(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 787 141 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
24.05.2017 Bulletin 2017/21

(21) Application number: **14151329.1**

(22) Date of filing: **15.01.2014**

(51) Int Cl.:
E04C 3/29 *(2006.01)* ***E04C 3/292*** *(2006.01)*

(54) **Building Component**

Bauteil

Construction de composant

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **15.01.2013 GB 201300725**

(43) Date of publication of application:
08.10.2014 Bulletin 2014/41

(73) Proprietor: **MiTek Holdings, Inc.**
Wilmington,
Delaware 19801 (US)

(72) Inventor: **FILLINGHAM, Anthony J.**
Dudley, West Midlands DY2 0XW (GB)

(74) Representative: **Freeman, Jacqueline Carol**
WP Thompson
138 Fetter Lane
London EC4A 1BT (GB)

(56) References cited:
EP-A1- 1 609 920
WO-A1-95/30808
DE-A1- 19 952 785
DE-C- 857 139
US-A- 2 937 418
US-A- 3 591 997
US-A- 4 295 318

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 787 141 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Introduction

[0001] The present invention relates to a building component for use in the built environment, such as may serve as a floor joist, roof rafter or wall stud, manufactured with timber chords separated by metal V shaped webs with integral teeth at their extents.

Background

[0002] Fire is a hazard during most construction processes and it is important that precautions are in place to mitigate the risk of spread of fire to adjacent buildings. Timber framed buildings including their associated timber floors are more vulnerable to fire during the construction phase because the linings to the walls and ceilings which the timber frame and timber floors relies upon to give fire protection are not normally in place until the whole timber frame building is complete.

[0003] There has been a lot of research and development over the last few years leading to the development of chemicals and processes which when impregnated into exposed timber studs, chords and decking boards offer fire retardant attributes reducing the spread of flame whilst not reducing the structural properties of the timber members and not corroding metal fixing driven into these fire retardant treated components; which was a problem with older fire retardant chemicals and processes.

[0004] There has also been a lot of research and development of different types of timber frame construction where either reduced combustion or non-combustible internal and external linings form part of the pre-manufactured timber frame walls, offering immediate protection of the timber stud members within the wall and not providing a material which can burn or easily spread flame to adjacent components which are combustible.

[0005] Solid timber generally has a predicted burn rate and the charring of the timber protects the un-burnt core, however when timber burns the edges of the timber (arris) are attacked by fire so square edges become round and any short teeth connectors in the edge become less effective. For pre-formed timber joists or rafters formed by joining timber chords with metal webs, as described in applicant's patent publication GB 2470721, the last row of teeth on the integral connector plates at the extent of the metal webs become less effective during and after a fire, and this weakens the joist or rafter.

[0006] In addition open web joists such as described in GB 2470721 allow fire to spread both longitudinally and laterally across the floor deck so the rate of spread of flame is greater than for a solid timber section.

[0007] EP 1609920 describes a building framework which comprises studs and which are coupled together by separate bracing elements which together form a bracing unit. The bracing unit is provided between a top plate and bottom plate. The bracing elements extend substantially all of the way from the top plate to the bottom plate. The bracing unit may have more studs. US 4,295,318 discloses a building component according to the preamble of claim 1.

Summary of the Invention

[0008] According to one aspect of the present invention there is provided a building component for use in a built environment, the component comprising: two generally parallel elongate timber chords; a plurality of metal web connectors for connecting the timber chords; a plurality of primary metal fixings integral with the web connectors adapted to penetrate and engage the timber chords to attach the metal web connectors to the timber chords; a plurality of holes in the web connectors formed by stamping the primary metal fixings; and a plurality of secondary metal fixings driven through the respective holes in the metal web connectors so as to extend further into the timber of the timber chords than the integral primary metal fixings, and to increase the integrity of the component if the timber suffers fire damage.

[0009] The secondary fixings connecting end region web connectors extend into the timber to a depth of at least one twentieth the width of the timber chord, more preferably at least one tenth, even more preferably at least one quarter, and optionally at least one third and up to one half the width of the chord.

[0010] The secondary fixings may comprise nails, screws or staples.

[0011] The nails, screws or staples are driven through holes or slots in the metal web connectors. They may be engaged during the manufacturing process or alternatively engaged during installation of the building component on site during a build.

