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(54) **LIGHT BUILDING PANEL WITH HIDDEN CONNECTION AND METHOD OF MAKING OF HIDDEN CONNECTION OF LIGHT BUILDING PANELS**

LEICHTE BAUPLATTE MIT UNSICHTBARER VERBINDUNG UND VERFAHREN ZUR
HERSTELLUNG EINER SOLCHEN VERBINDUNG

PANNEAUX DE CONSTRUCTION LEGERS AVEC CONNEXION CACHEE ET PROCEDE DE
FABRICATION DE CES CONNEXIONS CACHEES

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(56) References cited:
EP-A- 0 615 032 **US-A- 5 247 770**

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Description

Description of the problem

[0001] The invention relates to the problem of connection of two adjacent light building panels manufactured with flexible core (filling) and arising out of lack of strength of material when one of the objectives is to join at least two adjacent light building panels and/or connect said building panels to the wall in such a way that the observer does not see the details of the connection. For the purposes of this application such a connection is called "hidden". In addition, the fire safety of such "hidden" connection may be at issue.

State of the art

[0002] The assembly of two light building panels is performed by fitting of one edge of the first building panel to corresponding groove of the second (adjacent) light building panel (cf. for example US 5 247 770 A) whereby one achieves vertical leveling of the panels as well as good connection between adjacent panels. The panels are therefor fixed using removable or non removable connection (i.e. with use of screws or bolts).

[0003] There are several solutions of hidden connections available when dealing with light building panels with relatively rigid filling such as polyurethane. Unfortunately, these solutions are not suitable for light building panels manufactured with softer, flexible cores (such as glass or rock wool). Shape-wise (i.e. connection of two elements relying primarily on shape of connecting elements) or force-wise (i.e. connection of two elements relying primarily on force one element is exerting on another) connection one or both panels to a foundation will enhance fire resistance of the panels. It is well known that during the fire the panels connection disassembles hence increasing air supply available to the fire.

Description of new solution

[0004] The subject of this invention is Light building panel with hidden connection and method of making of hidden connection of light building panels which solves above described technical problem. The essence of the invention is in covering of connecting means of an adjacent light building panel with parts of the first light building panel while at the same time load (stress) distributing elements (e.g. washers) are used to distribute the forces on the panels in event of e.g. wind. The distributing element enables distribution of the force onto larger surface so the allowable stresses are not exceeded. When comparing the proposed solution to already existing ones (even when applied to light building panels with relatively rigid cores such as polyurethane) one may emphasize the advantage of proposed system when compared to fire safety of existing connections.

[0005] According to applicant's available data the so-

lution proposed herein is the first hidden connection of panels with flexible (e.g. mineral wool) core. The essence of the invention is in design and use of appropriate distributing element which increases allowable stress at the connecting point and thereby enables suitability of hidden connection for softer and/or more flexible type of light building panel filling, i.e. mineral (rock, glass, ...) wool.

[0006] Light building panels are building elements and are used for facades or roofs and are typically comprised of outer shell (e.g. top layer) which gives said panel shape, and of filling (also called core for the purposes of this application) which is made of insulation material which gives said panel a level of rigidity as well as limits heat transfer through it. Typical filling (yet by no means exclusive) of light building panel is mineral or glass wall with density up to 150 kg/m³. Light building panels can be manufactured continuously. The outer layer or plurality thereof can be smooth or shaped (grooved etc.).

[0007] The connection (junction) of at least two adjacent light building panels can be covered (hidden) during assembly process to achieve aesthetic and protective results using protective covers (in this application jointly referred to as protective means). This protective means element serves several purposes. Due to its mechanical properties it serves as a device to strengthen the connection. At the same time it enables manufacturing of the connection whereby the outer layers (usually in form of metal sheet) of the first (e.g. left) and the second (e.g. right) panel are mechanically connected, either removably (e.g. screws) or non-removably (e.g. rivets). As a result of such mechanical connection the junction is less likely to separate during possible fire, and if it does separate, this occurs later during the fire sequence. Covered, and for purposes of this application also called hidden, connection (for purposes of this application called also junction) can also be achieved through connection through the back side of the wall (also called supporting structure) which is covered with light building panel and onto which the panels are attached. When joined, the panels fit together hence forming a labyrinth significantly limiting and in some cases even preventing supply of fresh air within the junction and resulting oxidation within the junction during the fire. In addition, the same arrangement impedes water access during rain hence diminishing or eliminating need for sealing. In a way of example, the connection using screws or bolts is described in this application as an example of connecting means, however, the connecting function can be achieved using other connecting means, so the description below holds also for other forms of connecting (e.g. rivets, adhesives, sautering etc.).

