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(54) **Arrangement for joining wood-based construction elements**

(57) A connecting arrangement (15) for joining construction elements (1, 1A) that are components of a building and that are principally of wood-based material forming walls, stacked on each other, one on top of the other, built up from structural battens (2) and at least one surface layer (9) and that extend essentially parallel with a central plane (C). The connecting arrangement (15) comprises a first part (15a) and a second part (15b), of which the first part (15a) is arranged at one edge (14) of the construction element (1, 1A) and the second part (15b) is arranged at the second edge (17) of the construction element (1, 1A), which is located opposite the first edge (14), in that the first part (15a) can be connected to the second part (15b), and in that the second part (15b) comprises a locking unit (23) for the retention of the first part (15a) when wall elements (1, 1A) are connected.

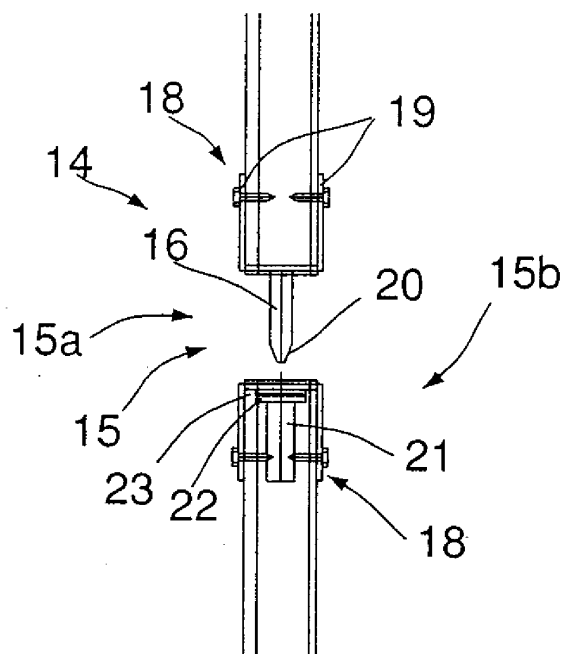


FIG.3a

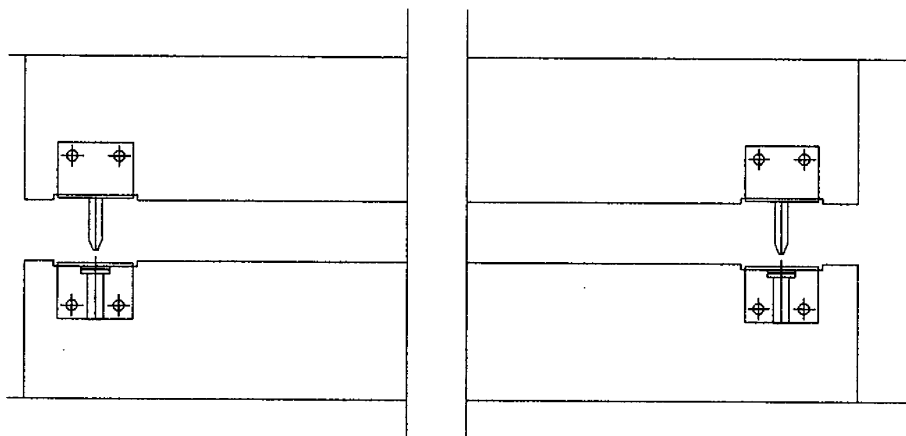


FIG. 3b

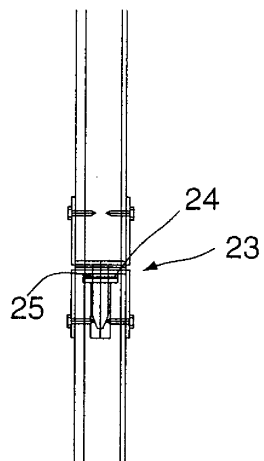


FIG. 3c

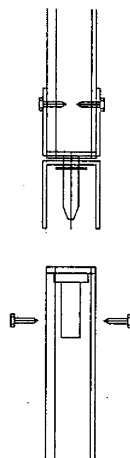


FIG. 3d

Description

[0001] The present invention concerns an arrangement for joining wood-based construction elements according to the introduction of claim 1.

[0002] The manufacture of houses and other types of building takes place evermore often with the aid of construction elements, for several reasons. Not only is it possible for the assembly of the house to take place with fewer persons involved at the building site, but also is the manufacture of the construction elements carried out in a controlled environment, such as that in a factory. The construction elements comprise modules that are put together, forming in this manner a building. The module may be fully complete, with its outer surface coated with a weather-resistant surface layer, the inner surface wall-papered, and the interior of the module provided with insulation and conduits installed for, for example, the electrical installations. The module may be one complete wall, a wall with at least one of windows and doors, and floor structure modules.

