



(51) International Patent Classification:

E04B 1/26 (2006.01) *E04C 3/17* (2006.01)
E04B 7/06 (2006.01)

(21) International Application Number:

PCT/US2016/033931

(22) International Filing Date:

24 May 2016 (24.05.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2015901960 27 May 2015 (27.05.2015) AU

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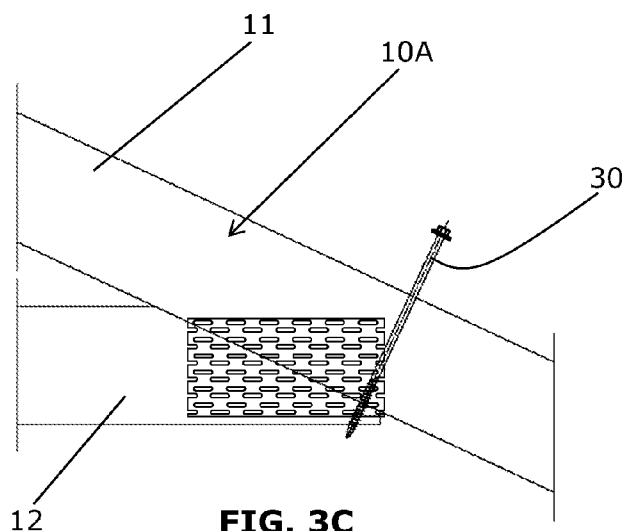
(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: CONNECTION OF STRUCTURAL COMPONENTS IN A BUILDING STRUCTURE



(57) Abstract: There is disclosed a method of assembling a building structure in which a first structural component is connected to a second structural component, the method comprising positioning the first component relative to the second component whereby an exposed tip of at least one fastener applied to one of the components is received into a surface of the other component or into a recess in said surface such that it precludes translational displacement of the first component in a plane parallel to the surface, and thereafter driving the or each fastener into the said other component to fix the components together.

CONNECTION OF STRUCTURAL COMPONENTS IN A BUILDING STRUCTURE

PRIORITY CLAIM

[0001] This international application claims priority to and the benefit of Australian Provisional Patent Application No. 2015901960, which was filed on May 27, 2015, the entire contents of which are incorporated herein by reference.

FIELD

[0002] The present invention relates to connection of a structural component to at least one other structural component in the assembly of a building structure. The invention has particular, though not exclusive, application to fixing of a roof member to another member in the assembly of the structure. The invention is particularly, though not exclusively, suited to construction of timber frame buildings.

BACKGROUND

[0003] Assembly of a structural framework of a building, particularly a timber framework, typically involves brackets installed so as to interconnect components in the framework. In one exemplary known arrangement, shown in Figure 1, a timber roof truss R is secured to a timber top plate T of a wall frame via a bracket B secured against the truss R and top plate T via fasteners F (typically comprising nails or screws) received through the bracket B. Alternatively, conventional brackets used to interconnect members of the framework may be configured with teeth which are driven into the members to secure the bracket to the members.

[0004] During assembly of the framework, it is often necessary to form some kind of temporary fixing between two members which are ultimately to be permanently interconnected, particularly where one member, e.g. a roof truss member, is lifted onto the other member by crane and is one of several members to be likewise lifted and secured to the other member (which may comprise a wall frame top plate) so as to minimise crane time (which is typically expensive). Consequently, each connection point

needs to be visited twice – first to establish the temporary fixing (typically established by toe nailing or skew nailing) and again to establish the permanent fixing. There is also a risk of a given permanent fixing not being effected due to oversight.

[0005] Installer skill is critical for correct bracket location and fixing.

SUMMARY

[0006] According to a first aspect of the present invention, there is provided a method of assembling a building structure in which a first structural component is connected to a second structural component, the method comprising positioning the first component relative to the second component whereby an exposed tip of at least one fastener applied to one of the components is received into a surface of the other component or into a recess in said surface such that it precludes translational displacement of the first component in a plane parallel to the surface, and thereafter driving the or each fastener into the said other component to fix the components together.

[0007] Preferably, the or each fastener is applied to the first component whereby said surface is a surface of the second component.

[0008] Preferably, the second component is *in situ* during the positioning of the first component and driving of the or each fastener.

[0009] Preferably, the connection of the first component to second component is such that the first component is supported by the second component in the building structure.

[0010] In a preferred embodiment of the invention, the positioning of the first component comprises lowering the first component and the or each tip is arranged so as to project from the first component in a direction having a downward component or to project from the second component in a direction having an upward component, so as to be received into the surface or recess as a result of the lowering.

[0011] In a preferred embodiment of the invention, the positioning of the first component comprises moving it sideways and the or each tip is arranged so as to project in a direction having a sideways component, so as to be received into said surface or recess as a result of the sideways movement of the first component.

[0012] In a preferred embodiment of the invention, the positioning of the first component comprises tilting or rotation of the first component whereby the receipt of the

or each tip into said surface or recess is effected. Preferably, the tilting or rotation of the first component is about a generally horizontal axis. Preferably the first component rests against the second component during the tilting or rotation thereof.

[0013] Preferably, the or each fastener is applied to said one component in a manner such that it passes through said one component.

[0014] Preferably, the or each fastener is threaded and the driving thereof into said other component comprises screwing it into said other component.

[0015] Preferably, the or each fastener taps the other component during screwing thereof into said other component. Preferably, the or each fastener is a self-tapping screw.

[0016] Preferably, the driving of the or each fastener comprises, before the screwing thereof, knocking or hammering it such that the tip thereof is at least partially embedded in said other component.

[0017] In one embodiment of the invention, the or each fastener comprises a nail and the driving thereof into said other component comprises knocking it into said other component.

[0018] Preferably, said other member comprises a timber member defining said surface. Alternatively, said other member may comprise a metal member.

[0019] Preferably, said one component comprises a timber member from which the tip of the or each fastener projects.

[0020] Preferably, the or each fastener is applied to said one component such that the tip thereof protrudes from a surface of said one component which is to abut said surface of said other component in the building structure.

[0021] In a preferred embodiment of the invention, the first component is truss. Preferably, in that embodiment, the or each fastener is applied to the truss such that the tip thereof protrudes from a member of the truss. Preferably, in that embodiment, the or each fastener is applied to the second component and said surface is defined by a member of the truss. Preferably, in that embodiment, said member of the truss is a chord of the truss. The truss may be a standard truss, valley truss, saddle truss, hip truss, jack truss, creeper truss or truncated girder truss.

[0022] The first component may comprise a hip or jack extension member.

[0023] The first component may comprise a hip, jack or creeper, or a top chord of a hip, jack or creeper truss.

[0024] The first component may comprise a rafter or creeper.

[0025] The first component may comprise a roof member.

[0026] Preferably, the second component comprises a wall structure. The wall structure may define part of an internal or external wall in the building structure. Preferably, the wall structure comprises a frame having a member defining said surface. Preferably, the wall structure comprises a frame to which the or each fastener is applied such that an end thereof on which the tip is formed protrudes from a member of the frame, and said surface is defined by the first component. Preferably, said member of the frame is a top plate.

