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(54) **Apparatus for providing prefabricated walls of the type with superimposed layers of wood boards, and method for using such apparatus**

(57) An apparatus (10) for providing prefabricated walls of the type with superimposed layers of wood boards comprising:
- means (11) for joining in series boards (12) made of wooden material,
- means (13) for cutting to size board portions, according to a preset sequence of successive cuts to size,
- means (14) for parking and transporting the board portions (15, 16, 17, 18) in a preset sequence for a subsequent positioning prior to assembly,

- means (19) for picking up the board portions from the parking and transport means (14), for positioning on an assembly apparatus (20), so as to define a succession of superimposed layers (21, 22, 23) of board portions, each board portion being arranged in a preset position designed to form a prefabricated wall (50) which is provided with through compartments (51, 52) for installing windows and doors, or blind compartments for installing plumbing, electrical and similar system elements, omitting any preset regions.

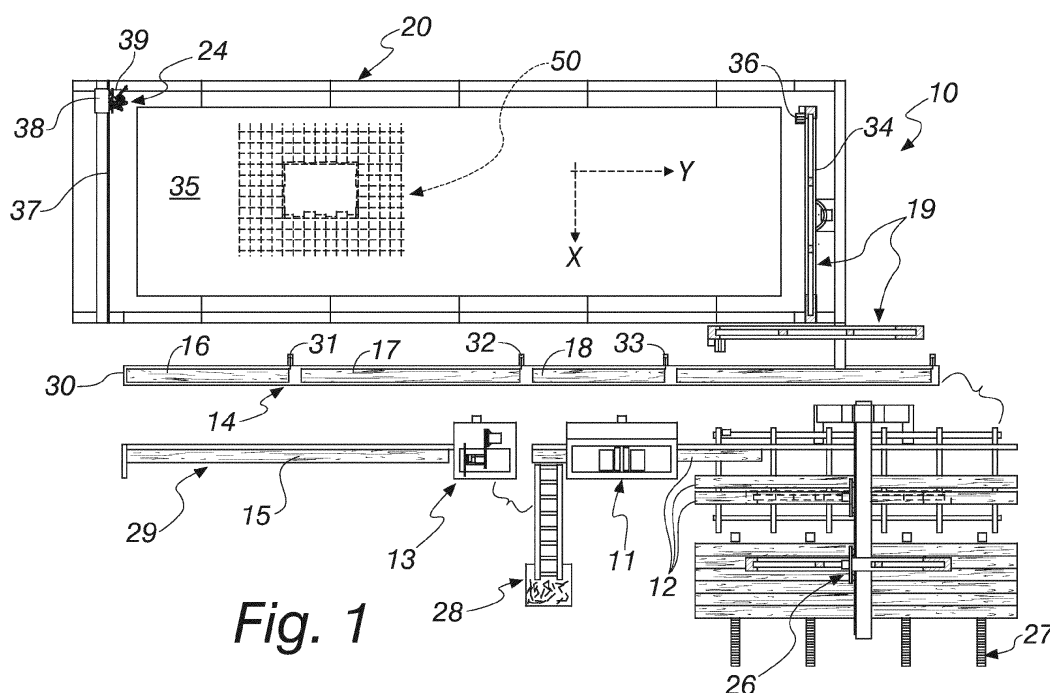


Fig. 1

Description

[0001] The present invention relates to an apparatus for providing prefabricated walls of the type with superimposed layers of wood boards.

[0002] The invention also relates to a method for using such apparatus.

[0003] Nowadays, in the field of prefabricated structures for the construction of buildings, it is known to install walls constituted by a plurality of superimposed layers of wooden boards laid side by side.

[0004] Such structures meet the need that is increasingly felt by operators in the sector to offer structures in the manufacture of which materials of natural origin are used.

[0005] The orientation of the boards that form the layers is alternated, from layer to layer, according to two mutually perpendicular directions.

[0006] In order to integrally join the layers to each other, and at the same time the boards that form them, nowadays several different solutions are known.