[0003] Various methods and arrangements for the joining of construction elements are known. A wall module of reinforced concrete designed to be used for the completion of a multi-storey building is described in the Swedish patent SE 527783, with applicant NCC AB. The wall module comprises two vertical joining arrangements in the form of a male part, such as a peg, and a female part, together with two horizontal joining arrangements.

[0004] One disadvantage of this variant is that the motions of the modules in the vertical direction are limited only by the weight of the modules, and that they are locked by the arrangements of the horizontal joints. A further disadvantage is that it is possible to displace the vertical joints in a horizontal direction. This solution makes possible large tolerances during the manufacture, but it places at the same time heavy demands on the personnel who are to assemble the various modules.

[0005] The degree to which the modules are completed during the manufacturing phase thus places heavy demands on those parts with which the modules are to be joined.

[0006] One aim of the present invention is to offer an arrangement for the joining of wood-based construction elements that gives an exact fitting of the elements to each other.

[0007] A second aim is to offer an arrangement for the fitting of the construction elements against each other that gives at the same time locking in both the vertical direction and the horizontal direction during the joining process.

[0008] An embodiment will be described below with reference to the attached drawings, of which:

Figure 1 shows a construction element arranged vertically with a plate,

Figure 2 shows a detail of an I-beam,

Figure 3a shows a cross-sectional view seen in the

longitudinal direction of two wall elements before joining,

Figure 3b shows a view of the wall elements from Figure 3a obliquely from the side,

Figure 3c shows a cross-sectional view of the wall elements from Figure 3a after joining,

Figure 3d shows the wall elements during disassembly,

Figures 4a-4d show a second variant of the connection arrangement in positions corresponding to those of Figures 3a-3d,

Figure 5 shows two wall elements with an installation layer, and

Figure 5A shows a second variant of the two wall elements corresponding to those in Figure 5.

[0009] Figure 1 shows a construction element in the form of a wall element 1 manufactured from wooden material that extends essentially parallel with a central plane C. The wall element 1, which for reasons of clarity will be described as standing in a vertical direction, comprises a structural body having structural battens of elongated I-beams 2, one of which is shown in more detail in Figure 2. It is an advantage if the webs 3 of the I-beams 2 are manufactured from wood-fibre sheet. The two edges of the web 3 are attached at the sides to a pressure flange 4 and a tensile flange 5 manufactured from wood. These may be, for example, solid wooden flanges, or they may also comprise LVL material or glulam. The term "pressure flange" 4 is used to denote the flange at which compression forces usually arise, and in an equivalent manner, the term "tensile flange" 5 to denote the flange at which tensile forces usually arise. The I-beams 2 are arranged essentially parallel to each other and at a certain separation, with their tensile flanges 5 attached to a first surface covering 6, for example a building sheet, adapted for an outdoor environment and advantageously provided with facade material such as panels or similar. It is appropriate that the separation between the I-beams 2 be adapted for insulation material of standard dimensions. It should be realised in this respect that the I-beams can be arranged with a greater or lesser distance between them, depending on the load that it is intended that the wall element is to carry, and depending on whether the wall element is to be insulated or not. It is an advantage that nogging pieces be arranged between the I-beams 2. It is an advantage if also a transverse I-beam 7 is arranged at the ends of the longitudinal I-beams, forming an end wall.

[0010] A plate 9 in the form of a lamellar board is attached to the pressure flanges 4 of the I-beams 2. The plate comprises a core 10 with fibres that are parallel to the longitudinal direction of the I-beams, and which core is covered by a surface layer 11 on at least the side that faces the I-beams 2. It is an advantage that the core 10 comprise planks 12 that are arranged with their long sides next to each other and parallel with the I-beams 2. The size of the plate 9 depends on the load to which the wall

element 1 will be subject when the building has been built. When using the wall element for walls of buildings that will have only one or one and a half storeys, the pressure flange side 4 of the beams 2 is only partially covered by the plate 9, since the load on the wall element 1 will be significantly lower than it will be in a multi-storey building. That part of the pressure flange side 4 of the I-beams 2 that is not covered by the plate 9 is, instead, arranged with a traditional type of building board. The arrangement of the sheet 9 in this manner can be compared with a truss beam. If the wall element 1 is to be used in a building with two or more storeys, then the pressure flange side of the wall element is fully covered by the plate 9.

[0011] It is an advantage that an installation layer 13 be arranged at the plate 9, comprising structural battens with a surface layer that does not have a load-bearing function, being intended solely to provide a compartment for, for example, piping. Since this surface layer face in towards the room that is formed by the connected wall elements, it is an advantage that it be painted or wallpapered.

