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(71) Applicant: **ILLINIOS TOOL WORKS INC.** [US/US];
155 Harlem Avenue, Glenview, IL 60025 (US).

(72) Inventor: **BRAKEMAN, David**; 69 Madeira Court, Saint
Charles, MO 63304 (US).

(74) Agents: **CUKIERSKI, Kevin J.** et al.; Eal, Gerber & Eis-
enberg LLP, 2 N. LaSalle Street, Chicago, IL 60602-3801
(US).

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(54) Title: TIE-DOWN AND SHEAR CONNECTION BETWEEN MEMBERS IN A BUILDING STRUCTURE

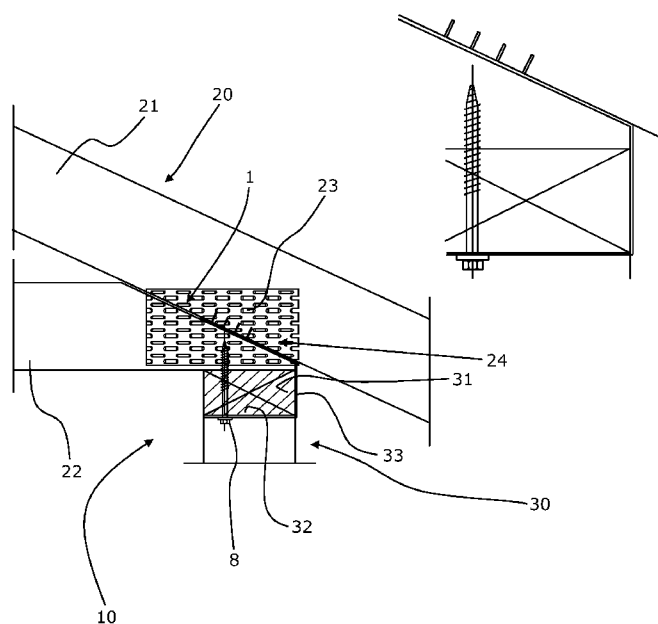


FIG. 2

(57) Abstract: There is disclosed a building structure comprising a first member and a second member which is secured to the first member by a tie-down strap and at least one fastener received through the strap to fix it against one member, wherein the or each fastener passes through said one member and into the other member whereby it can transfer horizontal loads from the second member to the first member.

TIE-DOWN AND SHEAR CONNECTION BETWEEN MEMBERS IN A BUILDING STRUCTURE

PRIORITY CLAIM

[0001] This international application claims priority to and the benefit of Australian Provisional Patent Application No. 2015901958, 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 member which may be prone to uplift to a wall frame on which the member is to be supported, such that the member is tied down to the wall frame and horizontal loads are transferred from the member into the wall frame. The invention has particular application to buildings in areas which are prone to heavy winds such as cyclones or hurricanes.

BACKGROUND

[0003] During severe wind storms, particularly cyclones or hurricanes, laterally protruding sections of a building, particularly the roof and possibly also raised floor sections, are generally subjected to upward forces, commonly termed “uplift”. Tie-down straps are commonly used to secure such sections within a building, so as to resist uplift on them. Generally speaking, provision must also be made to transfer, from the tied down section into the structure on which it is supported, horizontal loads to which the tied down structure is subjected. It is desirable to provide a straightforward and reliable means of meeting these objectives.

SUMMARY

[0004] According to a first aspect of the present invention, there is provided a building structure comprising a first member and a second member which is secured to the first member by a tie-down strap and at least one fastener received through the strap to fix it against one member, wherein the or each fastener passes through said one member and into

the other member whereby it can transfer horizontal loads from the second member to the first member.