[0007] A first one of these involves the use of adhesives.

[0008] This solution however is the least appreciated of all, since the contamination of the wood with the chemical agents in the adhesives is perceived negatively by customers, also because of the inhibiting effect that the layers of adhesive have on the wood's natural capacity for transpiration.

[0009] An alternative solution nowadays offered involves the use of knurled nails driven through the layers, so as to retain them.

[0010] However, this solution has a drawback in the scant hold of the nails which, during working on the wall assembled thereby, for example to make openings for windows and compartments for doors, tend to loosen, compromising the cohesion and the dimensional stability of the wall.

[0011] A solution that is nowadays appreciated involves fixing the layers by way of wooden pegs.

[0012] However such solution is difficult to industrialize, with consequently onerous timescales and costs necessary in order to implement it.

[0013] In order to overcome these drawbacks, a prefabricated wall structure has been devised, which is disclosed in EPA 12155063.6, comprising at least three superimposed layers of mutually adjacent wood boards, the first of which, which form at least a first one of such layers, being transverse with respect to second boards, which form a second one of such layers, threaded elements being provided which are screwed through such layers so as to join them integrally, the threaded elements being made of metallic material and/or of plastic material and having a hardness that is such as not to damage mechanical tools for machining the wall.

[0014] During the provision of such prefabricated walls, when the layers of boards are assembled, the parallelepiped body obtained is worked by cutting, milling

and other, similar forms of machining so as to adapt the through compartments for holding doors or windows, or so as to make blind compartments, for example in order to provide tracks for laying ducts or pipes.

[0015] During such machining the cutting tools can come into contact with the threaded elements, and for this reason such threaded elements must be made, as specified above, from materials with a hardness that is such as not to damage machining tools in the event of contact with the same.

[0016] Similar prefabricated walls and a similar method of production, although widespread and appreciated, have room for improvement.

[0017] The foremost of these aspects is the waste of material and of machining carried out in order to provide a prefabricated wall as described above.

[0018] In fact the removal of material from the block of layers of superimposed boards after those layers of boards were previously screwed together leads to a waste both in terms of wooden material, the removal of which after screwing yields board portions that are irretrievably damaged both by the milling for removal and by the penetration in multiple points of the fixing screws between layers, and also in terms of threaded elements, since together with the wooden material the threaded elements present in the portion of wall removed are also eliminated; such threaded elements could optionally be recovered, if undamaged, by means of a costly use of labor.

[0019] Moreover, eliminating the threaded elements used in the removed portions of the wall implies the substantial pointlessness of the previous screwing operations with which those same threaded elements were applied, retrospectively establishing a non-optimized use of the machinery for assembling the prefabricated wall.

[0020] The aim of the present invention is to provide an apparatus for providing prefabricated walls of the type with superimposed layers of wood boards, which is capable of overcoming the above-mentioned drawbacks exhibited by the known art.

[0021] Within this aim, an object of the invention is to provide a method for using a similar apparatus.

[0022] Another object of the invention is to provide an apparatus and a method that make it possible to optimize the use of wooden material, reducing discards almost to zero, and/or to locate the threaded connection elements only where they are necessary.

[0023] A further object of the invention is to provide a method that does not involve the removal of portions of wall, in regions where threaded connection elements are located, with the assembly already carried out.

[0024] Another object of the invention is to provide an apparatus for providing prefabricated walls of the type with superimposed layers of wood boards, as well as a method for using such apparatus, which can be obtained with known means and technologies.

[0025] This aim and these and other objects which will become more evident hereinafter are achieved by an ap-

paratus for providing prefabricated walls of the type with superimposed layers of wood boards, **characterized in that** it comprises:

- means for joining in series boards made of wooden material,
- means for cutting to size board portions, according to a preset sequence of successive cuts to size,
- means for parking and transporting the board portions in a preset sequence for subsequent positioning prior to assembly,
- means for picking up the board portions from said parking and transport means, for positioning on an assembly apparatus, so as to define a succession of superimposed layers of board portions, each board portion being arranged in a preset position designed to form a prefabricated wall modelled with through compartments for the installation of windows and doors, or blind compartments for the installation of plumbing, electrical and similar system elements,
- an assembly apparatus, which comprises means for joining the layers of board portions by screwing threaded elements.