[0012] The first edge 14 of the plate 9 comprises a first part 15a that is a component of a connection arrangement 15 and that is directed away from the edge 14, advantageously coincident with the direction of the central plane C. The second edge 17 of the plate 9 is arranged in an equivalent manner with the second part 15b that is a component of the connecting arrangement, and is directed in towards the edge 17, advantageously coincident with the direction of the central plane C. The plate 9 and the I-beams 2 are arranged, according to Figure 5, such that one end 8a of the I-beams is located a certain distance inside of the first edge 14 of the plate 9 while the second end 8b of the I-beams is located a certain distance outside of the second edge 17 of the plate 9.

[0013] In a further embodiment shown in Figure 5A, the edges of the plate 9 are at the same level as the transverse I-beam that is arranged at the ends of the longitudinal I-beams, i.e. when the wall elements are stacked on their edges, one on top of the other, then the elements will be in contact with their ends against each other.

[0014] The first part 15a, shown in Figure 3a-4d and directed out from the plate 9, has the form of a peg 16 or a shaft, and is mounted on a bracket 18a. It is an advantage if the surface of the peg 16a demonstrates a surface structure in order to improve its locking action with the connection. The bracket 18a has been given the form of a "U", and it is intended that it make contact with the edge 14 of the plate 9 with its two free legs 19 one on each side of the lamella 9 and that it be screwed into the lamella 9 with the peg 16 directed away from the edge 14 of the plate. The purpose of the bracket 18a and its design is that it provide the possibility to disassemble the complete wall element 1 if this should become necessary. In a second embodiment, the bracket has been given the form of an "L", i.e. the bracket is screwed attached only on

one side of the lamella. It should, however, be realised that the peg 16 can be inserted into and mounted directly on the plate 9. It is an advantage that the peg 16 be bevelled at its free end in order to facilitate the joining of the connection arrangement 15. It is an advantage that the bracket 18a be mounted in such a manner that the peg 16 is centred in the edge 14 of the plate 9.

[0015] The second part 15b that is a component of the connecting arrangement 15 is located in a hole or an opening that is present in the second edge 17 of the plate 9. The second part 15b has been given a dimension and a form that correspond to, or are somewhat greater than, those of the peg 16. The outermost part of the opening 21 is arranged with a collar or flange 22 against which a locking unit 23 is placed. The locking unit comprises a washer 24 that is in contact with the flange 22, and a cover 25 is mounted over the flange 22 and the washer 24 after the washer 24 has been placed in the locking unit 23, whereby the axial motion of the washer 24 is locked. The cover 25 comprises a "U"-bracket 18b that is screwed attached to the plate 9 and that is provided with a hole through which it is intended that the first part 15a of the locking arrangement 15 be inserted. The locking washer 24 is provided in the same manner with a hole that has the same purpose. The bracket 18b has been given the form of an "L" in a second embodiment, i.e. the bracket 18b is screwed attached solely to one side of the lamella. The hole of the locking washer has been given a dimension that is somewhat smaller than that of the peg that is a component of the first part 15a of the locking arrangement 15, in order to offer locking interaction with the surface of the peg 16. The hole of the locking washer 24 furthermore, demonstrates a sharp or pointed inner surface in order to make better contact and achieve better locking with the peg 16.

[0016] It should in this connection be realised that the first part 15a of the connecting arrangement 15 in one construction element is intended to interact with the second part 15b of the connecting arrangement 15 in a second construction element 1A that is stacked on the first construction element. It should be realised also that when a construction element with a plate 9 that only partially covers it is to be used, i.e. when the plate 9 can be considered to be similar to a truss beam, the construction element 1 comprises only one part 15b of the parts that are components of the connecting arrangement 15. On that part that the construction element is intended to be attached to at the foundation on which the building is to stand, the second part 15a of the parts that are components of the connecting arrangement 15 is attached to the transverse I-beam at the end wall of the element.

[0017] When the peg 16 is pressed into the hole of the washer 24, this hole is expanded through the edge of the hole being bent in the direction of the direction of motion of the peg 16, and it is then subject to tension. If the peg attempts to move outwards from the opening 21 as a result of, for example, wind loading, the tension is reinforced through the sharp edge of the hole pressing

against the surface of the peg whereby the peg 16 is prevented from leaving the hole of the washer 24. At least one of the first part 15a and the second part 15b is mounted at the relevant edge 14 or 17 of the plate 9, but it should be realised that each edge 14, 17 may be provided with two or more locking arrangements 15. It is, however, a requirement that the edges 14, 17 of two wall elements 1, 1A that are intended to be directed towards each other demonstrate an equal number of locking arrangements 15. It is an advantage if the number of locking arrangements 15 increases with increasing height of the building.

[0018] In a second embodiment that is illustrated in Figures 4a-4d, the brackets are designed to allow the locking arrangements to be arranged externally applied against the edge of the plate. The locking unit 23 is arranged between two retaining surfaces between which the vertical motion of the locking unit is locked.