[0005] In one preferred embodiment of the invention, the first member is a member of a floor structure and the second member is a member of a wall structure which is supported on the floor structure and tied down to the floor structure by said strap. Preferably, in that embodiment, the member of the floor structure is a member in a floor truss. Preferably, in that embodiment, the member in the floor truss is a top chord of the floor truss. Preferably, in that embodiment, the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured within a joint in the truss. Preferably, in that embodiment, the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured between a top chord of the truss and web member of the truss. Preferably, in that embodiment, the web member is a vertical web member. Preferably, in that embodiment, the web member is an end web member. Preferably, in that embodiment, said one member is said first member, said other member thus being said second member. Preferably, in that embodiment, the member of the wall structure is a bottom plate of a wall frame defining the wall structure. Preferably, in that embodiment, the strap is received against a topside of the first member and at least one said fastener passes through said topside

[0006] In another preferred embodiment of the invention, the first member is a member of a wall structure and the second member is a member of a floor structure, ceiling structure or roof structure which is supported on the wall structure and tied down to the wall structure by said strap. Preferably, in that embodiment, the member of the floor, ceiling or roof structure is a member in a truss. Preferably, in that embodiment, the member in the truss is a bottom chord of the truss. Preferably, in that embodiment, the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured within a joint in the truss. Preferably, in that embodiment, the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured between a top chord or web member of the truss and a bottom chord of the truss so as to be fixed to the truss. Preferably, in that embodiment, said one member is said second member, said other member thus being said first member. Preferably, in that embodiment, the member of the wall structure is a top plate of a wall frame defining the wall structure. Preferably, in that embodiment, the strap is received against an underside of the first member and at least one said fastener passes through said underside.

[0007] Preferably, the strap is received against a side face of said one member.

[0008] Preferably, the strap is wrapped around an edge of said one member whereby it engages said one member bindingly to resist upward loading on the first member.

[0009] Preferably, the first member comprises a timber member.

[0010] Preferably, the second member comprises a timber member.

[0011] Preferably, the or each fastener comprises a threaded fastener. Preferably, the or each threaded fastener comprises a screw. Alternatively, the or each threaded fastener may comprise a bolt.

[0012] Alternatively, the or each fastener may comprise a nail or rivet.

[0013] According to a second aspect of the present invention, there is provided a method of assembling said building structure, the method comprising inserting the or each fastener through the strap and said one member, such that the strap is fixed against said one member, whereby said second member is tied down to said first member by the strap and the or each fastener extends into said other member.

[0014] Preferably, the method comprises connecting the strap at one end to said other member, subsequently landing the second member atop the first member, and thereafter inserting the fastener(s) through the strap whereby second member is tied down to the first member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

[0016] Figure 1A is a schematic view showing attachment of a tie-down strap to an underside of a top chord of a roof truss, for securing the roof truss to a wall frame in accordance with a preferred embodiment of the present invention;

[0017] Figure 1B is a schematic view of a heel of the roof truss and the strap sandwiched between the top and bottom chords of the truss within a heel joint of the truss; and

[0018] Figure 2 is a cross sectional elevation view showing how the roof truss is secured to the wall frame via the strap and a threaded fastener received through the strap.

DETAILED DESCRIPTION

[0019] Referring firstly to Figure 2, a preferred embodiment of the present invention provides a method of assembling a building structure 10 in which a roof truss 20 is supported on a wall frame 30 and tied down to the wall frame 30 such that uplift, created by wind loads on the underside of the roof structure, is resisted, and is also restrained in a plane parallel to the upper face of a top plate 31 of the wall frame 30, which plane will generally be horizontal. The roof truss 20 includes a top chord 21, a bottom chord 22 and a nail plate 23 which secures the top chord 21 to the bottom chord 22 at a heel joint 24 of the truss 20. The truss 20 is supported on and secured to the top plate 31, which comprises a horizontally extending length of solid rectangular cross-section timber. The connection between the top plate 31 and truss 20 is formed by a tie-down strap 1, one end of which is secured to the truss 20 and the other end of which is received against a lower face 32 of the top plate 31, and a fastener 8, comprising a screw, which is passed through the strap lower end and driven all the way through the top plate 31 such that its leading end penetrates the bottom chord 22.