[0026] Advantageously, a method for providing prefabricated walls of the type with superimposed layers of wood boards is **characterized in that** it comprises the following operations:

- predefining, of a prefabricated wall, the position and dimensions of through compartments, for windows or doors, and of blind compartments, for installing plumbing, electrical and similar system elements,
- calculating, for each layer, the length and position of the board portions that make it up, in order to form said compartments,
- establishing a sequence for positioning the various board portions on an apparatus for the assembly of the prefabricated wall, beginning with a first, bottom, layer of boards, and proceeding with the layers superimposed successively,
- providing the board portions with a predefined length according to the preset sequence of placement on the assembly apparatus,
- positioning the board portions of predefined length according to said positioning sequence,
- joining the layers of boards by means of threaded elements or other similar and equivalent means.

[0027] Further characteristics and advantages of the present invention will become more apparent from the description of a preferred, but not exclusive, embodiment of the apparatus and the method according to the invention, which are illustrated by way of non-limiting example in the accompanying drawings wherein:

- Figure 1 is a plan view of an apparatus according to the invention;

- Figure 2 is a schematic example view of a first step of a method according to the invention;
- Figure 3 is a schematic example view of a series of further steps of a method according to the invention.

[0028] With reference to the figures, an apparatus for providing prefabricated walls of the type with superimposed layers of wood boards is generally designated with the reference numeral 10.

[0029] Such an apparatus 10 according to the invention comprises:

- means 11 for joining in series boards 12 made of wooden material, so as to subject material without discontinuities to the successive cutting means;
- means 13 for cutting to size board portions, for example 15, 16, 17 and 18, according to a preset sequence of successive cuts to size which sequence is based on a successive positioning prior to assembly,
- means 14 for parking and transporting the board portions in the preset sequence for the successive positioning prior to assembly,
- means 19 for picking up the board portions from said parking and transport means 14, for positioning on an assembly apparatus 20, so as to define a succession of superimposed layers, designated with 21, 22 and 23 in Figures 2 and 3, of board portions, each board portion being arranged in a preset position designed to form a prefabricated wall 50, modelled with through compartments, for example 51 and 52, for the installation respectively of a window and of a door, and optionally also with blind compartments for installing plumbing, electrical and similar system elements.

[0030] The assembly apparatus 20 comprises means 24 for joining the layers 21, 22 and 23 of board portions by screwing threaded elements 25.

[0031] In the specific embodiment of the invention described herein, by way of non-limiting example of the invention, the apparatus 10 comprises:

- a lift 26, of a known type, for the step lifting of pallets of boards made of wooden material;
- a horizontal traveling lift 27, the function of which is to select one board at a time by way of a grip system with suction cups in order to place it in the production cycle;
- the joining means 11, which are constituted by a conventional station for joining the boards by milling with contoured comb-like rollers with a vertical movement, the contoured rollers milling the ends of two adjacent boards to then proceed with the interlocking of such ends; associated with the joining station is a discharge station 28 for shavings that are small and not suitable for the production cycle;
- the means 13 of cutting the board portions to the

preset sizes, for example by way of adapted software, the means for cutting being understood as being of known type, such as for example a circular saw;

- a parking region 29 for the board portion just cut, for example the portion 15;
- the means 14 for parking and transporting the board portions 16, 17 and 18, which are constituted for example by a conveyor belt 30 with stop systems for the board portions, for example stop elements 31, 32 and 33 which are rendered operational, or retracted to allow the passage of a board portion, by means of a hydraulic or pneumatic cylinder, such stop elements being variable in position so as to reduce the grip, handling and placement times of the board portions in succession;
- the means 19 for picking up the board portions, which are constituted by a first portal 34, which moves along the axis Y; such first portal is provided with a grip system with suction cups with movement along the axis X and with means for rotating the grip system in order to pick up the board portion (or several portions simultaneously) and position them on the loading surface 35 in a preset position; said first portal 34 also has a carriage with a nailing assembly with fasteners 36 for providing a temporary junction of adjacent board portions;
- the means 24 for joining the layers 21, 22 and 23, which are constituted by a second portal 37 adapted to move along the axis Y and provided with a carriage 38 which moves along the axis X and which accommodates two or more screwing groups 39, which screw the layers 21, 22 and 23 at the end of the composition of the prefabricated wall 50.