[0027] In an embodiment of the invention, the second component comprises a truss. Preferably, in that embodiment, the or each fastener is applied to the truss which the second component comprises, such that the tip thereof protrudes from a member of that truss. Preferably, in that embodiment, the or each fastener is applied to the second component and said surface is defined by a member of the truss which the second component comprises. Preferably, in that embodiment, said member of the truss which the second component comprises is a chord of that truss. The truss which the second component comprises may be, for example, a standard truss, valley truss, saddle truss, hip truss, jack truss, creeper truss or truncated girder truss.

[0028] In a preferred embodiment of the invention, after the tip of the or each fastener is received in said surface or recess, the first member is moved such that that tip contacts said other member at a location where the fastener is to be driven into said other member to fix the members together, and thence so driven.

[0029] In a preferred embodiment of the invention, the or each fastener comprises a shaft, which is driven into said other component when the components are fixed together, and a narrow leading end portion, on which said tip is defined, which is narrower than said shaft and which is received into the surface or recess when said tip is received into the surface or recess, the narrow leading end portion having an exterior face extending around it which is generally parallel to a longitudinal axis of the fastener, whereby, when said portion has been received into the surface or recess, loading on the fastener which is perpendicular to said axis forces said exterior face against material in said other component such that there is little or no force component parallel to the axis exerted on the fastener or other component resulting from the loading.

[0030] Preferably, said tip is pointy, or convergent in a direction from a trailing end of the fastener to a leading end of the fastener, whereby receipt thereof into the surface or recess is facilitated.

[0031] In a preferred embodiment of the invention, the or each tip is received into said surface to preclude said translational displacement. The or each tip may penetrate said other member so as to be received into said surface to preclude said translational displacement.

[0032] In an alternative preferred embodiment of the invention, the or each tip is received into a said recess in said surface to preclude said translational displacement. The recess may be defined by a hole in said other member. The recess may be at a said location.

[0033] Preferably, the method includes positioning the first component whereby, at a location remote from said fastener(s), an exposed tip of at least one further fastener applied to one of the first component and another structural component which is to form part of the building structure is received into a surface of the other of those two components or into a recess in that surface, such that it precludes translational displacement of the first component in a plane parallel to that surface, and thereafter driving the or each fastener into said other of said two components to fix said two components together. In a preferred embodiment of the invention, said other structural component is said second component.

[0034] According to a second aspect of the present invention, there is provided the building structure formed via said method.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] The invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

[0036] Figure 1 shows a typical type of permanent connection between a roof truss and wall frame in a timber-frame building, as previously discussed;

[0037] Figures 2A to 2C show successive stages in fixation of a roof truss to a wall frame top plate in accordance with a preferred embodiment of the present invention;

[0038] Figures 3A to 3C show successive stages in the fabrication of the truss and pre-application of a fastener to effect the connection shown in Figure 2C;

[0039] Figure 4 shows an additional fastener to strengthen the connection between the truss and top plate;

[0040] Figures 5A to 5D depict initial stages of fixation of alternative forms of truss to the frame of an external wall in accordance with preferred embodiments of the present invention;

[0041] Figures 6A to 6E depict initial stages of fixation of alternative forms of truss to the frame of an internal wall in accordance with preferred embodiments of the present invention;

[0042] Figures 7A to 7D show initial stages of fixation of alternative pairs of members in accordance with preferred embodiments of the present invention; and

[0043] Figure 8 shows a configuration of the fastener used in the preferred embodiments of the invention.

DETAILED DESCRIPTION

[0044] Each of the preferred embodiments of the invention involves the use of a fastener, firstly to maintain relative positions of a roof member and a member which is to support the roof member in a building structure, and thereafter to fix one member to the other permanently. In the embodiments described and illustrated, the members comprise timber members though the invention has application to members formed of other material, such as, for example, metal.

[0045] Shown in Figures 2A to 2C are successive stages of formation of a connection between a first building component, in the form of a roof truss 10, and a second component, in the form of a wall frame 20, in accordance with a first preferred embodiment of the invention. The truss 10 includes a top chord 11, a bottom chord 12 having a chamfered end 13 the inclined face of which abuts the underside of the top chord 11, and a nail plate 14 driven into side faces of the top chord 11 and bottom chord 12 so as to form a connection therebetween. The wall frame 20 includes a timber top plate 21 on which the truss 10 is to be supported and to which that truss is to be fixed by a fastener 30 which is pre-applied to the truss 10.

[0046] Successive stages in fabrication of the truss 10 and pre-application of the fastener 30 to it are shown in Figures 3A to 3C. Referring to Figure 3A, the top chord 11 is cut from a length of timber and, prior to connection of the top chord 11 to the bottom chord 12, a hole 15 is drilled through the top chord 11, such that it is

perpendicular to parallel upper and lower faces of the top chord 11 and opens through those faces. The connection between the top chord 11 and bottom chord 12, comprising the nail plate 14, is thereafter formed, in a manner such that the lower end of the hole 15 is located within a resulting heel joint in the truss 10 and is occluded by the tapered end of the bottom chord 12. The screw 30 is thereafter inserted through the hole 15 and screwed into the end of the bottom chord 12 such that the tip thereof projects from the underside of that chord, as shown in Figure 3C. A screw 30 is likewise pre-applied to the truss 10 at a heel joint formed at the opposite end of the bottom chord 12, the configuration defined by the screw and truss at that end being the mirror image of that illustrated in Figure 3C (whereby the screws 30 are downwardly convergent in the plane of the truss 10).

[0047] Referring to Figure 2A, assembly of the building structure comprises lifting of the truss 10 over the wall frame 20 and lowering it such that the tip of the fastener 30 is received against the upper face of the top plate 21 and thus, under the weight of the truss 10, partially embeds in the top plate 21 in proximity to the location at which the fastener 30 is to be driven into the top plate 21. The tip of the aforementioned fastener 30 at the opposite end of the bottom chord 12 is likewise received against an upper face of the top plate 21 of a wall frame 20 which underlies the heel at the opposite end of the bottom chord 12, in proximity to the location at which it is to be driven into that top plate. Owing to the partial embedment of the fastener tips in the top plates 21, the fasteners 30 preclude translational displacement of the truss 10 in a plane parallel to the upper faces of those top plates. The position of each end of the truss 10 relative to the top plate underlying it is thus, advantageously, maintained without any fixing between the truss 10 and each wall frame 20 having yet been established. An installer at each end of the truss then ensures that the fastener tip at that end is located precisely at the point on the respective top plate at which it is to be driven into that top plate (if necessary, lifting the truss end and moving it to land the fastener tip at that location), then causes the fastener 30 to be forced downwardly either by allowing the respective truss end to drop, under the weight of the truss 10 or knocking the head of the respective fastener, e.g. with a hammer, such that the tip is driven into the top plate 21 at that location, whereby a temporary fixing between the respective truss end and the top plate on which it is supported is established with one truss end being correctly positioned on the top plate 21 supporting it, as shown in Figure 2B, and the opposite end likewise being

correctly positioned on the top plate supporting it as would be shown by a mirror image of Figure 2B. Each screw 30 is then screwed into the respective top plate 21 whereby a permanent connection between the truss 10 and top plate 21 is effected, one of those connections being shown in Figure 2C and the other being consistent with a mirror image of that drawing. Advantageously, the installer at the respective truss end needs to visit the position at which the truss 10 is fixed to the respective top plate only once and, because the fastener 30 which he or she drives into the respective top plate 21 is held by the truss 10 (as shown in Figure 2A), he or she can locate both the respective truss end and fastener 30 at the appropriate position on the respective top plate 21 using only one hand, whereby safety and ease/speed of installation are increased.