[0019] When two wall elements 1, 1A are to be joined, the first wall element 1 is located standing in a vertical position and a strip of sealing material is arranged at the edge 14 of the plate 9 as shown in Figure 5. The pegs 16 of the next wall element 1A, which pegs are arranged in the lamellar edge 17 of this wall element 1A, are subsequently fitted into the opening 21 of the first wall element 1, which opening is arranged in the lamellar edge 14 of this wall element. When the lamellar edge 17 of the second wall element 1A is placed in contact with the lamellar edge 14 of the first wall element 1, the peg 16 of the second wall element is pressed into the opening 21 and a locking washer 24 of the first wall element 1. The mutual motions of the wall elements 1, 1A in the vertical direction and in the horizontal direction are thus locked.

[0020] If the second wall element 1A must be dismounted, the brackets of the peg 18a and of the opening 18b are screwed from the respective lamellar edges 14, 17. The wall element 1A can subsequently be dismounted and the connecting arrangements 15 must be discarded. When the wall element 1A is to be mounted again, new connecting arrangements 15 are mounted on both of the wall elements 1, 1A, after which the method is repeated.

[0021] The arrangement functions as described below:

[0022] Laying the foundation is carried out in the normal manner by pouring the foundation of the building or by an assembly of the elements of the crawlspace. A sill is arranged at the beam at the edge, on which the wall element 1 is to be mounted. It is an advantage that a first set of the locking unit 23 that is a component of the connecting arrangement 15 is mounted in the sill. It should, however, be realised that the first level of the wall element 1 can be attached at the sill in a traditional manner without the connecting arrangement 15 according to the invention.

[0023] The first level of wall elements 1 is attached to the sill and joined at the corners in a manner that is already known, for example, with the aid of tracks and riders or with the aid of ready-made corner pieces that are attached in a traditional manner. The strip of sealing ma-

terial is placed on the edge 14 of the wall elements. The next level of wall elements 1A can now be lifted into place. Each wall element 1A is lifted and positioned with the pegs 16 towards the openings 21, after which the wall elements 1A are lowered such that the pegs 16 are pressed into the openings 21 and the holes in the washers 24. In association with the insertion of the pegs 16 into the openings 21, the edge 17 of that part of the plate 9 that is located outside of the end pieces 8b of the I-beams is placed in contact against the edge 14 of the plate of the existing wall elements. The surface layers of the wall elements 1, 1A are placed in this way at the same level.

[0024] It is an advantage if the component parts 16, 21, 22, 24 of the coupling arrangements 15 described above are manufactured from at least one of high-strength steel and stainless steel. It should, however, be realised that other types of material, such as composite materials, can be used. However, in the case in which the parts are manufactured from composite material the spring washer is manufactured from spring steel in order to achieve a sharp locking edge.

[0025] The present invention is not limited to what has been described above and revealed in the drawings: it can be changed and modified in a number of different ways within the scope of the innovative concept specified by the attached claims.

Claims

1. An arrangement (15) for joining two construction elements (1, 1A) that are components of a building and that are principally of wood-based material forming walls, stacked on each other, one on top of the other, built up from structural battens (2) and at least one surface layer (9) and that extend essentially parallel with a central plane (C), **characterised in that** the connection arrangement (15) comprises a first part (15a) and a second part (15b), of which the first part (15a) is arranged at one edge (14) of the construction element (1, 1A) and the second part (15b) is arranged at the second edge (17) of the construction element (1, 1A), which is located, when the elements are stacked, opposite the first edge (14), **in that** the first part (15a) can be connected to the second part (15b), and **in that** the second part (15b) comprises a locking unit (23) for the retention of the first part (15a) when wall elements (1, 1A) are connected.
2. The connection arrangement according to claim 1, whereby the locking unit (23) comprises a washer (24) with a hole for the reception and retention of the first part (15a) that is a component of the connecting arrangement (15).
3. The connection arrangement according to claim 1,

whereby the first part (15a) of the connecting arrangement (15) comprises a peg (16) that protrudes from the first edge (14) of the construction element (1, 1A) in a direction that coincides with the direction of the central plane (C).