[0032] The invention also relates to a method for providing prefabricated walls 50 of the type with superimposed layers 21, 22 and 23 of wood boards, which comprises the following operations:

- predefining, of a prefabricated wall 50, the position and dimensions of through compartments, for windows or doors, for example 50 and 51, and of blind compartments, for installing plumbing, electrical and similar system elements,
- calculating, for each layer 21, 22 and 23, the length and position of the board portions for forming the compartments; for example for the first layer 21 the portions designated in Figure 2 with A1, A2, A3 and A4 have the same length L1, the portion A5 has a second length L2, the portion A6 has a third length L3, etc.; such board portions are provided with the preset length in the preset sequence that will later be the positioning sequence, and so the portion A1, which is cut first, is positioned, for example with one of its corners at the preset point P1, with the coordinates X1 and Y1 on the loading surface 35; the portion A2, which is cut second, is positioned with one

of its corners at the preset point P2 with the coordinates X2 and Y2 on the loading surface 35, and so on similarly for all the other board portions A3, A4, A5, A6, A7 and others.

- establishing a sequence of positioning the various board portions A1, A2, A3, A4, A5, A6, A7 and others on the apparatus 20 for the assembly of the prefabricated wall, i.e. the loading surface 35 with the first portal 34 and the second portal 37; as shown in the example above, the positioning sequence corresponds to the sequence of making the board portions, which are positioned on the loading surface 35 starting with a first, bottom layer 21 of boards, and proceeding with the layers 22 and 23 which are superimposed subsequently.

[0033] Similarly to what is done for the portions of the first layer 21, the lengths of the portions B1, B2, B3 and others of the second layer 22, and of the portions C1, C2, C3 and others of the third layer 23 are preset.

[0034] Similarly for such portions B1, B2, B3, C1, C2, C3, the assembly position and the sequence of assembly are preset.

[0035] Once the dimensions of the board portions A1, A2, A3, A4, A5, A6, A7 and others have been preset, and the positioning coordinates of the portions and the positioning sequence of those portions have been preset, the method then actually provides the board portions A1, A2, A3, A4, A5, A6, A7 and others of preset length according to the preset positioning sequence on the assembly apparatus, and then carries out the positioning of the board portions of preset length according to the preset positioning sequence, starting from the first, bottom layer of boards.

[0036] Finally, the layers of boards are joined by way of threaded elements or other similar and equivalent means, and this is done by the joining means 24 described above.

[0037] The prefabricated wall 50 is finally trimmed by way of operations to level any ends of board portions that should protrude with respect to the preset dimensions.

[0038] Conveniently, regions can be provided where the layers are not joined with threaded elements, so that these regions can be removed, by making cuts, after the prefabricated wall has been completed.

[0039] By working in this manner, the threaded connection elements, which are expensive, are spared with respect to all the regions that will be eliminated.

[0040] In practice it has been found that the invention fully achieves the intended aim and objects.

[0041] In fact, with the invention an apparatus and a method are provided which make it possible to optimize the use of the wooden material by reducing discards almost to zero, since the board portions made of wooden material to be used are made to measure before assembly, thus eliminating the subsequent operations for removing portions of prefabricated walls for the provision of through or blind compartments.

[0042] What is more, with the invention an apparatus and a method are provided which also optimize the use of threaded connection elements between the layers of boards, and which therefore optimize the use of the screwing devices, since the screws and the screwing means are used only where there are board portions to be connected.