[0048] Without departure from the invention, the truss 10 can be lowered onto the top plates 21 such that it rests on one of its sides on the top plates 21 (i.e. the plane of the truss is generally horizontal), and thereafter tilted up to bring the fastener tips into engagement with the top plates 21 as shown in Figure 2A.

[0049] Referring to Figure 4, a further screw 30' may be employed at each truss-top plate connection, e.g. where the roof will be prone to relatively high uplift loads. The further fastener 30' can, like the fastener 30, be pre-applied (in which case the tip thereof will be exposed and level with the tip of the fastener 30, as shown in Figure 2A, such that it likewise catches on the top plate 21 to provide horizontal restraint to the truss 10, or can be driven through the truss 10, and into the top plate 21, after the fastener 30 has been driven into the top plate 21.

[0050] The invention has application to location and securement of various forms of truss, and indeed other structural components, to a support structure, which structure may comprise a wall frame as previously described or an alternative component, such as a truss. Figures 5A to 5D show alternative exemplary trusses 10A to 10D, respectively, locatable and securable to a top plate 21 of an external wall frame via pre-applied fasteners 30 in accordance with preferred embodiments of the invention. The fastener 30 may be skewed relative to the top plate as shown in Figure 5B or perpendicular to it, as shown in Figures 5A, 5C and 5D.

[0051] Figures 6A to 6E show exemplary alternative trusses 10E to 10I, respectively, which can be located and fastened to top plates 21 of internal walls in accordance with preferred embodiments of the invention. Again, the fasteners 30 can be skewed, as shown in Figures 6A to 6D, or upright, as shown in Figure 6E. In addition,

as also shown in Figure 6E, plural fasteners 30 may be employed whereby flush tips thereof dig into the top plate 21 when received thereagainst.

[0052] Referring to Figure 7A, in an alternative embodiment of the invention, a truss 10' is located and fastened to a sloping top chord 40 of a standard truss. Referring to Figure 7B, in another embodiment of the invention, a member 50, being a hip, jack or creeper or the top chord of a hip, jack or creeper truss, is located and secured to a top chord 60 of a truncated girder truss. Referring to Figure 7C, in a further embodiment of the invention, a hip or jack extension 70 is located and secured to the top chord 80 of a truncated standard truss.

[0053] In any of the arrangements shown in Figures 5A to 5D, 6A to 6E and 7A to 7C, the member to which the fastener/s 30 is/are pre-applied can, be lowered or tilted up, as previously described, to cause the fastener tip(s) to dig into the structural component(s) to which the member is to be secured.

[0054] Finally, referring to Figure 7D, in yet another embodiment of the invention, a rafter or creeper 90 is translationally displaced horizontally such that the tip of the fastener 30 applied to it, which tip projects generally sideways through an end face of the creeper, is received against a side face of a hip truss 100 and, under a maintained horizontal load applied axially through the rafter or creeper 90, partially embeds in the hip truss 100, thereby precluding translational displacement of the rafter or creeper 90 in a plane parallel to the truss side face, before being driven into the truss 100 such that the permanent fixing is formed. Alternatively, with the end of the rafter or creeper 90 to which the fastener 30 is resting against the side face of the truss 100, the rafter or creeper 90 can be rotated, about an upright axis through that end, such that the engagement between the fastener tip and truss side face is effected.

[0055] Referring to Figure 8, the fastener 30 in each embodiment comprises a threaded shaft 31, which is driven into the member 21/40/60/80/100 and a narrow leading end portion 32, on which a pointed tip 33 of the fastener is formed, the narrow leading end portion 32 having a side face 34 parallel to a longitudinal axis of the screw 30. The leading end portion 32 can be smooth or configured such that a thread is provided on the side face 34. The fastener 30 includes a tapered transition portion 35 between the shaft 31 and leading end portion 32. The narrowness of the leading end portion 32 gives rise to a high pressure engagement between the tip/leading end and the member 21/40/60/80/100, facilitating penetration of that member by the tip/leading

end and thus assuring reliable anchorage to the member in a plane parallel to the face of the member against/into which the tip/leading end is received. Loading on the fastener 30 which is perpendicular to the axis forces the face 34 against material in the member 21/40/60/80/100 and, owing to the face 34 being parallel to that axis, there is, advantageously, no force component parallel to the axis exerted on the fastener or member 21/40/60/80/100 resulting from the loading, which component could tend to separate the tip 33 from the member 21/40/60/80/100 whereby the anchorage in the plane would be lost.

[0056] It will thus be appreciated that tips of fasteners 30 can, without departure from the invention, protrude from faces of the members to which they are applied that are other than bottom/underside faces (e.g. side faces or end faces).

[0057] Also, in alternatives to the embodiments described above and illustrated, without departure from the invention, the/each fastener 30 is, instead of being applied to the member being installed/positioned so as to catch on and be driven into the member already *in situ*, applied to the member already *in situ* so as to catch on and be driven into the member being installed/positioned.

[0058] In alternative embodiments, including in particular such embodiments in which the member into which the fastener is to be driven comprises a metal member, the fastener tip, before the fastener is driven home, can, instead of penetrating the member (so as to be received into the surface thereof) be received into a recess formed in that surface, whereby the tip/leading end of the fastener will abut a side wall of the recess to preclude the translational displacement parallel to the surface. The recess may, for example, be defined by a hole (either a blind hole or through-hole) in the member, into which hole the fastener is then driven to effect the permanent fixing.

[0059] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.

[0060] Throughout this specification and the claims which follow, unless the context requires otherwise, the word “comprise”, and variations such as “comprises” and “comprising”, will be understood to imply the inclusion of a stated integer or step or

group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0061] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

CLAIMS

1. A method of assembling a building structure in which a first structural component is connected to a second structural component, the method comprising positioning the first component relative to the second component whereby an exposed tip of at least one fastener applied to one of the components is received into a surface of the other component or into a recess in said surface such that it precludes translational displacement of the first component in a plane parallel to the surface, and thereafter driving the or each fastener into the said other component to fix the components together.
2. A method according to claim 1, wherein the or each fastener is applied to the first component whereby said surface is a surface of the second component.
3. A method according to claim 2, wherein the second component is *in situ* during the positioning of the first component and driving of the or each fastener.
4. A method according to any one of the preceding claims, wherein the connection of the first component to second component is such that the first component is supported by the second component in the building structure.
5. A method according to any one of the preceding claims, wherein the positioning of the first component comprises lowering the first component and the or each tip is arranged so as to project from the first component in a direction having a downward component or to project from the second component in a direction having an upward component, so as to be received into the surface or recess as a result of the lowering.
6. A method according to any one of claims 1 to 5, wherein the positioning of the first component comprises moving it sideways and the or each tip is arranged so as to project in a direction having a sideways component, so as to be received into said surface or recess as a result of the sideways movement of the first component.
7. A method according to any one of the preceding claims, wherein the positioning of the first component comprises tilting or rotation of the first component whereby the receipt of the or each tip into said surface or recess is effected.
8. A method according to claim 7, wherein the tilting or rotation of the first component is about a generally horizontal axis.
9. A method according to claim 7 or 8, wherein the first component rests against the second component during the tilting or rotation thereof.
10. A method according to any one of the preceding claims, wherein the or each

fastener is applied to said one component in a manner such that it passes through said one component.

