14a
14c
14a
14b
15a
12c
12a
11a
11c
VI
VI
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13a
10
13c
13b
10
13b
13b
13c
13a
10
15a
11c
18
12a
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13b
12b
12a
12c
11c
11b
11b
11a
12b
11a

FIG.5

FIG.6

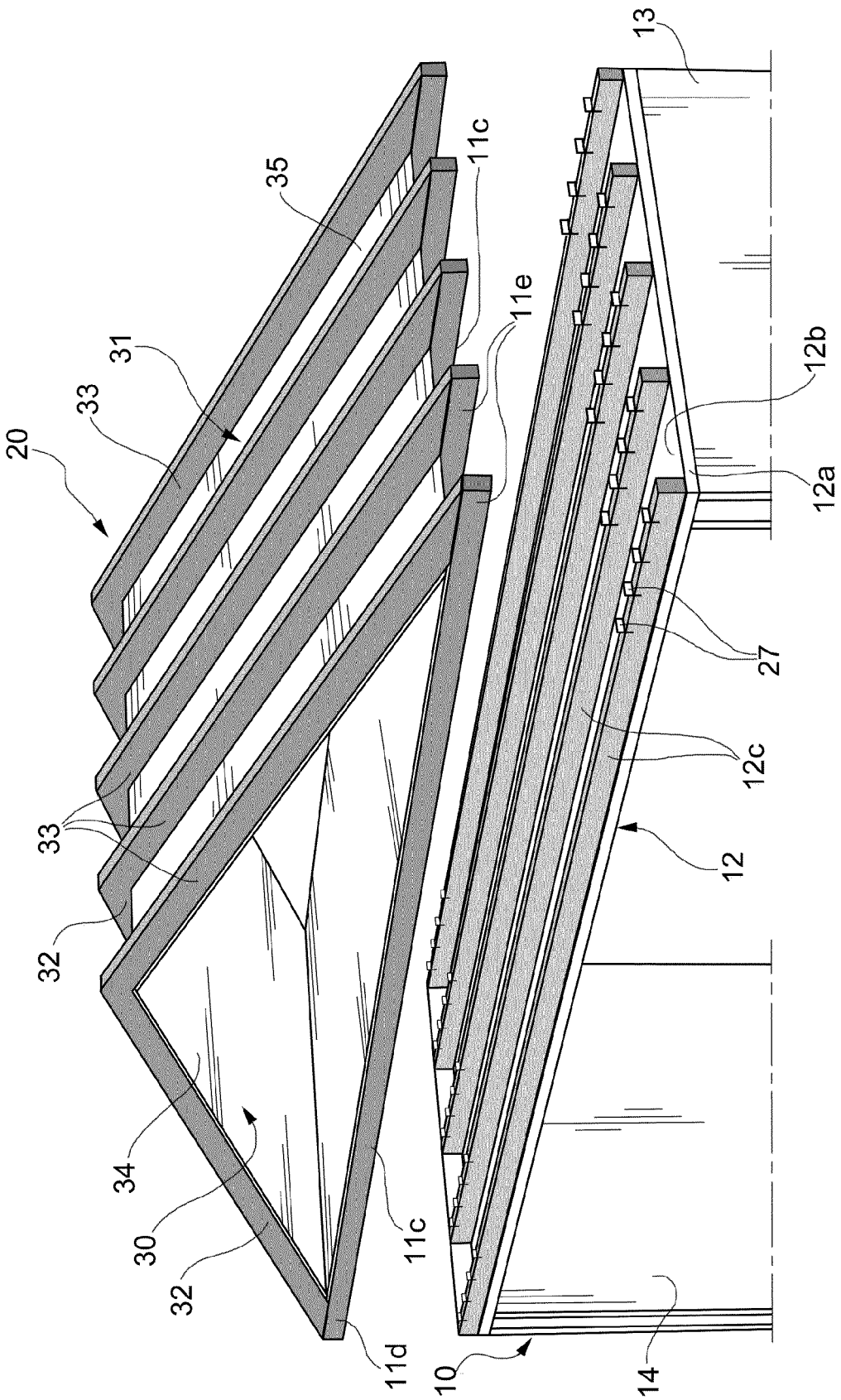


FIG.7

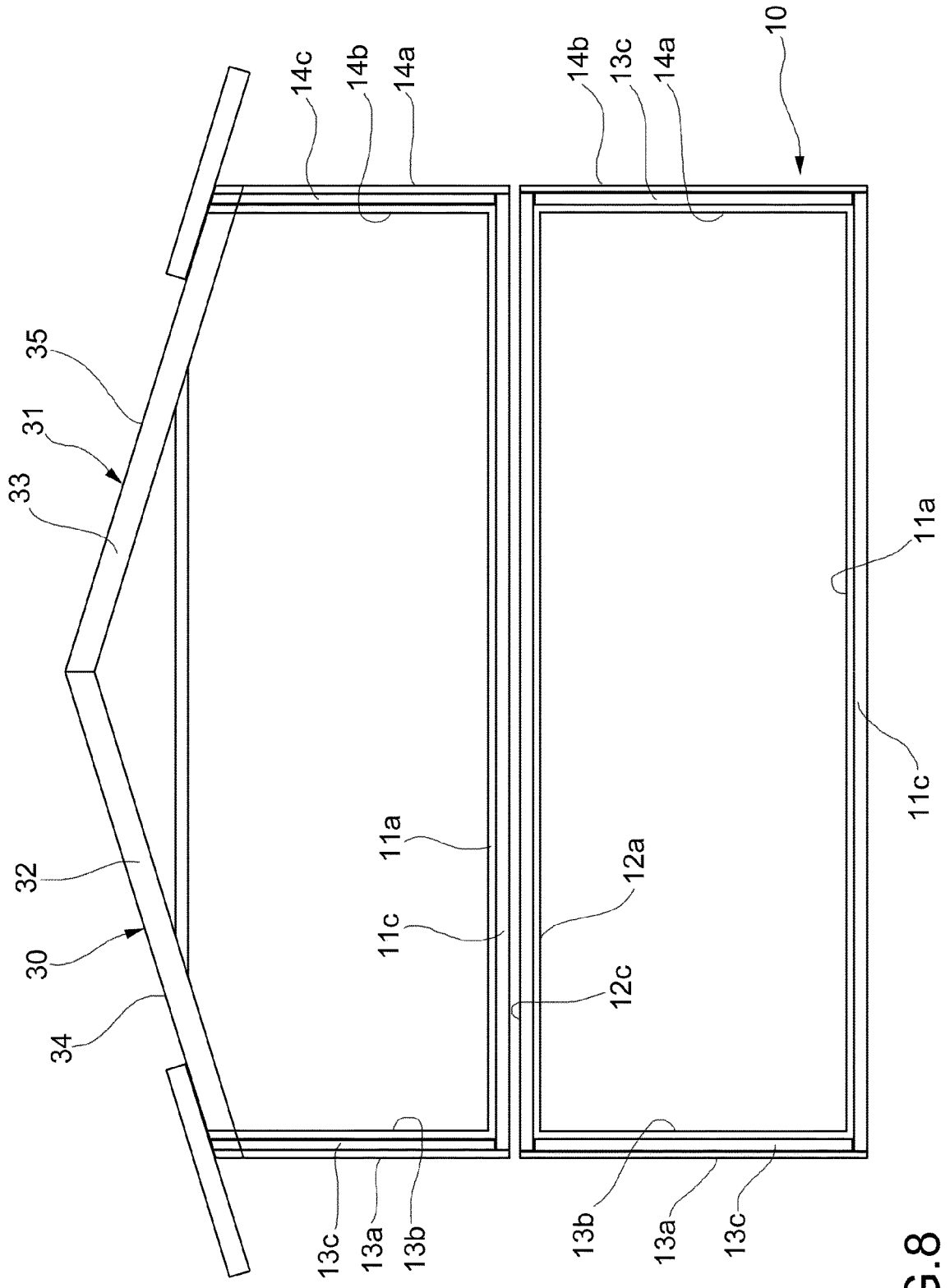

10
14c
14b
14a
14b
13c
14a
35
31
33
32
30
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11c
12a
12c
11a
11c
13c
13a
13b
13b
13a
13c