[0012] The integral primary fixings are stamped out of the web connectors and formed as teeth shapes protruding perpendicular to the plane of the web connector. The secondary fixings are driven through holes formed in this stamping process.

[0013] The secondary fixings are not integral with the web connector. They extend into the core of the timber. They increase the structural integrity of the component which is particularly useful during fire load, i.e. when the timber is damaged by fire which tends to burn the edges of timber more so that the outer rows of integral primary fixings on the web connectors are less effective.

[0014] The building component of the invention may additionally comprise a non-combustible material, of flexible and/or rigid composure, which may optionally be compressed as a tight fit between the timber chords. Stonewool is one suitable material which does not shrink when subjected to high temperatures.

[0015] Preferably the material is flexible. Advantageously it is rigid rather than supplied in a roll.

[0016] According to one embodiment the non-combustible material is compressed between the timber chords to provide a tight fit.

[0017] Preferably the non-combustible material does not shrink when subjected to high temperatures.

[0018] One example of a suitable non-combustible material is commonly known as stonewool. There are a number of proprietary brands which are readily available in standard batt widths and lengths which are easily cut either in the factory during manufacture of the building item, or on site, for example to allow passage of building services such as pipes and wires.

[0019] This arrangement serves to retard the spread of fire and reduce the rate of spread of flame, for example laterally across a floor deck which uses such building items as floor joists, or through a roof which uses such items as roof rafters, or through a wall which uses such building items as wall studs.

[0020] The rows of connectors in the integral connector plate ends of the metal webs which may have become ineffective if the timber edges have burnt away, forming a round rather than square edge, are still effective because of the secondary fixings comprising enhanced nails, screws or staples driven through the connector into the un-burnt solid core of the timber chords. The additional fixings not only restore the effectiveness of the integral connector plated ends of the metal webs during or after a fire but increase the anchorage strength capacity of the metal webs even if there is no fire.

[0021] Advantageously both aspects of the invention can be combined to provide a building component which has increased fire retardance and increased effectiveness even after a fire.

Specific embodiments

[0022]

Figure 1 is a perspective view of part of a building component such as a joist or rafter according to the prior art.

Figure 2 is a perspective view of part of a building component according to the invention.

Figure 3a is a cross section through two building components according to the invention, and Figure 3b is an enlarged view of part of Figure 3a.

Figure 4 is an elevation view of a building component according to the invention.

Detailed descriptions of drawings

[0023] Figure 1 shows a building component 1 which may form a floor joist, roof rafter or wall stud. It comprises two parallel timber chords 2, 3 and two metal web connectors 4, 5 which hold the timber chords 2, 3 in spaced relationship. The metal web connectors 4, 5 are formed by stamping metal forms and folding over the long edges 6 to increase strength. They have metal teeth (not shown) integrally formed of the metal, at the extremities (in the regions 7 and 8) and these teeth penetrate the wood of the timber chords 2, 3. These teeth are indicated more clearly in Figure 4 which shows the rectangular holes 18 formed by stamping teeth shapes so that they protrude perpendicular to the plane of the web connector.

[0024] Figure 2 illustrates a similar building component 1 according to the invention. The metal web 4 is connected to the timber chords 2, 3 by additional protruberances such as fixings 10 which may be nails, screws or staples. These are driven through the metal web 4 into the timber of the chords 2, 3 so as to penetrate further into the timber than the integral teeth of the web 4.

[0025] This is illustrated more clearly in Figure 3a which shows two such building components 1A, 1B arranged to support a floor deck 12. The nails, screws or staples 10 penetrate a significant distance into the timber, preferably into the core of the timber chords. The nails, screws or staples 10 achieve advantages by penetrating at least one twentieth of the thickness of the chord but increasing advantages can be achieved if they penetrate one tenth, one fifth, one quarter, one third or one half of the thickness. Figure 3b is an enlarged view of part of one timber chord showing that the nails or screws 10 penetrate significantly more than the integral metal teeth 19.

[0026] By way of one example, the integral teeth 19 typically extend around 8mm into the timber whereas the nails or screws forming secondary fixings 10 might typically extend 50mm into the timber. Timber chords may typically be up to about 147mm wide.