11. A method according to any one of the preceding claims, wherein the or each fastener is threaded and the driving thereof into said other component comprises screwing it into said other component.

12. A method according to claim 10, wherein the or each fastener taps the other component during screwing thereof into said other component.

13. A method according to claim 12, wherein the fastener is a self-tapping screw.

14. A method according to any one of claims 11 to 13, wherein the driving of the or each fastener comprises, before the screwing thereof, knocking or hammering it such that the tip thereof is at least partially embedded in said other component.

15. A method according to any one of claims 1 to 10, wherein the or each fastener comprises a nail and the driving thereof into said other component comprises knocking it into said other component.

16. A method according to any one of the preceding claims, wherein said other member comprises a timber member defining said surface.

17. A method according to any one of the preceding claims, wherein said one component comprises a timber member from which the tip of the or each fastener projects.

18. A method according to any one of the preceding claims, wherein the or each fastener is applied to said one component such that the tip thereof protrudes from a surface of said one component which is to abut said surface of said other component in the building structure.

19. A method according to any one of the preceding claims, wherein the first component is a truss.

20. A method according to claim 19, wherein the or each fastener is applied to the truss such that the tip thereof protrudes from a member of the truss.

21. A method according to claim 19, wherein the or each fastener is applied to the second component and said surface is defined by a member of the truss.

22. A method according to claim 20 or 21, wherein said member of the truss is a bottom chord of the truss.

23. A method according to claim 20 or 21, wherein said member of the truss is a top chord of the truss.

24. A method according to any one of claims 19 to 23, wherein the truss is a standard truss, valley truss, saddle truss, hip truss, jack truss, creeper truss or truncated girder truss.
25. A method according to any one of claims 1 to 18, wherein the first component comprises a hip or jack extension member.
26. A method according to any one of claims 1 to 18, wherein the first component comprises hip, jack or creeper, or a top chord of a hip, jack or creeper truss.
27. A method according to any one of claims 1 to 18, wherein the first component comprises a rafter or creeper.
28. A method according to any one of the preceding claims, wherein the first component comprises a roof member.
29. A method according to any one of the preceding claims, wherein the second component comprises a wall structure.
30. A method according to claim 29, wherein the wall structure defines part of an internal wall in the building structure.
31. A method according to claim 29 or 30, wherein the wall structure defines part of an external wall in the building structure.
32. A method according to any one of claims 29 to 31, wherein the wall structure comprises a frame having a member defining said surface.
33. A method according to any one of claims 29 to 31, wherein the wall structure comprises a frame to which the or each fastener is applied such that an end thereof on which the tip is formed protrudes from a member of the frame, and said surface is defined by the first component.
34. A method according to claim 32 or 33, wherein said member of the frame is a top plate.
35. A method according to any one of claims 1 to 28, wherein the second component comprises a truss.
36. A method according to claim 35, wherein the or each fastener is applied to the truss which the second component comprises, such that the tip thereof protrudes from a member of that truss.
37. A method according to claim 35, wherein the or each fastener is applied to the second component and said surface is defined by a member of the truss which the second component comprises.

38. A method according to claim 36 or 37, wherein said member of the truss which the second component comprises is a bottom chord of that truss.
39. A method according to claim 36 or 37, wherein said member of the truss which the second component comprises is a top chord of that truss
40. A method according to any one of claims 35 to 39, wherein the truss which the second component comprises is a standard truss, valley truss, saddle truss, hip truss, jack truss, creeper truss or truncated girder truss.
41. A method according to any one of the preceding claims, wherein, after the tip of the or each fastener is received in said surface or recess, the first member is moved such that that tip contacts said other member at a location where the fastener is to be driven into said other member to fix the members together, and thence so driven.
42. A method according to any one of the preceding claims, wherein the or each fastener comprises a shaft, which is driven into said other component when the components are fixed together, and a narrow leading end portion, on which said tip is defined, which is narrower than said shaft and which is received into the surface or recess when said tip is received into the surface or recess, the narrow leading end portion having an exterior face extending around it which is generally parallel to a longitudinal axis of the fastener, whereby, when said portion has been received into the surface or recess, loading on the fastener which is perpendicular to said axis forces said exterior face against material in said other component such that there is little or no force component parallel to the axis exerted on the fastener or other component resulting from the loading.
43. A method according to any one of the preceding claims, wherein said tip is pointy, or convergent in a direction from a trailing end of the fastener to a leading end of the fastener, whereby receipt thereof into the surface or recess is facilitated.
44. A method according to any one of the preceding claims, wherein the or each tip is received into said surface to preclude said translational displacement.
45. A method according to claim 44, wherein the or each tip penetrates said other member so as to be received into said surface to preclude said translational displacement.
46. A method according to any one of claims 1 to 43, wherein the or each tip is received into a said recess in said surface to preclude said translational displacement.
47. A method according to claim 47, wherein the recess is defined by a hole in said other member.

48. A method according to claim 46 or 47 as dependent from claim 41, wherein the or each recess is at a said location.
49. A method according to any one of the preceding claims, including positioning the first component whereby, at a location remote from said fastener(s), an exposed tip of at least one further fastener applied to one of the first component and another structural component which is to form part of the building structure is received into a surface of the other of those two components or into a recess in that surface, such that it precludes translational displacement of the first component in a plane parallel to that surface, and thereafter driving the or each fastener into said other of said two components to fix said two components together.
50. A method according to claim 49, wherein said other structural component is said second component.
51. The building structure formed via a method according to any one of the preceding claims.