[0020] Referring to Figures 1A and 1B, the strap 1 is pre-applied to the truss 20 during manufacture of the latter. The strap 1, referring firstly to Figure 1A, comprises a strap portion 3 and preformed teeth 4, which are integral with and project transverse to the strap portion 3, and is configured with holes 5 therethrough at its other end. The strap 1 is secured to a face of the top chord 21 which is to define an underside of the top chord 21 in the assembled truss 20. Specifically, the teeth 4 are hammered, through that face, into the top chord 21 such that the strap 1 is secured to the top chord 21 and the strap portion 3 thereof is against or closely adjacent the top chord face. When the truss 20 is thereafter assembled, the top chord 21 is secured to the bottom chord 22 via nail plate 23, whereby there is formed the heel joint 24, in which an upper end section of the strap 1 is sandwiched between the top chord 21 and bottom chord 22, the opposite end portion projecting, from the heel joint, along the underside of the top chord 21.

[0021] The truss 20, after fabrication thereof, is lifted onto the wall frame 30 such that the underside of the bottom chord 22 is received against the upper face of the top plate 31 and the tip of the bottom chord 22 at the lower end of the heel joint is positioned substantially flush with a laterally outer side face 33 of the top plate 31. The truss 20 is temporarily secured to the top plate 31 by conventional means, typically toe nailing or skew nailing. The exposed end section of the strap portion 3 is then folded downwardly, so as to be received against the side face 33, and laterally inwardly so as to be received against the lower face 32,

whereby the pre-applied strap 1 is bent tightly around the top plate 31. At least one screw 8 is then passed through a respective hole 5 in the strap portion 3 and driven through the lower face 32 such that it passes all the way through the top plate 31 and projects through the upper face thereof, whereby it penetrates the bottom chord 22. The fastener 8 thus, advantageously, performs two functions, one being fixation of the strap 1 against the underside of the top plate 31, and the other being horizontal restraint of the truss 20 by virtue of the ability of the fastener(s) 8 to transfer horizontal loads on the truss 20 into the wall frame 30 through shear. In addition, the/each fastener 8 provides some resistance to uplift of the truss 20.

[0022] The or each fastener may be head stamped with a unique marking that can be used to determine the properties of the fastener, e.g. length, gauge, material type, corrosion protection, manufacturer capacity.

[0023] In an alternative embodiment, the or each fastener may comprise, instead of a screw, a bolt, nail or rivet. Also, in an alternative embodiment, the fastener could be driven through the side face 33, and extend diagonally through the top plate 31 such that its leading end projects through the upper face of the top plate 31 and penetrates the bottom chord 22 (in which case the strap might not be wrapped around the top plate 31 to such an extent that it is received against the lower face thereof as shown in Figure 2). That said, the configuration illustrated in Figure 2 is particularly advantageous in that the installer can comfortably fix the truss down from inside and below the wall frame top plate, with very little risk of error caused by the installer not knowing how to fix any of the connections correctly. Moreover, the connections are able to be readily inspected with correct fixing being confirmable by observing that the head of the/each screw 8 is received tightly against the lowermost face of the strap portion 3 and the strap portion 3 lies against the underside of the top plate 31. Also, the degree of screw penetration and positioning are not particularly critical for restraint of uplift forces because the load in the screw(s) 8 is significantly curtailed by virtue of the binding/frictional engagement between the strap portion 3 and top plate 31 resulting from the wrapping of the former around the latter.

[0024] Moreover, the installation methodology can preclude misalignment of the truss 20 and wall frame(s) on which it is supported.

[0025] The invention is not limited to tying down of roof members to wall members. In one alternative embodiment of the invention, it is a floor member, which is to form part of an upper floor which is to be supported on the wall frame 30, that is (instead of the truss 20) tied down to the top plate 31 by the strap 1 and fastener(s) 8, the latter passing through the top plate 31 and into the floor member. In another alternative embodiment of the

invention, a wall frame is tied down to a top chord of a floor truss, which is to form part of a floor on which the wall frame is to be supported, by the strap 1 and fastener(s) 8, in which case the toothed part of the strap 1 is secured between a top chord and an vertical end web in the floor truss (in a similar way to that in which it is secured between the top and bottom chords as shown in Figures 1B and 2) and, thereafter, the wall frame is arranged atop the truss and the exposed end portion of the strap portion 3 is wrapped around a bottom plate of the wall frame and the fasteners (8) driven downwardly through the strap 1 and through the a bottom plate of the wall frame so as to extend into the top chord of the truss.