[0027] A fire retardant material 15 is located between the chords 2, 3 to prevent, or at least reduce, the spread of fire longitudinally and laterally. This may be stonewool material or any other known fire retardant. It is preferably flexible but rigid enough to be self-supporting in the space between the chords 2, 3. The webs 4, 5 help to retain the fire retardant material 15 in place. The material 15 may also be compressed and is resistant to shrinking at extreme temperatures, e.g. high heat.

[0028] The nails, screws or staples 10 are preferably driven through the holes 18 in the web 4, which are formed when the integral teeth are stamped out. This can be seen more clearly in Figure 4.

[0029] It will be seen that use of fire retardant material 15 between chords significantly improves the fire safety of buildings constructed with building components, such as joists, according to the present invention.

[0030] Similarly use of the nails, screws or staples 10 increases the integrity of the building components in the event of a fire, thus making such buildings more robust and resilient to fire damage, and structurally stronger, even if the timber has suffered fire damage.

Claims

1. A building component (1) for use in a built environ-

ment, the component (1) comprising:

two generally parallel elongate timber chords (2, 3);
a plurality of metal web connectors (4) for connecting the timber chords (2, 3);
a plurality of primary metal fixings (19) integral with the web connectors (4) adapted to penetrate and engage the timber chords to attach the metal web connectors to the timber chords;
a plurality of holes (18) in the web connectors (4) formed by stamping the primary metal fixings (19);**characterized in that** the building component further comprises a plurality of secondary metal fixings (10) driven through the respective holes (18) in the metal web connectors (4) so as to extend into the core of the timber chords and further into the timber of the timber chords (2, 3) than the integral primary metal fixings (19), and to increase the integrity of the component (1) if the timber suffers fire damage;
wherein each metal web connector (4) located in an end region of the component (1) is connected to the timber chords (2, 3) by the plurality of secondary fixings (10) which extend into the timber to a depth of at least one twentieth the width of the timber chord (2, 3).

2. A building component (1) according to claim 1 wherein the holes are slots.

3. A building component (1) according to any one of the preceding claims wherein the holes (18) are rectangular.

4. A building component (1) according to any one of claims 1 to 3 wherein each metal web connector (4) located in an end region of the component (1) is connected to the timber chords (2, 3) by a plurality of secondary fixings (10) which extend into the timber to a depth of at least one tenth the width of the timber chord (2, 3).

5. A building component (1) according to any one of claims 1 to 3 wherein each metal web connector (4) located in an end region of the component (1) is connected to the timber chords (2, 3) by a plurality of secondary fixings (10) which extend into the timber to a depth at least one third the width of the timber chord (2, 3).

6. A building component (1) according to any one of claims 1 to 3 wherein each metal web connector (4) located in an end region of the component (1) is connected to the timber chords (2, 3) by a plurality of secondary fixings which extend into the timber to a depth of at least one half the width of the timber chord.

7. A building component (1) according to any one of the preceding claims wherein each metal web connector (4) located in an end region of the component (1) is connected to the timber chords (2, 3) by a plurality of secondary fixings (10) which extend into the timber at least twice as far as the primary fixings (19).

8. A building component (1) according to any one of the preceding claims wherein said secondary fixings (10) comprise nails, screws or staples.

9. A building component (1) according to any one of claims 1 to 8 further comprising a non-combustible material (15) between the elongate timber chords (2, 3).

10. A building component (1) according to claim 9 wherein the material (15) is flexible.

11. A building component (1) according to claim 9 or 10 wherein the material (15) is compressed between the timber chords (2, 3).

12. A building component (1) according to any one of claims 9 to 11 wherein the material (15) is impervious to shrinkage when subjected to high temperatures.