FIG.8

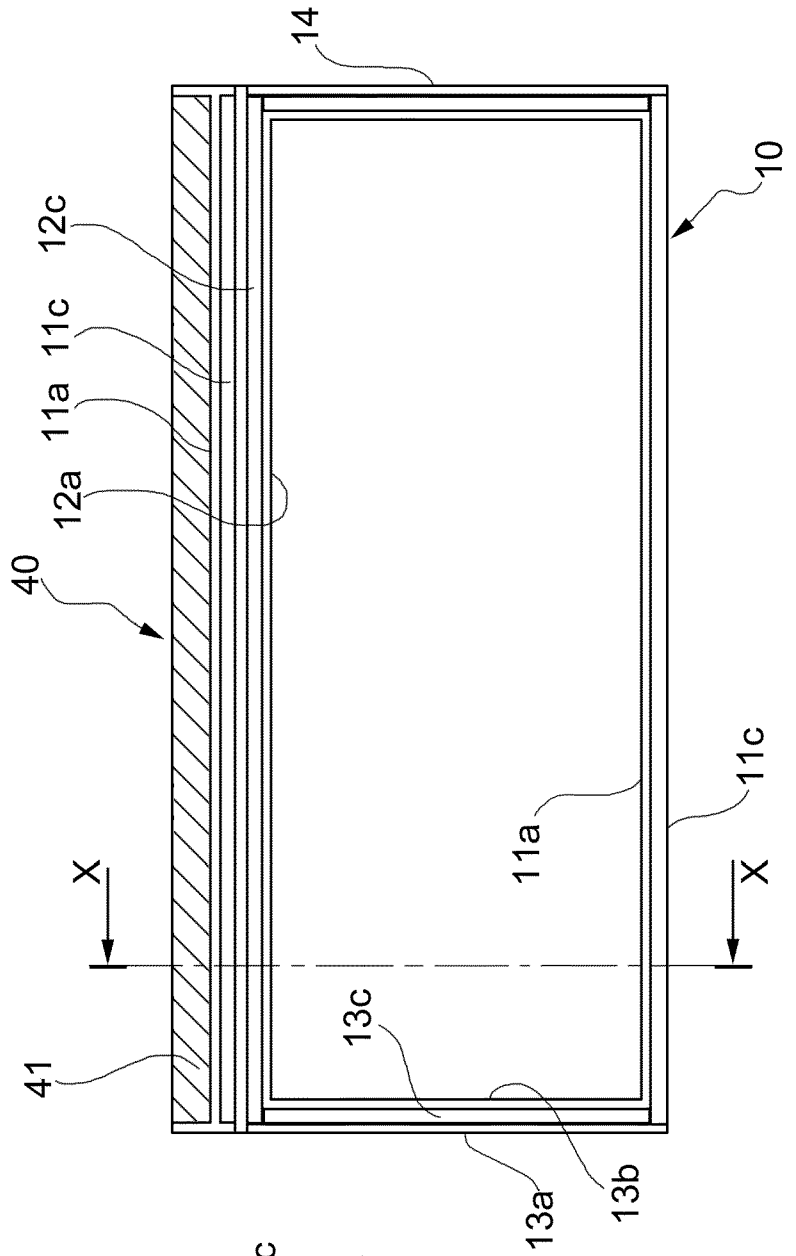

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11c
11a
12a
40
X
X
11a
11c
41
13c
13a
13b

FIG.9

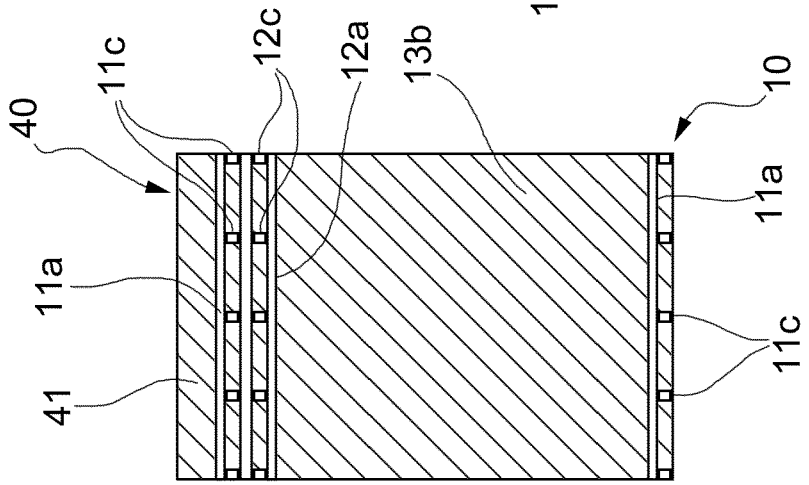

40
11c
12c
12a
13b
10
11a
11a
11c
41

FIG.10

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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 3996

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Place of search	Date of completion of the search	Examiner
The Hague	31 August 2015	Righetti, Roberto

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