[0026] In addition, the installer can be kept relatively safe because there is no need for him or her to have any tool, bracket or fixing with him except a lightweight or compact driver and screws. The fixing down of trusses to wall frames in accordance with preferred embodiments of the invention is much faster than with conventional methods. Also, the fixing can be through the two laminates of the top plate whereas, in most existing methodologies, the fixing is only to the upper laminate. In addition, the installer can have three points of support for a great deal more of the time that he or she is working at height, which is generally not the case with conventional methods.

[0027] 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.

[0028] 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.

[0029] 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 building structure comprising a first member and a second member which is secured to the first member by a tie-down strap and at least one fastener received through the strap to fix it against one member, wherein the or each fastener passes through said one member and into the other member whereby it can transfer horizontal loads from the second member to the first member.
2. A building structure according to claim 1, wherein the first member is a member of a floor structure and the second member is a member of a wall structure which is supported on the floor structure and tied down to the floor structure by said strap.
3. A building structure according to claim 2, wherein the member of the floor structure is a member in a floor truss.
4. A building structure according to claim 3, wherein the member in the floor truss is a top chord of the floor truss.
5. A building structure according to any one of claims 2 to 4, wherein the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured within a joint in the truss.
6. A building structure according to any one of claims 2 to 4, wherein the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured between a top chord of the truss and web member of the truss.
7. A building structure according to claim 6, wherein the web member is a vertical web member.
8. A building structure according to claim 6 or 7, wherein the web member is an end web member.
9. A building structure according to any one of claims 2 to 8, wherein said one member is said first member, said other member thus being said second member.
10. A building structure according to any one of claims 2 to 9, wherein the member of the wall structure is a bottom plate of a wall frame defining the wall structure.
11. A building structure according to any one of claims 2 to 10, wherein the

strap is received against a topside of the first member and at least one said fastener passes through said topside.

12. A building structure according to claim 1, wherein the first member is a member of a wall structure and the second member is a member of a floor structure, ceiling structure or roof structure which is supported on the wall structure and tied down to the wall structure by said strap.

13. A building structure according to claim 12, wherein the member of the floor, ceiling or roof structure is a member in a truss.

14. A building structure according to claim 13, wherein the member in the truss is a bottom chord of the truss.

15. A building structure according to claim 13 or 14, wherein the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured within a joint in the truss.

16. A building structure according to claim 13 or 14, wherein the or each fastener is received through one end portion of the strap and an opposite end portion of the strap is secured between a top chord or web member of the truss and a bottom chord of the truss so as to be fixed to the truss.

17. A building structure according to any one of claims 12 to 16, wherein said one member is said second member, said other member thus being said first member.

18. A building structure according to any one of claims 12 to 17, wherein the member of the wall structure is a top plate of a wall frame defining the wall structure.

19. A building structure according to any one of claims 12 to 18, wherein the strap is received against an underside of the first member and at least one said fastener passes through said underside.

20. A building structure according to any one of the preceding claims, wherein the strap is received against a side face of said one member.

21. A building structure according to any one of the preceding claims, wherein the strap is wrapped around an edge of said one member whereby it engages said one member bindingly to resist upward loading on the first member.

22. A building structure according to any one of the preceding claims, wherein the first member comprises a timber member.
23. A building structure according to any one the preceding claims, wherein the second member comprises a timber member.
24. A building structure according to any one of the preceding claims, wherein the or each fastener comprises a threaded fastener.
25. A building structure according to claim 24, wherein the or each threaded fastener comprises a screw.
26. A building structure according to claim 24, wherein the or each threaded fastener comprises a bolt.
27. A building structure according to any one of claims 1 to 23, wherein the or each fastener comprises a nail or rivet.
28. A method of assembling a building structure according to any one of the preceding claims, the method comprising inserting the or each fastener through the strap and said one member, such that the strap is fixed against said one member, whereby said second member is tied down to said first member by the strap and the or each fastener extends into said other member.
29. A method according to claim 28, comprising connecting the strap at one end to said other member, subsequently arranging the second member atop the first member, and thereafter inserting the fastener(s) through the strap whereby second member is tied down to the first member.