13. A building component (1) according to any one of claims 9 to 11 wherein the material (15) comprises stonewool.

Patentansprüche

1. Bauteil (1) zur Verwendung in einer Gebäudeumgebung, wobei das Teil Folgendes umfasst (1):

zwei allgemein parallele langgestreckte Holzgurte (2, 3);
eine Vielzahl von Stegverbindern (4) aus Metall zum Verbinden der Holzgurte (2, 3);
eine Vielzahl von Hauptbefestigungselementen (19) aus Metall, die mit den Stegverbindern (4) integriert sind und dazu angepasst sind, in die Holzgurte einzudringen und damit in Eingriff zu treten, um die Stegverbinder aus Metall an den Holzgurten zu befestigen;
eine Vielzahl von durch Stanzen der Hauptbefestigungselemente (19) aus Metall gebildeten Löchern (18) in den Stegverbindern (4);
dadurch gekennzeichnet, dass das Bauteil weiter eine Vielzahl von Sekundärbefestigungselelementen (10) aus Metall umfasst, die durch die jeweiligen Löcher (18) in den Stegverbindern (4) aus Metall getrieben werden, um sich in den Kern der Holzgurte und weiter als die integrierten Hauptbefestigungselemente (19) aus Metall in das Holz der Holzgurte (2, 3) zu erstrecken,

und um die Standsicherheit des Teils (1) zu erhöhen, falls das Holz Brandschaden erleidet; wobei jeder in einem Endbereich des Teils (1) gelegene Stegverbinder (4) aus Metall durch die Vielzahl von Sekundärbefestigungselementen (10), die sich bis zu einer Tiefe von mindestens einem Zwanzigstel der Breite des Holzgurts (2, 3) in das Holz erstrecken, mit den Holzgurten (2, 3) verbunden ist.

2. Bauteil (1) nach Anspruch 1, wobei es sich bei den Löchern um Langlöcher handelt.

3. Bauteil (1) nach einem der vorangehenden Ansprüche, wobei die Löcher (18) rechteckig sind.

4. Bauteil (1) nach einem der Ansprüche 1 bis 3, wobei jeder in einem Endbereich des Teils (1) gelegene Stegverbinder (4) aus Metall durch eine Vielzahl von Sekundärbefestigungselementen (10), die sich bis zu einer Tiefe von mindestens einem Zehntel der Breite des Holzgurts (2, 3) in das Holz erstrecken, mit den Holzgurten (2, 3) verbunden ist.

5. Bauteil (1) nach einem der Ansprüche 1 bis 3, wobei jeder in einem Endbereich des Teils (1) gelegene Stegverbinder (4) aus Metall durch eine Vielzahl von Sekundärbefestigungselementen (10), die sich bis zu einer Tiefe von mindestens einem Drittel der Breite des Holzgurts (2, 3) in das Holz erstrecken, mit den Holzgurten (2, 3) verbunden ist.

6. Bauteil (1) nach einem der Ansprüche 1 bis 3, wobei jeder in einem Endbereich des Teils (1) gelegene Stegverbinder (4) aus Metall durch eine Vielzahl von Sekundärbefestigungselementen, die sich bis zu einer Tiefe von mindestens der Hälfte der Breite des Holzgurts in das Holz erstrecken, mit den Holzgurte (2, 3) verbunden ist.

7. Bauteil (1) nach einem der vorangehenden Ansprüche, wobei jeder in einem Endbereich des Teils (1) gelegene Stegverbinder (4) aus Metall durch eine Vielzahl von Sekundärbefestigungselementen (10), die sich mindestens zweimal so weit wie die Hauptbefestigungselemente (19) in das Holz erstrecken, mit den Holzgurte (2, 3) verbunden ist.

8. Bauteil (1) nach einem der vorangehenden Ansprüche, wobei die Sekundärbefestigungselemente (10) Nägeln, Schrauben oder Klammern umfassen.

9. Bauteil (1) nach einem der Ansprüche 1 bis 8, weiter umfassen ein nicht brennbares Material (15) zwischen den langgestreckten Holzgurten (2, 3).

10. Bauteil (1) nach Anspruch 9, wobei das Material (15) biegsam ist.

11. Bauteil (1) nach Anspruch 9 oder 10, wobei das Material (15) zwischen den Holzgurte (2, 3) gepresst ist.

12. Bauteil (1) nach einem der Ansprüche 9 bis 11, wobei das Material (15) unempfindlich auf Schrumpfung ist, wenn es hohen Temperaturen ausgesetzt wird.