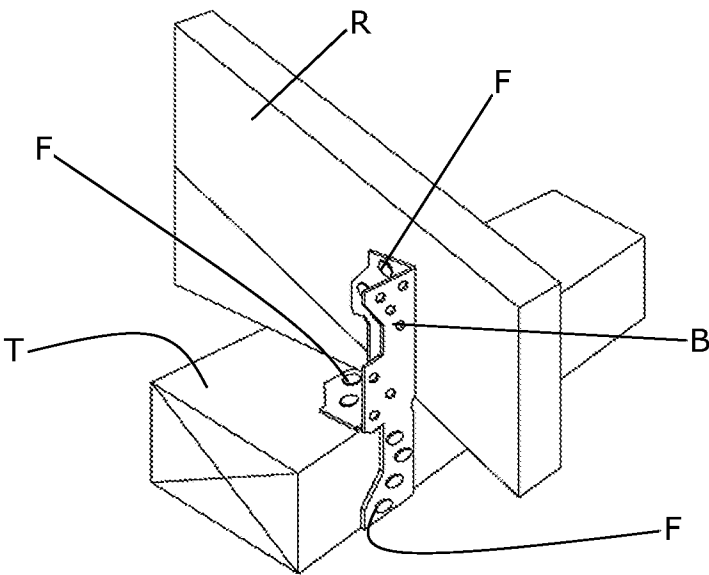


FIG. 1

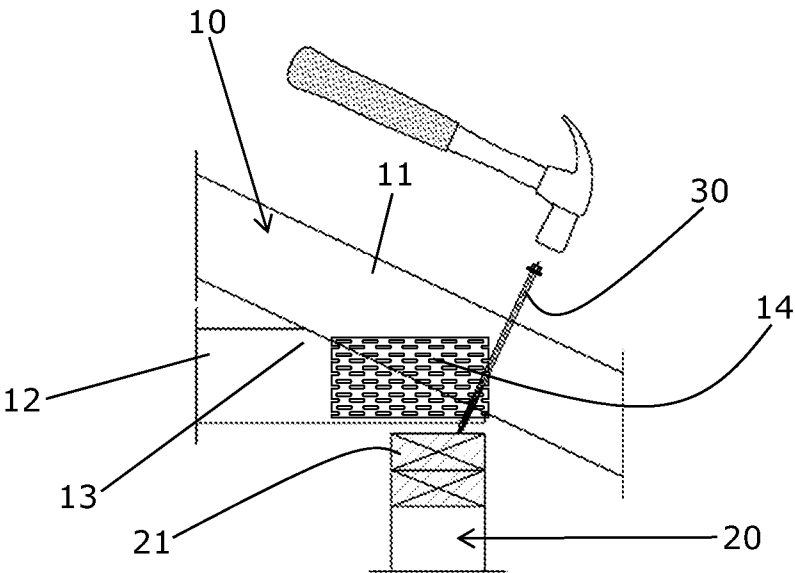


FIG. 2A

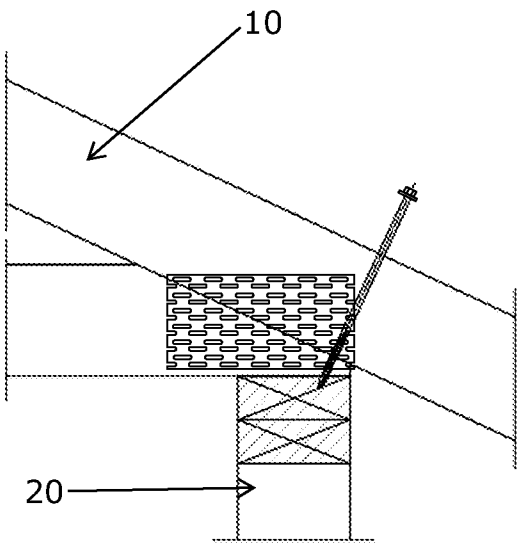


FIG. 2B

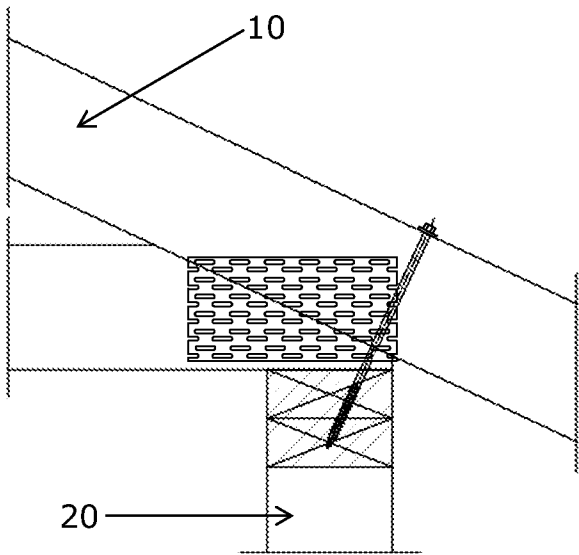


FIG. 2C

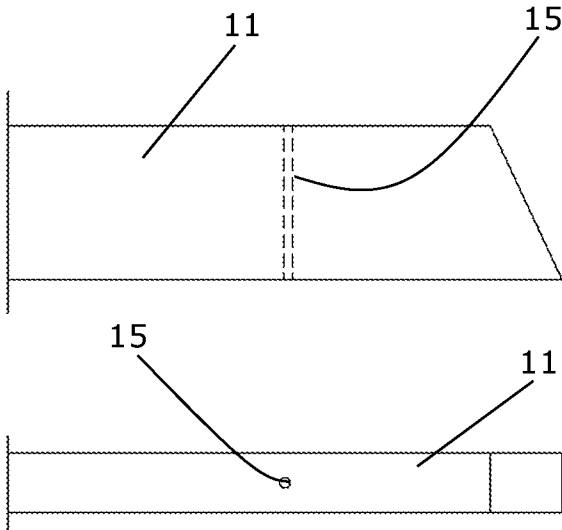


FIG. 3A

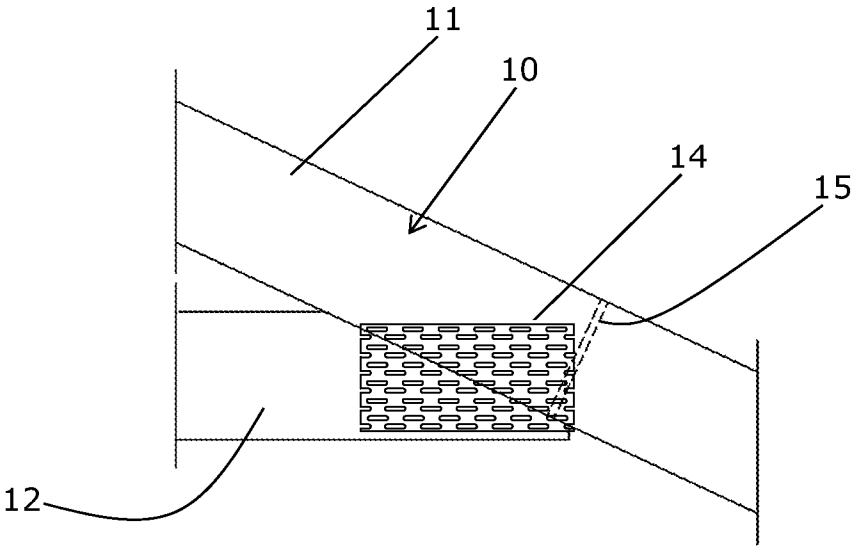
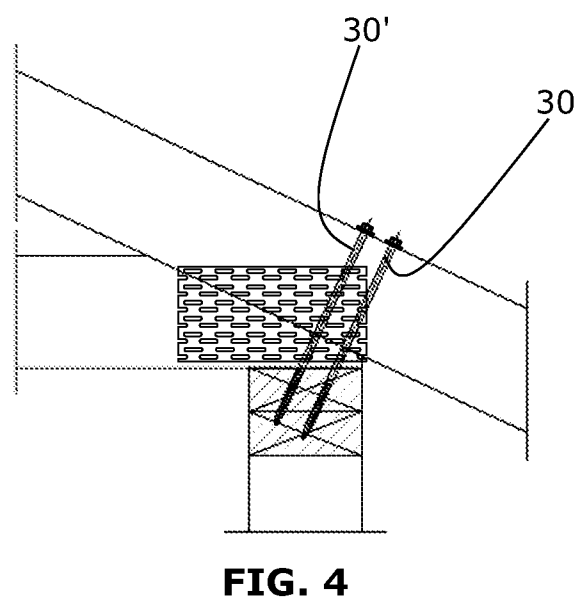
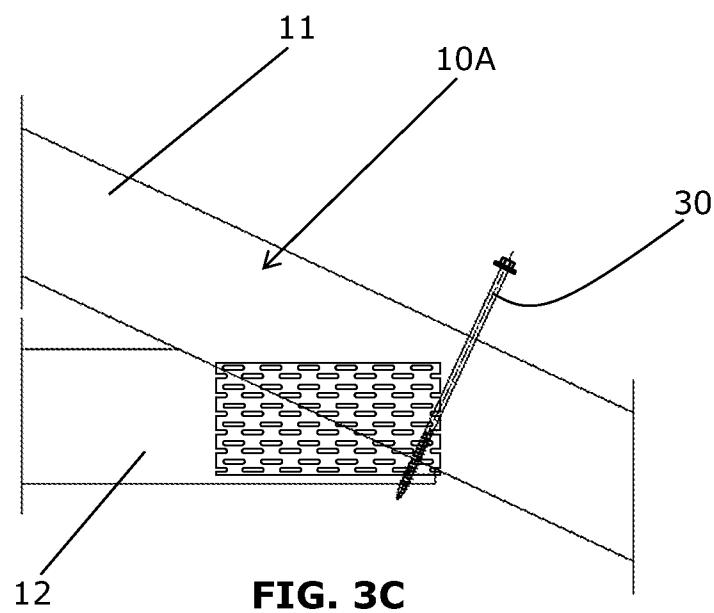