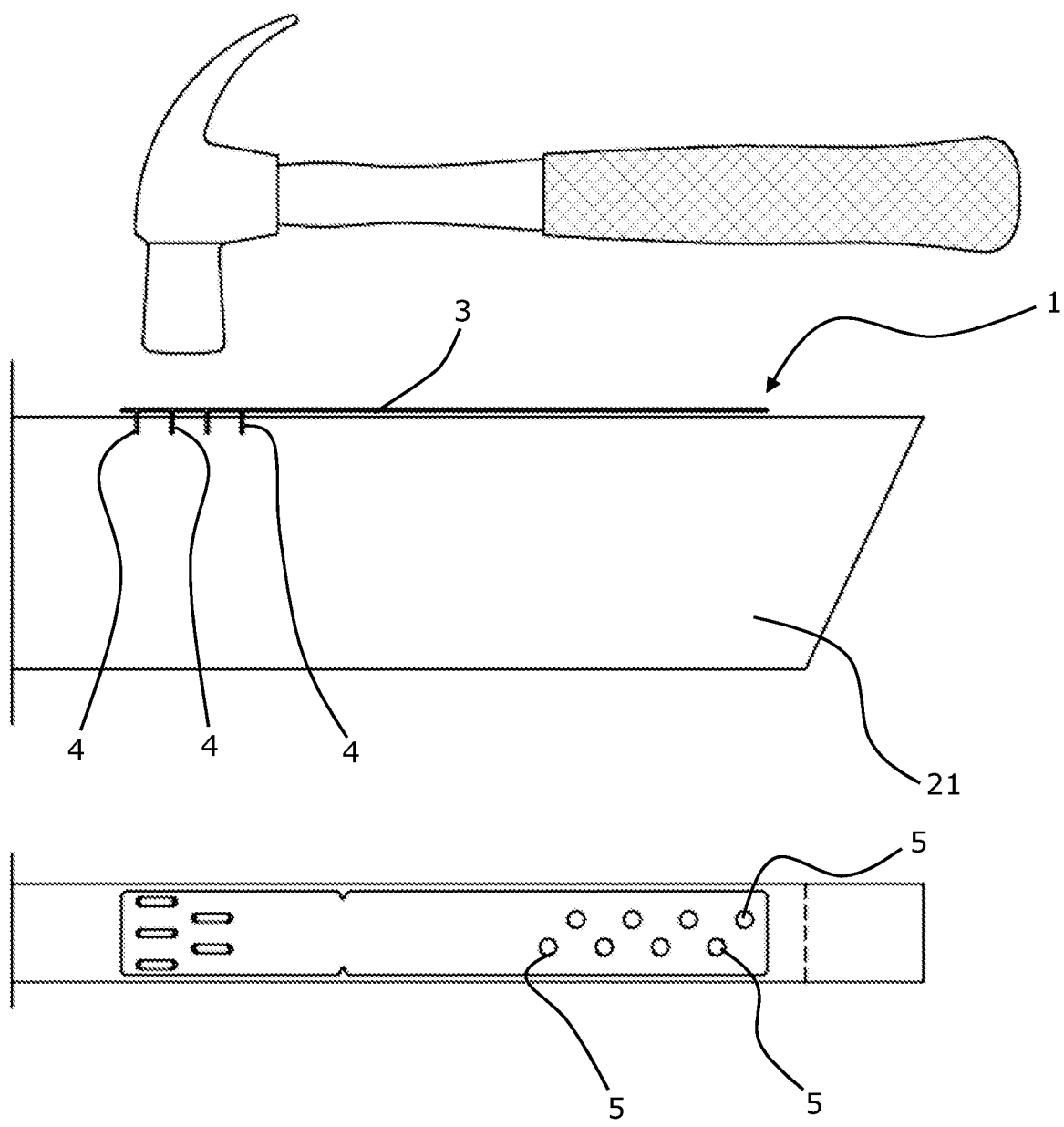


FIG. 1A

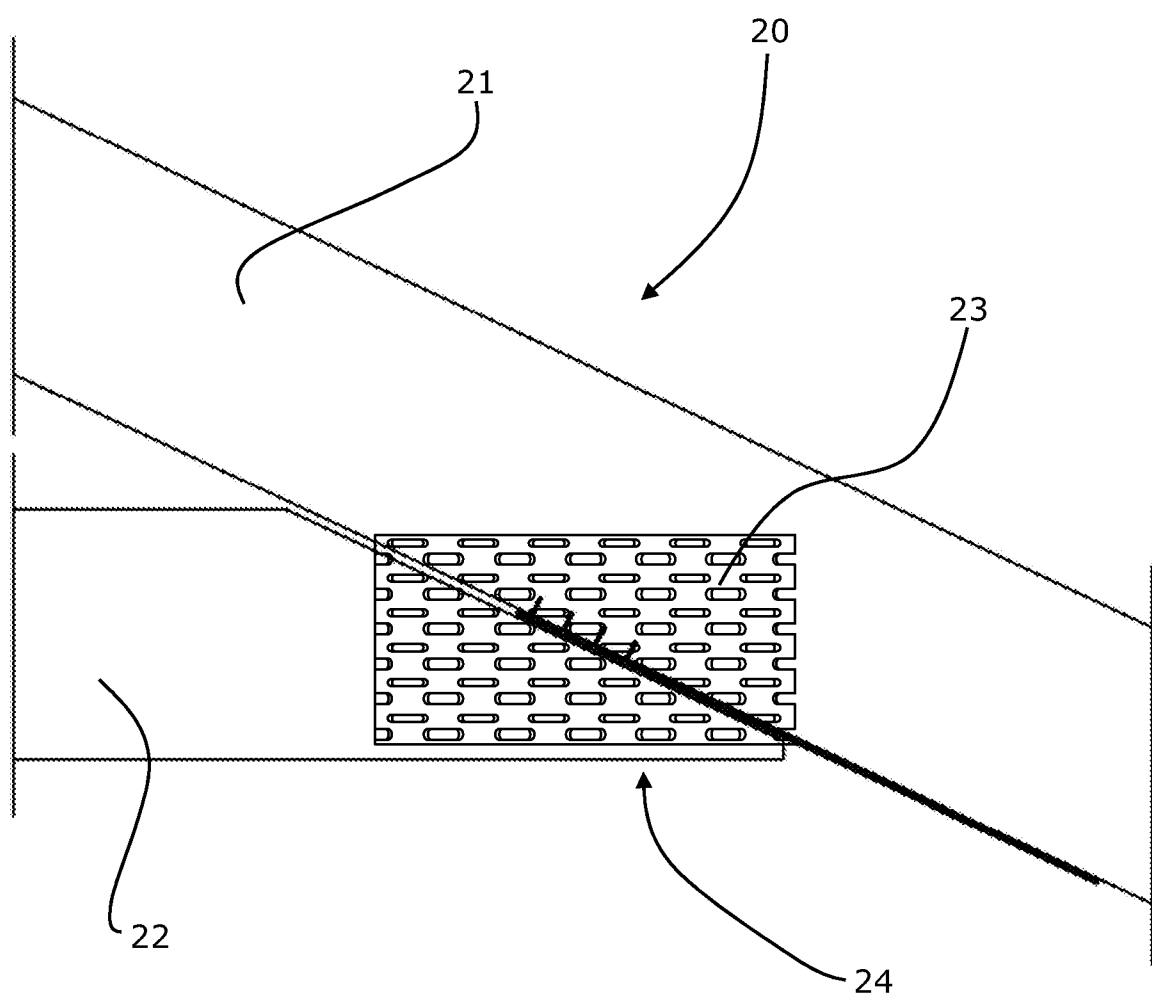


FIG. 1B

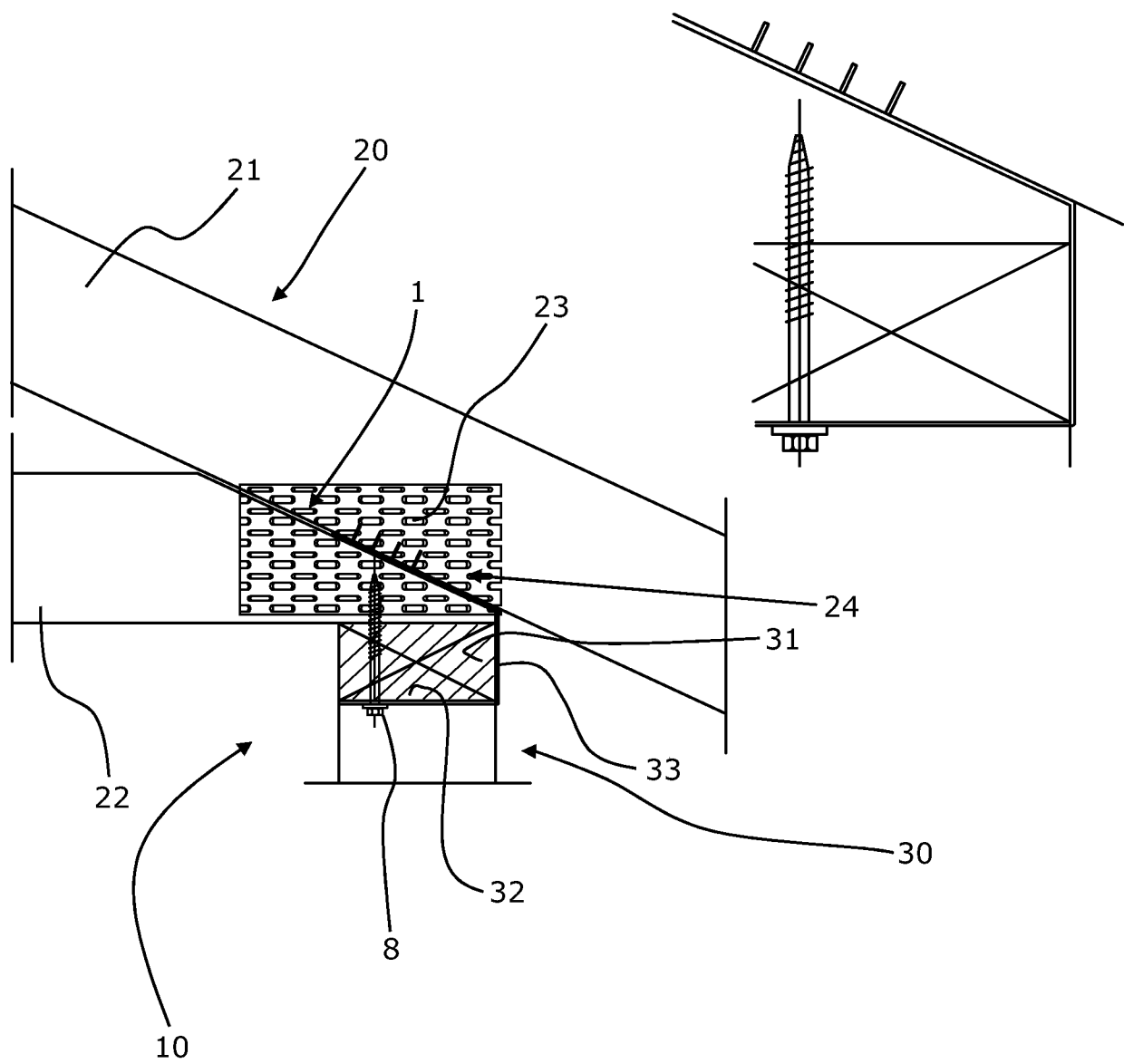


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/033935

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04B7/04
ADD. E04B1/26 E04B7/06 E04H9/14

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 E04H

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)

EP0-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 A	US 1 007 871 A (HORTON JAMES F [US]) 7 November 1911 (1911-11-07) figure 1 -----	1,2,9, 11-29 5-8
X	EP 0 745 735 A1 (SIMPSON STRONG TIE CO INC [US]) 4 December 1996 (1996-12-04) figures 1,2 -----	1-4, 9-14,17, 18,20-29
X	US 5 333 426 A (VAROGLU EROL [CA]) 2 August 1994 (1994-08-02) figures 1,3,4 -----	1-4, 9-14, 17-26, 28,29



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Petrinja, Etjel

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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