13. Bauteil (1) nach einem der Ansprüche 9 bis 11, wobei das Material (15) Steinwolle umfasst.

Revendications

1. Composant de construction (1) à des fins d'utilisation dans un environnement construit, le composant (1) comportant :

deux membrures en bois allongées généralement parallèles (2, 3) ;
une pluralité de dispositifs d'assemblage à âme métallique (4) servant à assembler les membrures en bois (2, 3) ;
une pluralité de fixations métalliques primaires (19) formées d'un seul tenant avec les dispositifs d'assemblage à âme (4) adaptées pour pénétrer dans et entrer en prise avec les membrures en bois pour attacher les dispositifs d'assemblage à âme métallique aux membrures en bois ;
une pluralité de trous (18) dans les dispositifs d'assemblage à âme (4) formés par l'estampage des fixations métalliques primaires (19) ;
caractérisé en ce que le composant de construction comporte par ailleurs
une pluralité de fixations métalliques secondaires (10) enfoncées au travers des trous respectifs (18) dans les dispositifs d'assemblage à âme métallique (4) de manière à s'étendre dans la partie centrale des membrures en bois et plus encore dans le bois des membrures en bois (2, 3) par rapport aux fixations métalliques primaires intégrales (19), et de manière à augmenter l'intégrité du composant (1) si le bois subit des dommages causés par le feu ;
dans lequel chaque dispositif d'assemblage à âme métallique (4) situé dans une région d'extrémité du composant (1) est assemblé au niveau des membrures en bois (2, 3) par la pluralité de fixations secondaires (10) qui s'étendent dans le bois jusqu'à une profondeur d'au moins un vingtième de la largeur de la membrure en bois (2, 3).

2. Composant de construction (1) selon la revendication 1, dans lequel les trous sont des fentes.

3. Composant de construction (1) selon l'une quelconque des revendications précédentes, dans lequel les trous (18) sont rectangulaires.

4. Composant de construction (1) selon l'une quelconque des revendications 1 à 3, dans lequel chaque dispositif d'assemblage à âme métallique (4) situé dans une région d'extrémité du composant (1) est assemblé au niveau des membrures en bois (2, 3) par une pluralité de fixations secondaires (10) qui s'étendent dans le bois jusqu'à une profondeur d'au moins un dixième de la largeur de la membrure en bois (2, 3).

5. Composant de construction (1) selon l'une quelconque des revendications 1 à 3, dans lequel chaque dispositif d'assemblage à âme métallique (4) situé dans une région d'extrémité du composant (1) est assemblé au niveau des membrures en bois (2, 3) par une pluralité de fixations secondaires (10) qui s'étendent dans le bois jusqu'à une profondeur d'au moins un tiers de la largeur de la membrure en bois (2, 3).

6. Composant de construction (1) selon l'une quelconque des revendications 1 à 3, dans lequel chaque dispositif d'assemblage à âme métallique (4) situé dans une région d'extrémité du composant (1) est assemblé au niveau des membrures en bois (2, 3) par une pluralité de fixations secondaires qui s'étendent dans le bois jusqu'à une profondeur d'au moins une moitié de la largeur de la membrure en bois.

7. Composant de construction (1) selon l'une quelconque des revendications précédentes, dans lequel chaque dispositif d'assemblage à âme métallique (4) situé dans une région d'extrémité du composant (1) est assemblé au niveau des membrures en bois (2, 3) par une pluralité de fixations secondaires (10) qui s'étendent dans le bois au moins deux fois plus loin que les fixations primaires (19).

8. Composant de construction (1) selon l'une quelconque des revendications précédentes, dans lequel lesdites fixations secondaires (10) comportent des clous, des vis ou des agrafes.

9. Composant de construction (1) selon l'une quelconque des revendications 1 à 8, comportant par ailleurs un matériau non combustible (15) entre les membrures en bois allongées (2, 3).