FIG. 3B



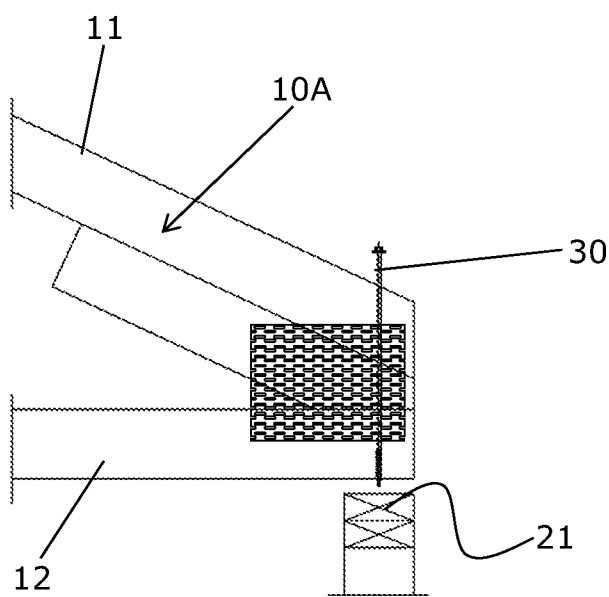


FIG. 5A

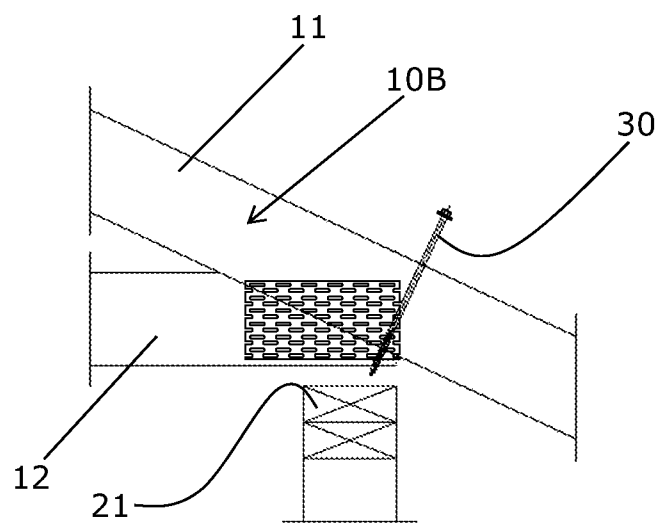


FIG. 5B

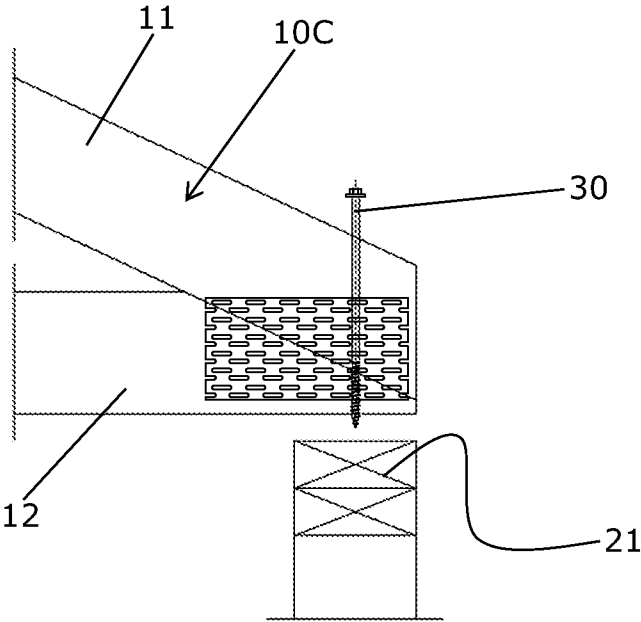


FIG. 5C

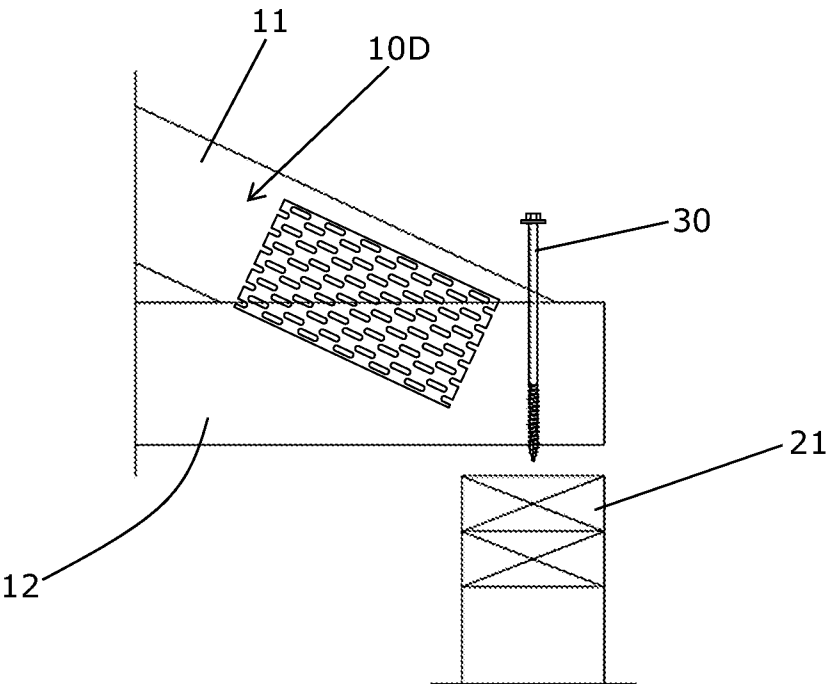


FIG. 5D

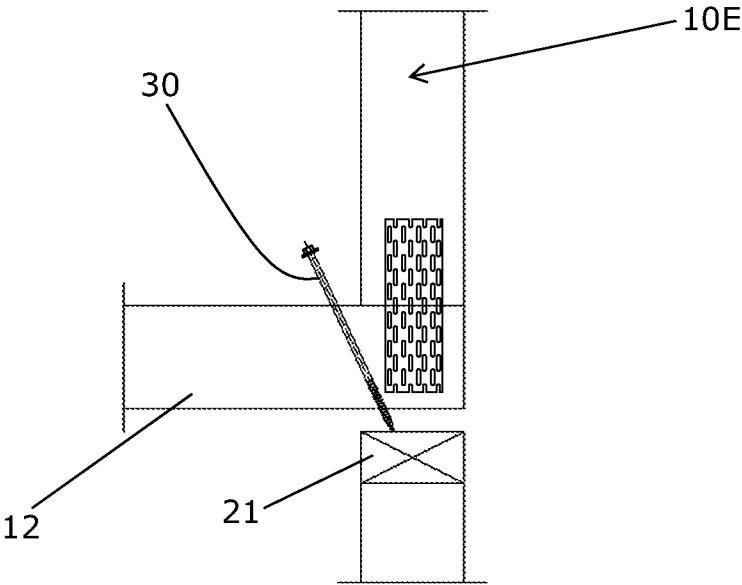