[0008] The described connection between the outer layer (in a way of example metal sheet) of the first (for the purposes of this application also called »left«) and the second (for the purposes of this application also

called »right«) light building panel provides for enhancement of mechanical characteristics of the junction. Higher load capacity of the junction is provided by load distributing means (such as washers) of larger surface used to distribute the load caused by the screw across larger area. In the way of example the load distributing means can be manufactured using cold deformation of metal sheet and feature strengthening elements around the edges and in the middle to enhance the rigidity of load distributing means element. Said element can also be manufactured of different material such as plastics.

[0009] The junction is designed in such a way that the load as generated by the connecting means is transferred from the part of the panel in contact with load distributing means via system "lip-groove" to the rest of the panel. The load distributing means element can be prestressed prior to assembly so that during the tightening of the screws (or bolt) it flattens out and comes into contact with the panel with most of its surface.

[0010] In addition to load distributing means the junction can be secured with other forms of removable connections, e.g. using screws.

[0011] The covering portion of the panel finally gives appearance of smooth surface of both panels and covers position of the junction thereby contributing to nicer, more uniform view of the surface without visible signs of connection other than narrow seam between two panels in contact.

[0012] The new invention is described in more detail below with description of embodiments and drawings whereby the drawings make integral part of this patent application and show:

Figure 1 shows the disassembled junction between two light building panels presenting insulation filling (1), upper (2), and lower (3) metal sheet of light building panel, covering part of the panel (4), load distributing means element (5), connecting means (6), connecting lip of the panel (8), and support construction (9, e.g. wall).

Figure 2 shows assembled junction of Figure 1.

Figure 3 shows load distributing means element with visible fold (7) alongside load distributing means element whereby said element is in prestressed arrangement.

Figure 4 presents the same junction as in previous figures using additional connecting means element (10), in this particular embodiment a screw, this arrangement presenting an additional option to improve characteristics of the junction from the view of load capability and fire hazard whereby the figure shows insulation (1), upper (2), and lower (3) metal sheet of light building panel, load distributing means element (5), screw (6), support construction, connecting means (10).

[0013] The embodiment as presented in this patent application comprises removable connecting means, in particular screw, which, at the same time, serves to connect at least one panel onto the support construction (i. e. wall). Both of light building panels are connected taking advantage of shape of connecting parts (i.e. shape-wise) whereby the junction can be disassembled if desired. The top layer (i.e. appropriately shaped metal sheet) of the left (2) light building panel with covering part (4) is positioned over the top layer of right light building panel and is in contact with it forming an overlap. At the same time there is a bore hole drilled through the light building panel, to receive the screw (6) which is screwed into the supporting structure (9). Screw head is positioned within the depression to be covered by covering part (4). This arrangement provides for better aesthetic, strength, and safety considerations. Figure 4 shows an embodiment which should experience reduced risk for break of the junction during the fire due to mechanical connection of both metal sheets.

[0014] The right light building panel can be screwed onto the supporting structure (9) during the assembly phase of both panels. In this case the lip comprising of load distribution means element (5) and connecting lip (8) of the panel fits the groove of the left light building panel and exerts the pressure on the left light building panel to secure appropriate level of waterproof ability and/or ability to shape-wise connect the adjacent panels. This could be modified so the lip would be comprised solely of connecting lip (8) if said arrangement would have had displayed sufficient strength. The joined panels are shown in Figure 2. The covering part of the panel (4) thereby prevents or limits water access to the connecting spot while the connecting lip (8) prevents or limits access of water between both panels as well as air access between the panels or into the space bounded by the panels.

[0015] Should one be satisfied with lower standards for sealability (displaying labyrinth-like ability) one could use less precise tools.

[0016] The material of top layer of light building panels (2,3) can be vary, from black or color metal sheet, to other metal materials as well as plastics and other non-metal materials. Materials can be combined, e.g. use of metal sheet coated by plastics.