4. The connection arrangement according to claim 2, whereby the peg (16) is arranged at a bracket (18a) with the form of a "U" and that is attached at the edge (14) of the construction element (1, 1A) with its two free legs (19) one on each side of the construction element (1, 1A).
5. The connection arrangement according to claim 4, whereby the bracket (18a) is attached to the edge (14) of the construction element (1, 1A) in a manner that allows it to be removed.
6. The connection arrangement according to any one of the preceding claims, whereby the second part (15b) of the connecting arrangement (15) comprises an opening (21) that is directed in through the second edge (17) of the construction element (1, 1A) in towards the construction element (1, 1A) in a direction that coincides with the central plane (C), in which opening the locking washer (24) is arranged.
7. The connection arrangement according to claim 6, whereby the locking washer (24) is arranged at the location at which the opening (21) opens out.
8. The connection arrangement according to claim 6, whereby the hole of the locking washer (24) is arranged at a certain distance in from the edge (17) of the construction element.
9. The connection arrangement according to claim 3, whereby the hole of the locking washer (24) comprises a sharp edge intended to interact with the surface of the peg.
10. The connection arrangement according claim 2, whereby the locking washer (24) is arranged at a flange (22) that is arranged at the first part (15a) that is a component of the connecting arrangement (15) with a cover (25) provided with a hole that retains the washer (24) against the flange (22).
11. The connection arrangement according to claim 6, whereby the cover that is provided with a hole comprises a bracket (18b) that has the form of a "U" and that is attached at the edge (17) of the construction element (1, 1A) with its two free legs (19) one on each side of the construction element (1, 1A).
12. The connection arrangement according to any one of claims 1-10, whereby the bracket (18a, 18b) has been given the form of an "L".

13. The connection arrangement according to claim 11, whereby the bracket (18b) is attached to the edge (17) of the construction element (1, 1A) in a manner that allows it to be removed.

14. The connection arrangement according to claim 1, whereby the structural battens (2) comprise I-beams, one side of which is partially covered by the surface layer in the form of a plate (9), one edge (14) of which protrudes past the end parts (8a) of the structural battens (2) of the wall element and comprises the first part (15a) of the connecting arrangement (15), and in that the second edge (17) of the plate (9) protrudes past the second end sections (8b) of the structural battens (2) opposite to the first edge (14) of the plate (9) and comprises the second part (15b) of the connecting arrangement (15).

15. The connection arrangement according to claim 3, whereby the free end (20) of the peg (16) demonstrates a bevelled edge.

16. The connection arrangement according to any one of the preceding claims, whereby the surface of the peg demonstrates a structure.

17. The connection arrangement according to claim 1, whereby at least one of the first part (15a) and the second part (15b) of the connecting arrangement (15) is arranged on the side of the construction element parallel to the central plane.

18. The connection arrangement according to any one of the preceding claims, whereby at least one of the first part (15a) and the second part (15b) of the connecting arrangement is manufactured from stainless steel.

19. The connection arrangement according to any one of the preceding claims, whereby at least one of the first part (15a) and the second part (15b) of the connecting arrangement (15) is manufactured from composite material.

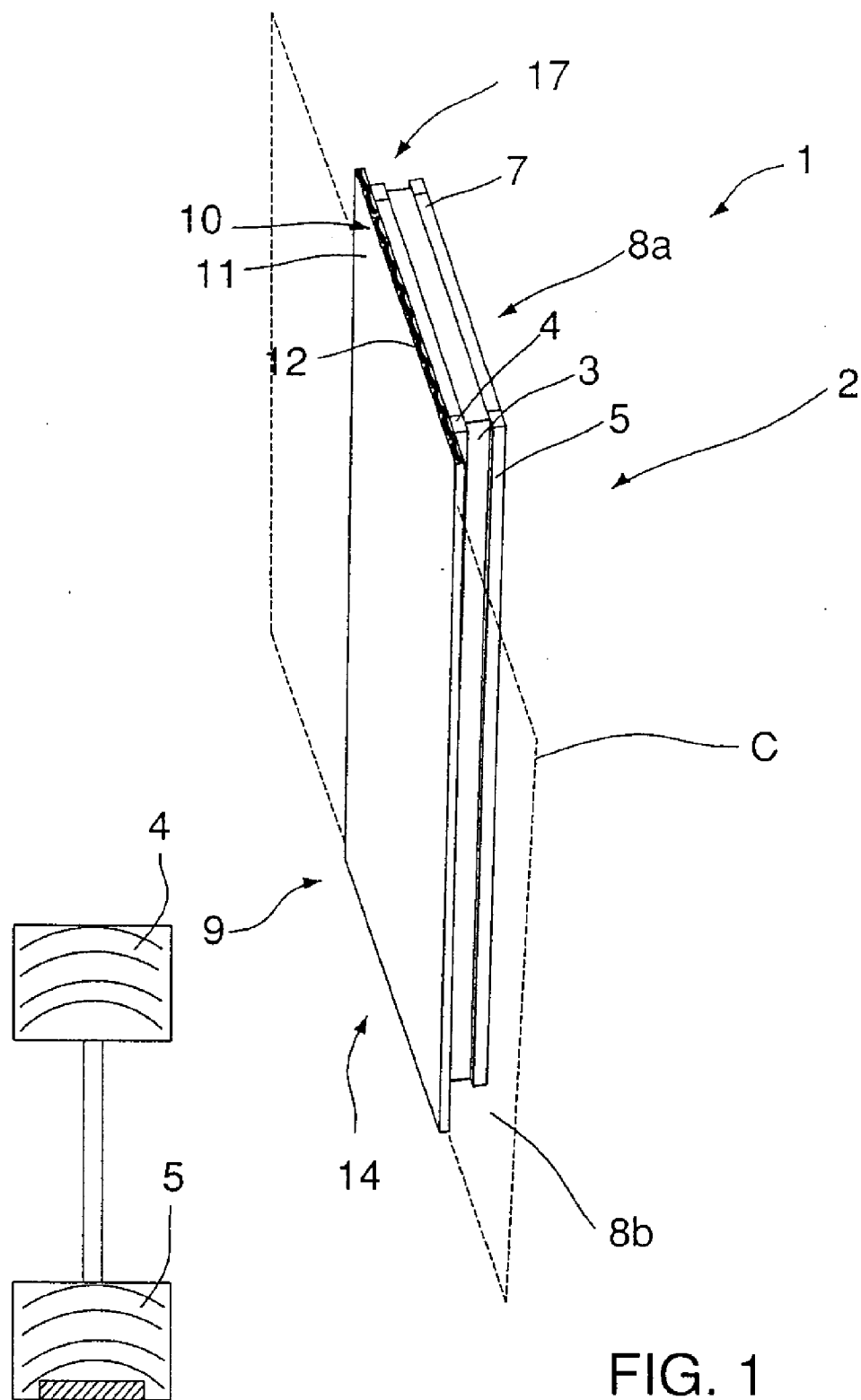
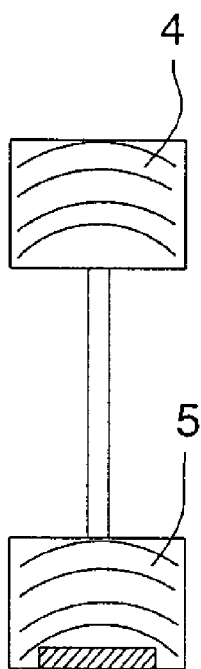