[0043] Alternatively, there will still be an advantage even if there are regions without connection elements which will be removed after completion of the prefabricated wall, thus sparing the connection elements that are unnecessary.

[0044] Last but not least, with the invention an apparatus for providing prefabricated walls of the type with superimposed layers of wood boards, as well as a method for using such apparatus, are provided, which can be obtained with known means and technologies.

[0045] The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other, technically equivalent elements.

[0046] In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements and to the state of the art.

[0047] The disclosures in Italian Patent Application No. PD2012A000220 from which this application claims priority are incorporated herein by reference.

[0048] Where technical features mentioned in any claim are followed by reference signs, such reference signs have been inserted for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An apparatus (10) for providing prefabricated walls of the type with superimposed layers of wood boards, **characterized in that** it comprises:

- means (11) for joining in series boards (12) made of wooden material,
- means (13) for cutting to size board portions, according to a preset sequence of successive cuts to size,
- means (14) for parking and transporting the board portions (15, 16, 17, 18) in a preset sequence for a subsequent positioning prior to assembly,
- means (19) for picking up the board portions from said parking and transport means (14), for positioning on an assembly apparatus (20), so as to define a succession of superimposed layers (21, 22, 23) of board portions, each board

portion being arranged in a preset position designed to form a prefabricated wall (50) which is provided with through compartments (51, 52) for installing windows and doors, or blind compartments for installing plumbing, electrical and similar system elements,

- an assembly apparatus (20), which comprises means (24) for joining the layers (21, 22, 23) of board portions by screwing threaded elements (25), omitting any preset regions.

2. The apparatus according to claim 1, **characterized in that** said means (19) for picking up the board portions are constituted by a first portal (34), which moves along a first axis (Y), said first portal being provided with a grip system with suction cups with movement along a second axis (X) and with means for rotating the grip system in order to pick up one or more board portions and position them on the loading surface (35) in a preset position.

3. The apparatus according to the preceding claims, **characterized in that** said means (24) for joining the layers (21, 22, 23) are constituted by a second portal (37), which is adapted to move along the first axis (Y) and is provided with a carriage (38) which moves along the second axis (X) and which accommodates two or more screwing groups (39), which screw the layers (21, 22, 23) at the end of the composition of the prefabricated wall (50).

4. The apparatus according to the preceding claims, **characterized in that** said joining means (11) are constituted by a station for joining the boards by milling with contoured comb-like rollers with a vertical movement, said contoured rollers milling the ends of two adjacent boards to then proceed with the interlocking of said ends.

5. The apparatus according to the preceding claims, **characterized in that** said means (14) for parking and transporting the board portions (16, 17, 18) are constituted by a conveyor belt (30) with stop systems for the board portions.

6. The apparatus according to the preceding claims, **characterized in that** said stop systems for the board portions are constituted by stop elements (31, 32, 33) which are rendered operational, or retracted to allow the passage of a board portion, by means of a hydraulic or pneumatic cylinder, said stop elements being variable in position so as to reduce the grip, handling and placement times of the board portions in succession.

7. A method for providing prefabricated walls (50) of the type with superimposed layers (21, 22, 23) of wood boards, **characterized in that** it comprises the

following operations:

- predefining, for a prefabricated wall (50), the position and dimensions of through compartments (51, 52), for windows or doors, and of blind compartments, for installing plumbing, electrical and similar system elements, and/or other preset regions; 5
- calculating, for each layer (21, 22, 23), the length and position of the board portions (A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, C1, C2, C3) in for forming said compartments (51, 52), 10
- establishing a sequence for positioning the various board portions on an apparatus (20) for the assembly of the prefabricated wall (50), 15
- providing the board portions (A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, C1, C2, C3) with a predefined length according to the preset sequence of placement on the assembly apparatus,
- positioning the board portions of predefined length according to said positioning sequence, 20
- joining the layers of boards by means of threaded elements (25) or other similar and equivalent means. 25