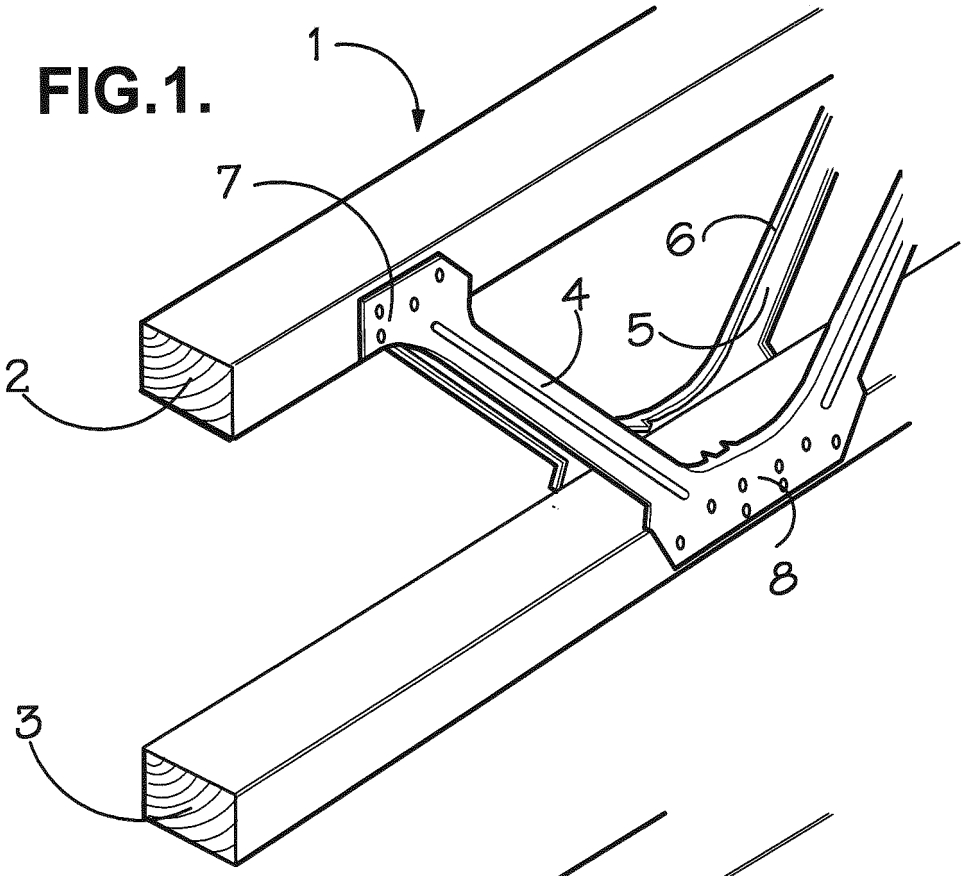
10. Composant de construction (1) selon la revendication 9, dans lequel le matériau (15) est flexible.

11. Composant de construction (1) selon la revendication 9 ou la revendication 10, dans lequel le matériau (15) est comprimé entre les membrures en bois (2, 3).

12. Composant de construction (1) selon l'une quelconque des revendications 9 à 11, dans lequel le matériau (15) est résistant au retrait quand il est soumis à des températures élevées.

13. Composant de construction (1) selon l'une quelconque des revendications 9 à 11, dans lequel le matériau (15) comporte de la laine de roche.

FIG.1.