FIG.2



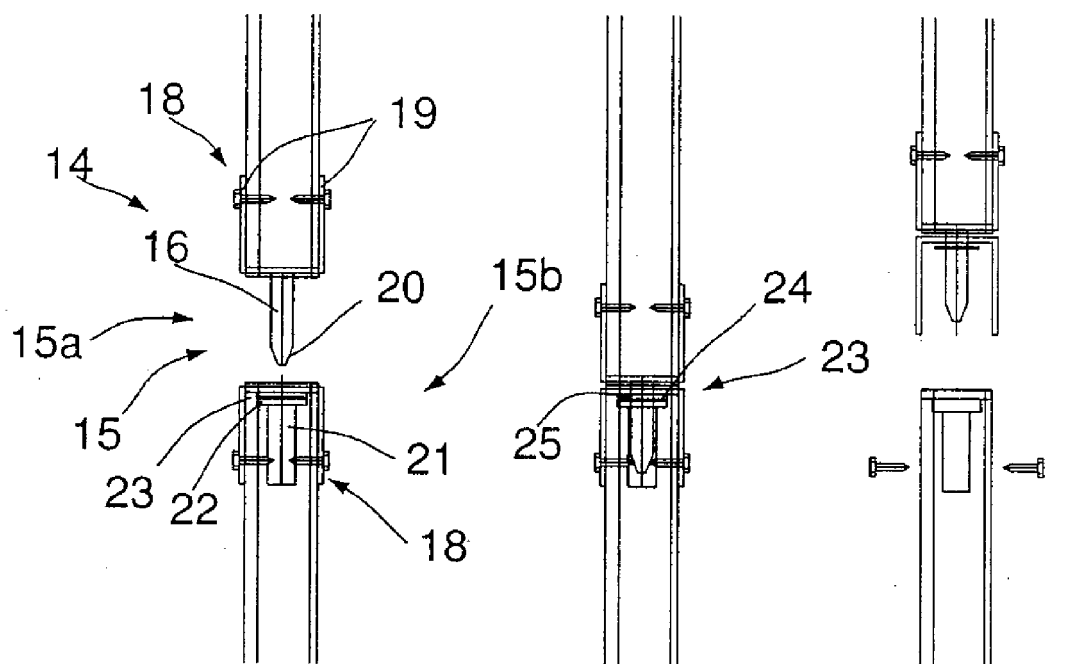


FIG.3a

FIG.3c

FIG.3d

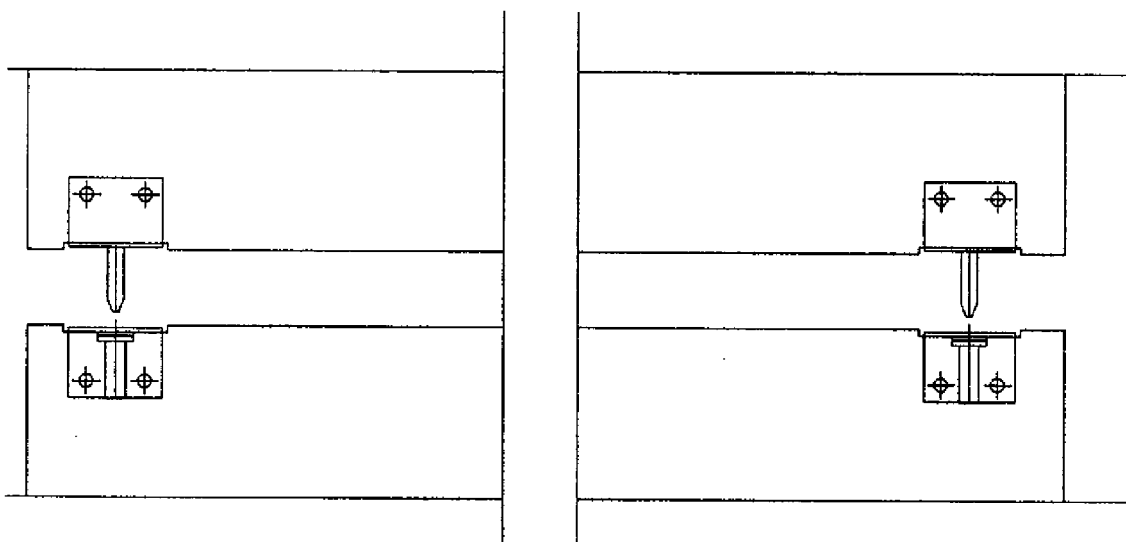


FIG.3b

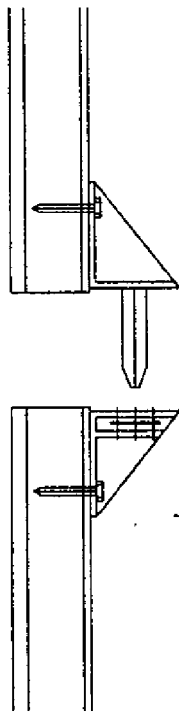