8. A method for providing prefabricated walls (50) of the type with superimposed layers (21, 22, 23) of wood boards, according to claims 1 and 7, **characterized in that** said preset regions do not have threaded connecting elements and are removed, by cutting, after the completion of the prefabricated wall. 30

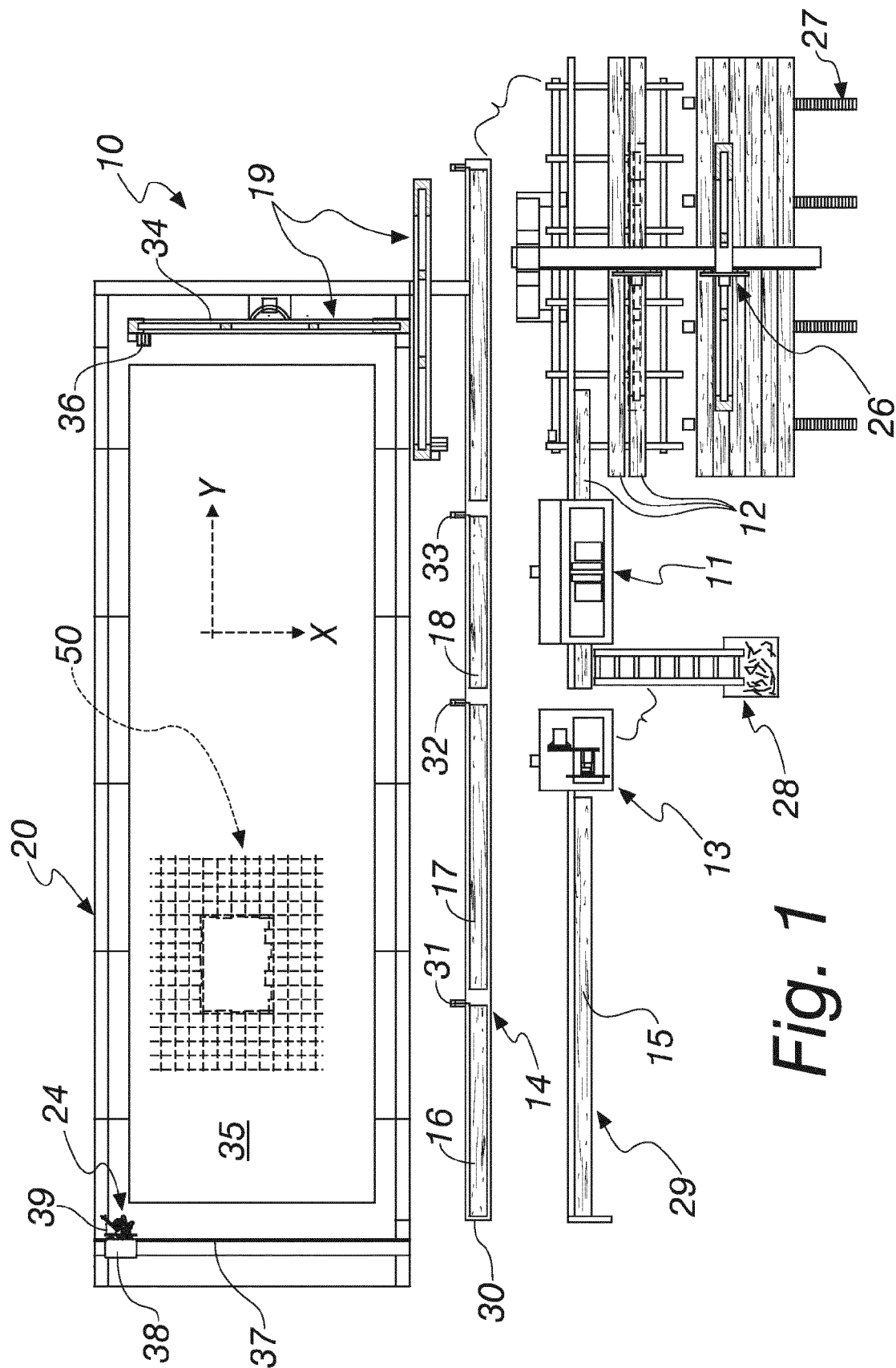
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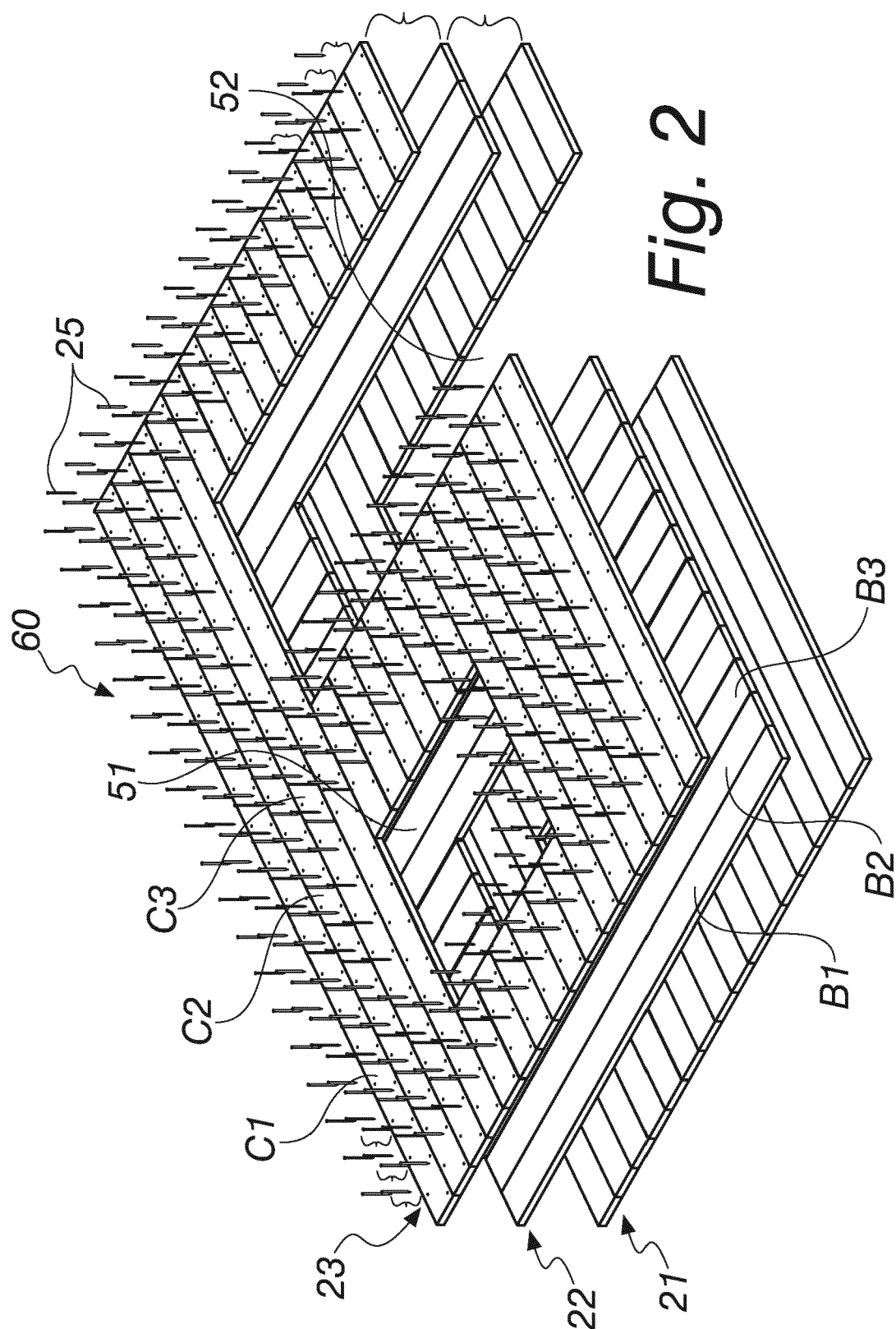