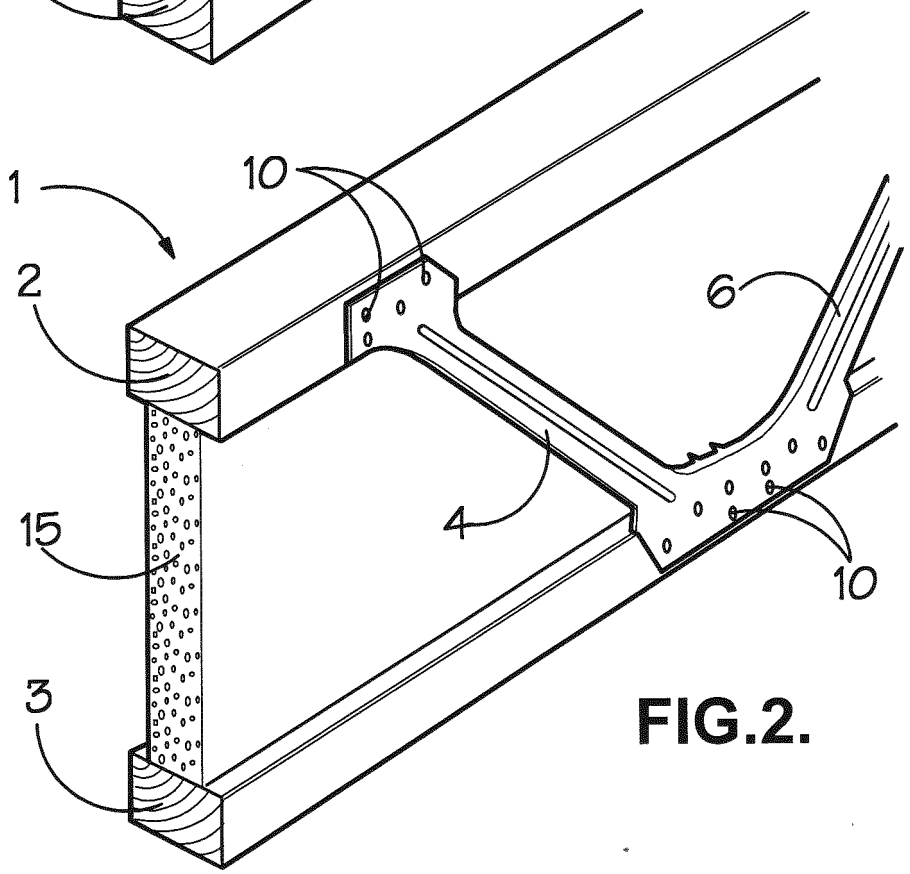


FIG.2.

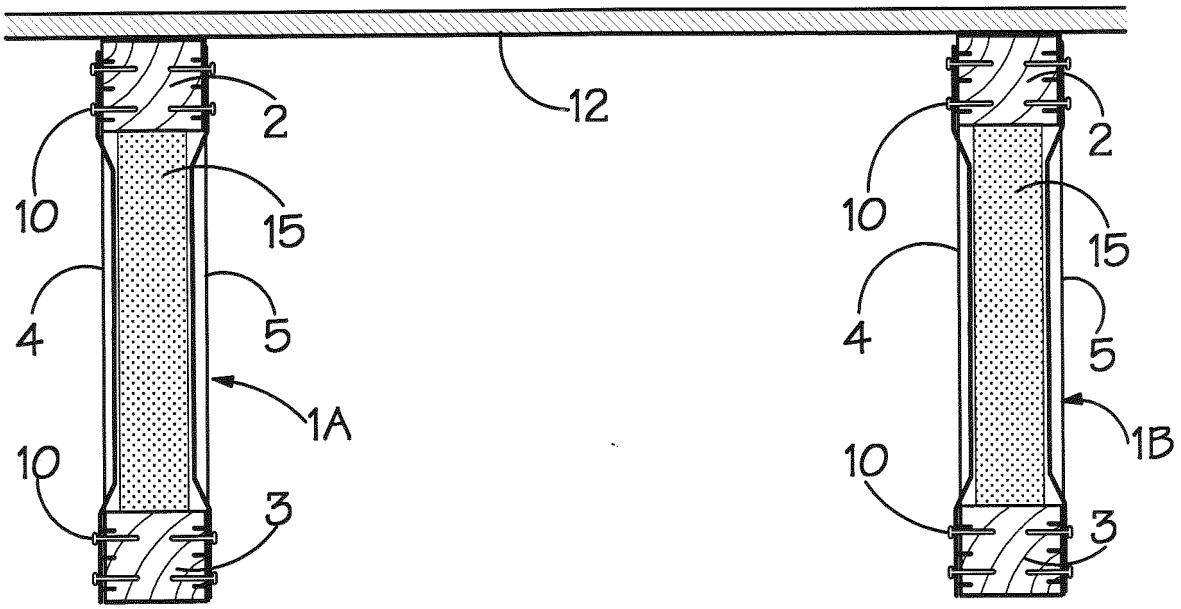


FIG.3a.