FIG. 4a

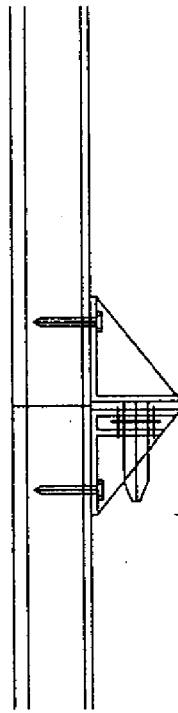


FIG. 4c

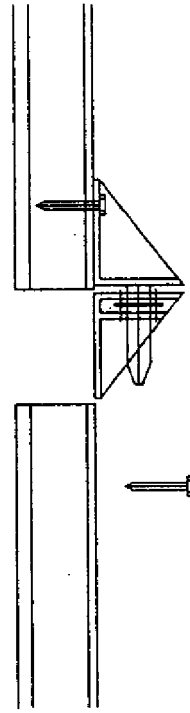


FIG. 4d

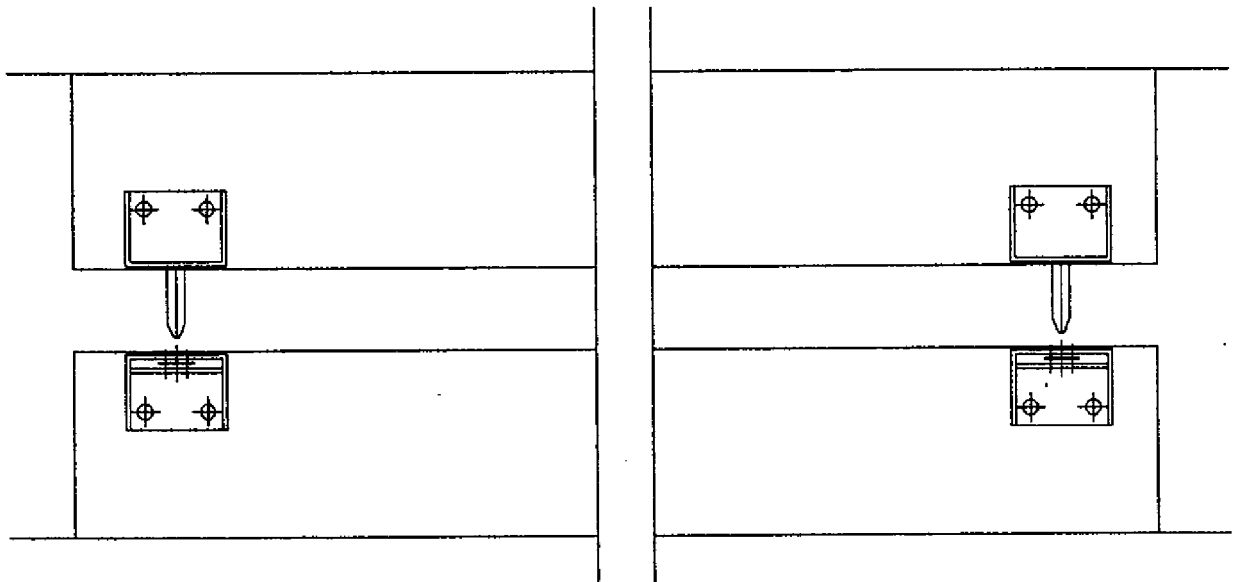


FIG. 4b