FIG. 6A

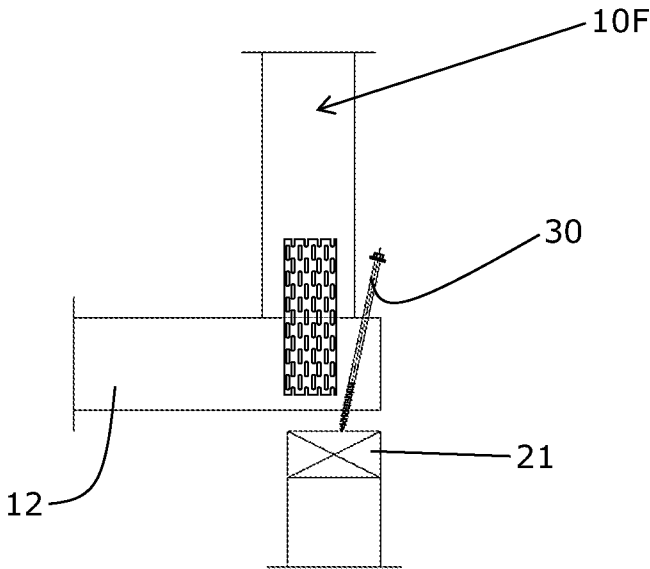
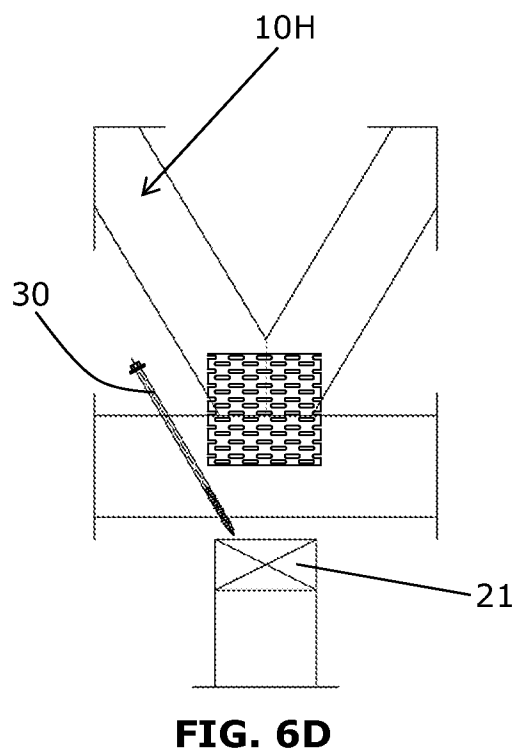
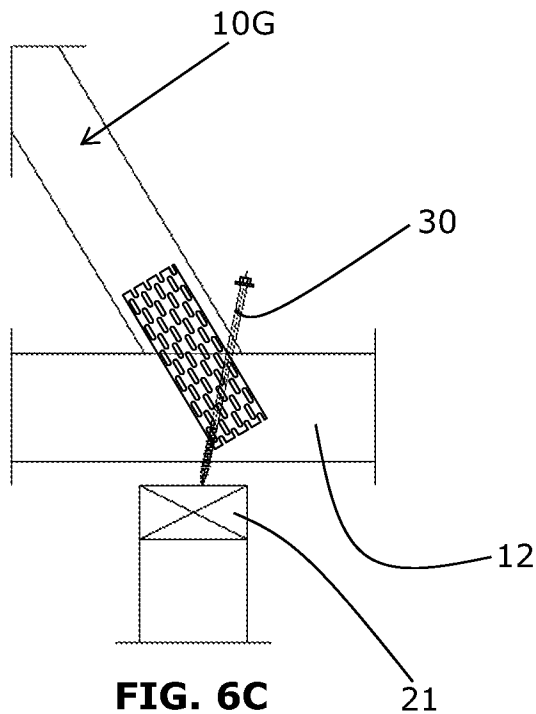


FIG. 6B



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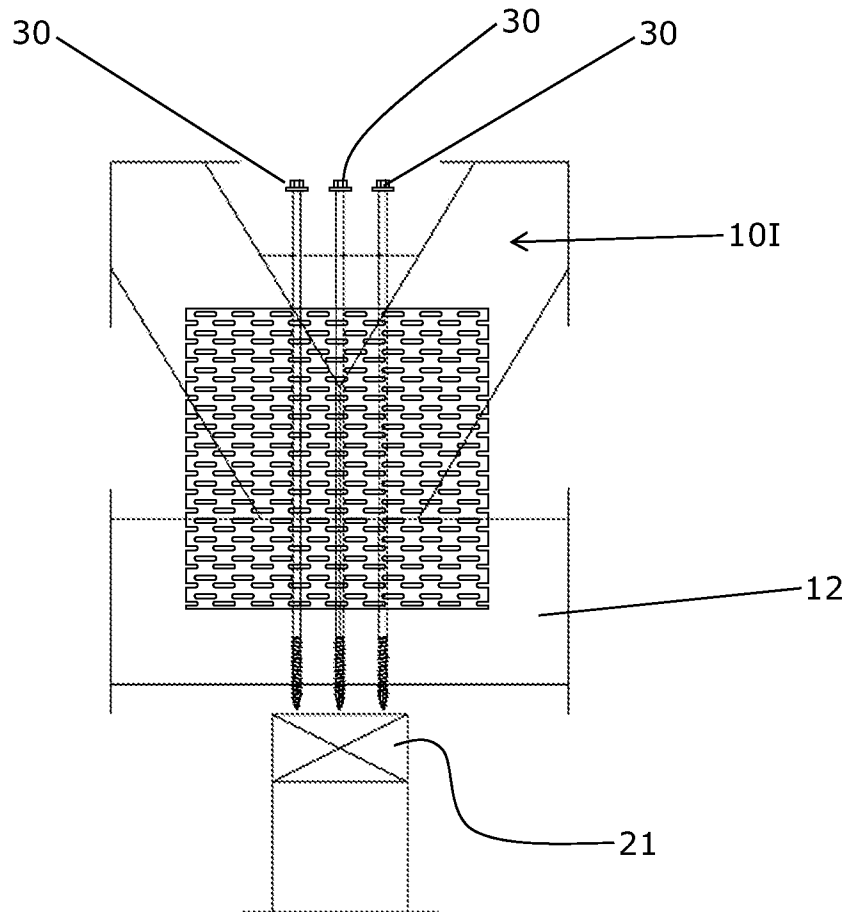