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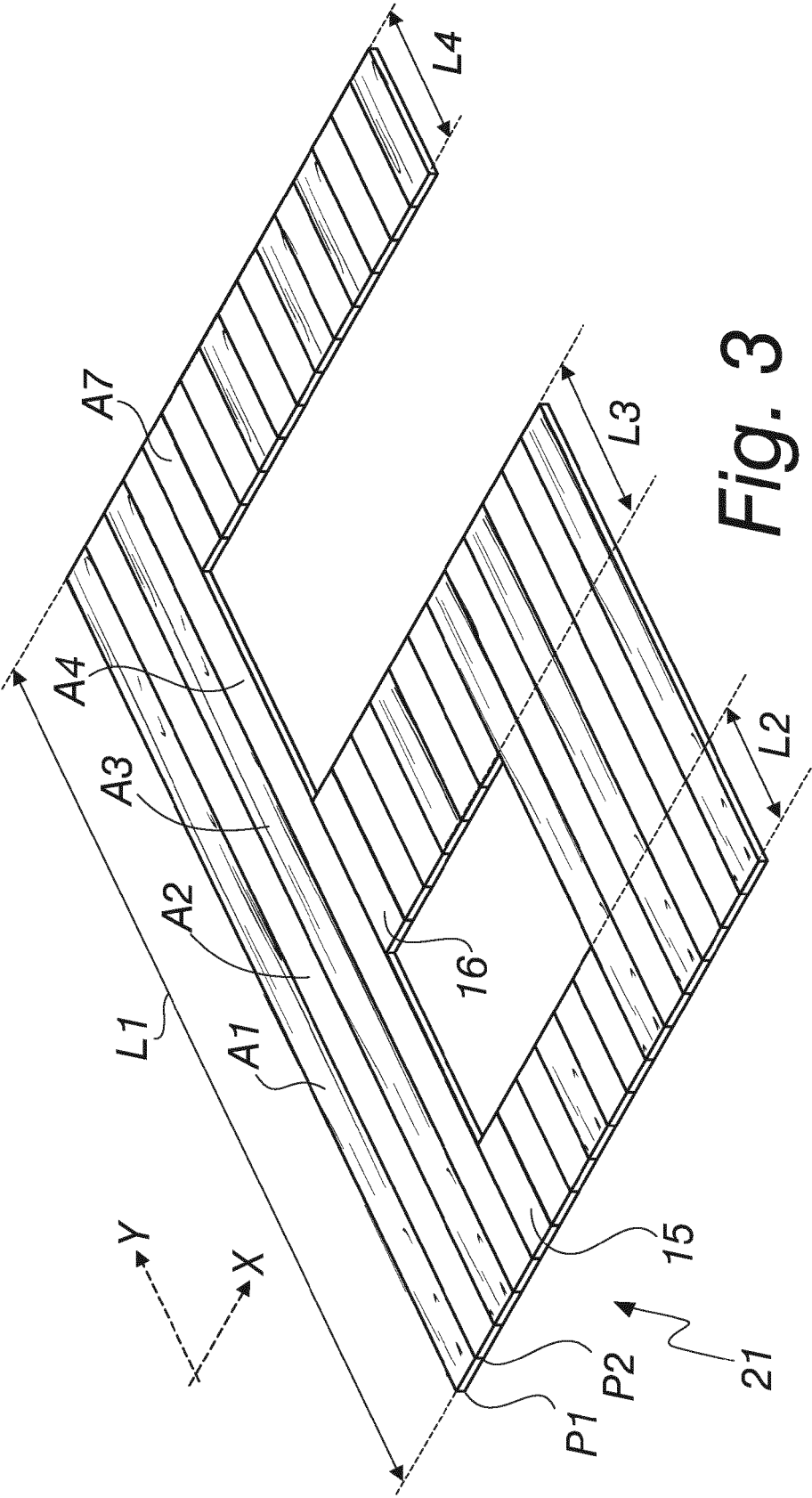


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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