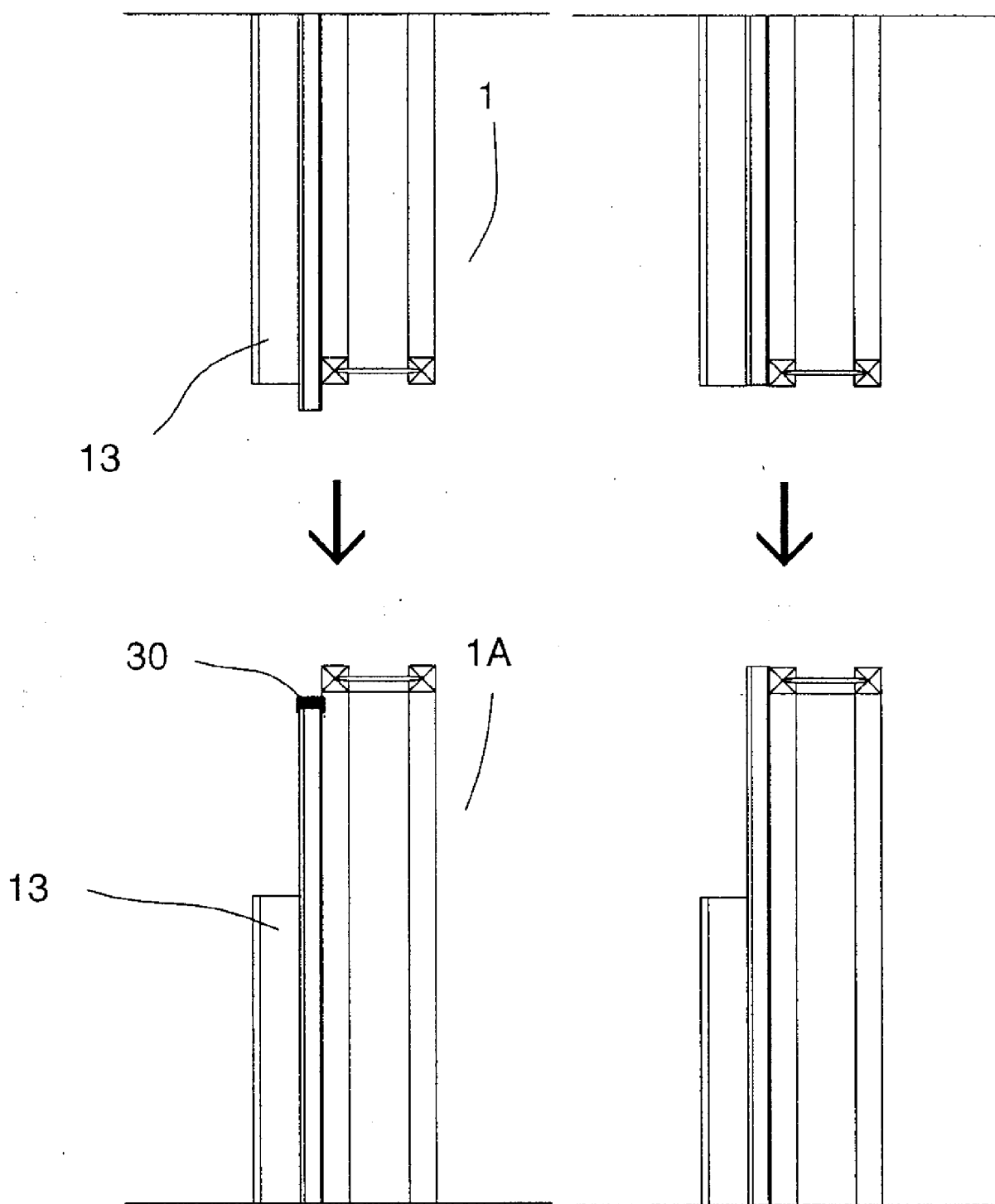


FIG. 5

FIG. 5A

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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