FIG. 6E

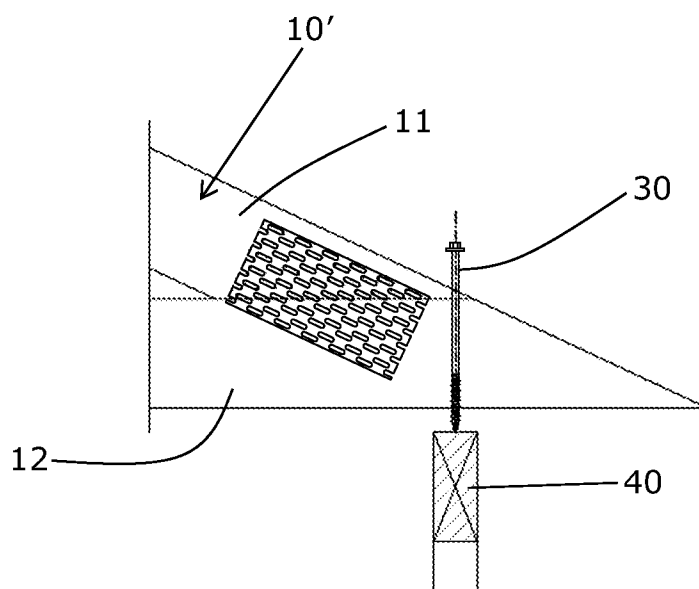


FIG. 7A

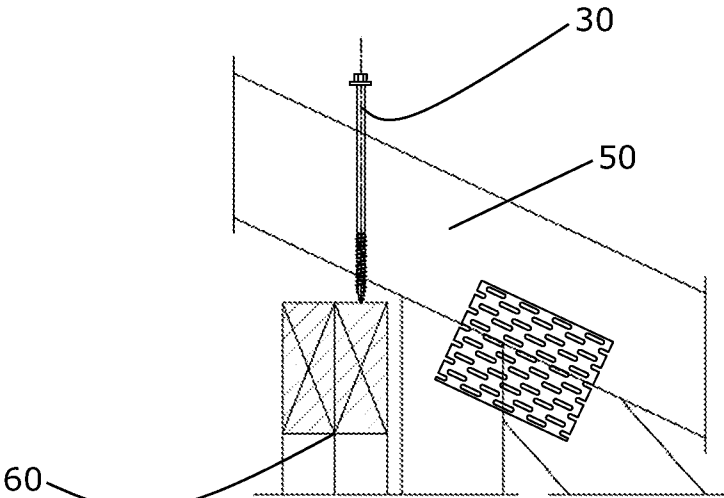


FIG. 7B

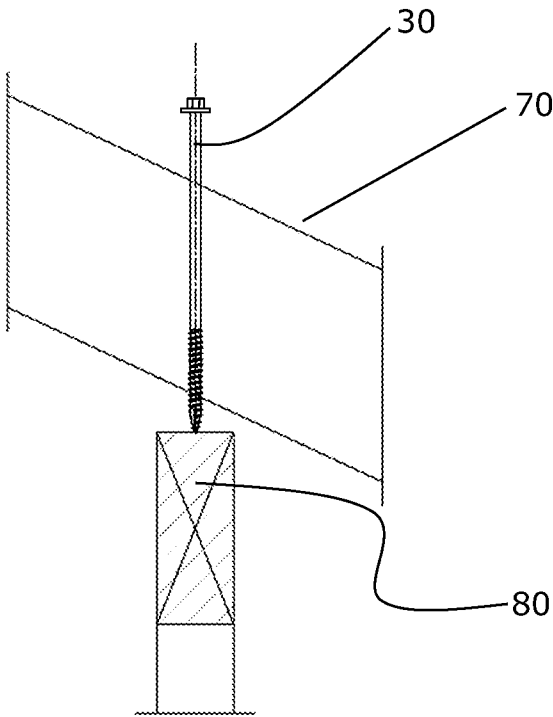


FIG. 7C

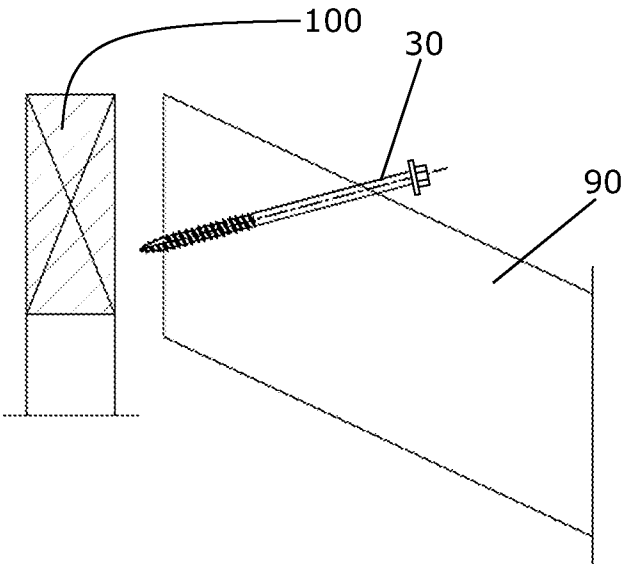


FIG. 7D

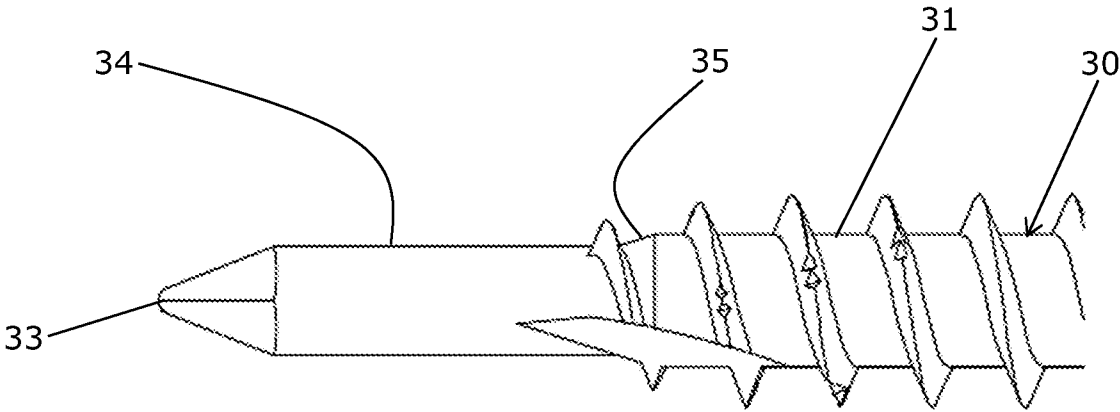


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2016/033931

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04B1/26 E04B7/06
 ADD. E04C3/17

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)

E04B E04C

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 376 362 A (JACKSON THOMAS E) 15 March 1983 (1983-03-15) figures 1, 1b -----	1-8, 10-28, 35-46, 49-51
X	US 3 328 056 A (HEIKEN RALPH A) 27 June 1967 (1967-06-27) figures 1,5 -----	1-11, 16-18, 25-32, 41,42, 44-51
X	US 2014/000192 A1 (CRAMB STEPHEN GEORGE [AU] ET AL) 2 January 2014 (2014-01-02) figures 2,21 -----	1-15,18, 25-34, 41-51



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

29 July 2016

Date of mailing of the international search report

04/08/2016

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Authorized officer

Petrinja, Etjel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/033931

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4376362	A	15-03-1983	NONE	
US 3328056	A	27-06-1967	NONE	
US 2014000192	A1	02-01-2014	NONE	