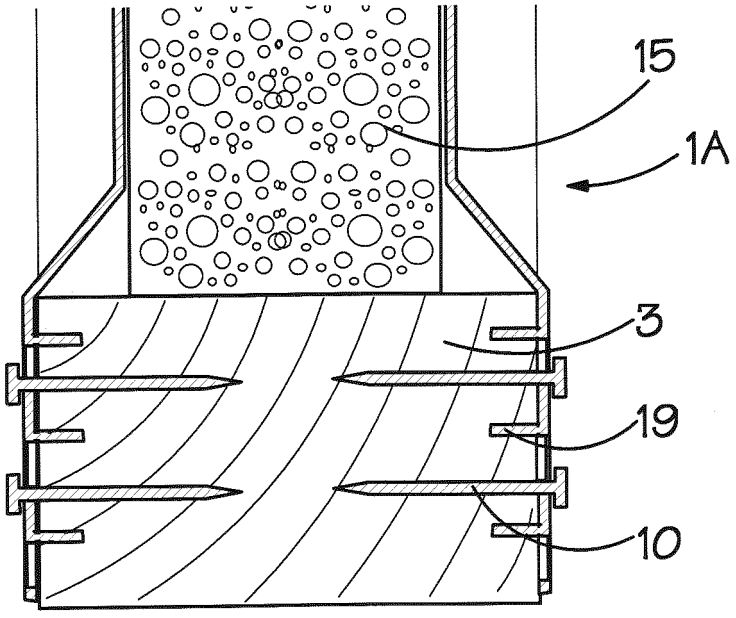


FIG.3b.

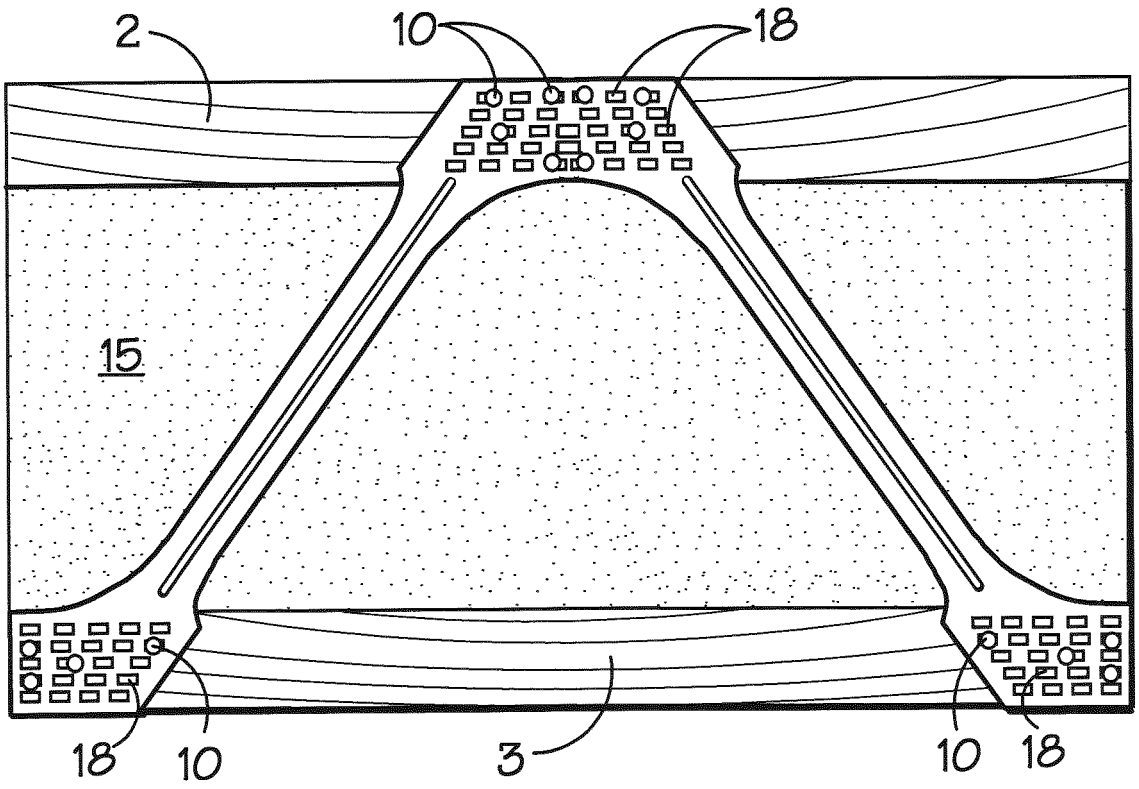


FIG.4.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 2470721 A **[0005] [0006]**
- EP 1609920 A **[0007]**
- US 4295318 A **[0007]**