[0017] In addition, the junction can be reinforced using reinforcing means, e.g. washers, profiles, ribs, filling, etc. to increase the strength and the load capability of said junction. In this case the reinforcing means element or plurality thereof is inserted under covering part (4) which therefore hides the reinforcing means. This reinforcement contributes to better load distribution onto larger area and therefore better load capacity of the panels whereby the aesthetic view of the panels is not significantly altered. The junction is in the embodiment performed with the screw (6) and additional load distribution means element (5) which also serves as reinforcement means element whereby the preferred form of said re-

inforcement means element is observed in figure 3.

[0018] The load distributing means element (5) can be in the embodiment reinforced on its edges with suitable design and manufacturing during production phase of said element, e.g. with process of cold deformation of its material, preferably steel sheet. The reinforcement is usually achieved with formation of the fold (7) which provides for sufficient rigidity of load distributing means element and appropriate distribution of load caused by screwing of screw (6) across essentially whole areas of load distributing means element. The fold can be manufactured by folding (bending) of the material or using appropriate deformation method with appropriate tools (e.g. cold pressing).

[0019] In the particular embodiment as described herein the load distributing means element (5) is slightly bent. During screwing of the screw the element is becoming flatter until the load is uniformly distributed hence the effect of prestressing has been achieved.

[0020] The form of the metal sheet surface (2,3) of the left and the right light building panel outside of the above described system of lip and groove is left to market expectations and is not subject of this patent application. It is shown for better understanding only.

[0021] One can also use the embodiment providing for mechanical connection of two panels. This embodiment is shown in figure 4 and provides for higher fire resistance than embodiment where only one panel is mechanically connected to the supporting structure (9) at the junction. In this embodiment the connection means according to the invention are comprised of at least one screw for connecting each of the panels onto the supporting structure whereby one of connecting means elements (10) extends through the supporting structure (9) and through connecting metal sheets of both light building panels as well as through load distributing means element (5).

[0022] It is self evident that the above described solution can be carried out in different embodiments from the ones described without effecting the essence of the invention, the extend of the protection being determined by the terms of the claims.

Claims

1. A light building panel having a filling of flexible material and having at least one edge surface adapted to form a hidden junction upon assembly alongside an adjacent similar building panel fitting therewith, when at least one of said light building panels is connected to a supporting structure (9) with a removable or non-removable connection, said hidden junction comprising a load distributing means element (5), a connecting means element (6), and a connecting lip (8),
characterised in that the load distributing means element is bent in a central part to take advantage

of flattening of said element and thereby a more even load distribution.

2. A light building panel according to claim 1 further **characterised in that** the filling material is mineral wool.
3. A light building panel according to claim 1 or claim 2, further **characterised in that** at least one hidden junction element (5, 6, 8) has a shape adapted to connect to the adjacent similar panel.
4. A light building panel according to any one of the preceding claims, further **characterised by** having protective means (4) adapted to protect said connection.
5. A light building panel according to claim 4, further **characterised in that** the load distributing means element (5) is adapted to be hidden by said protective means (4) upon assembly.
6. A light building panel according to any one of the preceding claims, further **characterised in that**, upon assembly, the panels overlap by means of the protective means (4) and connecting lip (8) whereby to significantly limit access of rainwater and air to the junction of the panels.
7. A light building panel according to any one of the preceding claims, further **characterised in that** the load distributing means element (5) is reinforced on its edge and/or central part.
8. A light building panel according to any one of the preceding claims, further **characterised in that** its design provides for load transfer from an edge of the panel which is not connected to a supporting structure (9) to the edge of the panel connected directly to a supporting structure via a lip-groove system on an inner or outer side of the panel.
9. An assembly of first and second adjacent light building panels in accordance with any one of the preceding claims, at least one of said light building panels being connected to a supporting structure (9) with a removable or non-removable connection, the panels being connected together by a hidden junction comprising a load distributing means element (5), a connecting means element (6), and a connecting lip (8), **characterised in that** the load distributing means element has a bent configuration in a central part before assembly to take advantage of flattening of said element upon assembly, and thereby a more even load distribution.
10. An assembly according to claim 9, adapted for both horizontal and vertical assembly of the panels.

11. An assembly according to claim 9 or claim 10, further **characterised in that** the connection between the panels comprises screws (6) and additional load distributing means elements (5) to distribute the load from the screws over a larger contact area. 5
12. An assembly according to any one of claims 9 to 11, further **characterised in that** reinforcements are provided alongside the junction by reinforcing means. 10
13. An assembly according to any one of claims 9 to 12, further **characterised in that** a single connecting element (10) extends through both light building panels and through a said load distributing means element (5). 15
14. A method of making a hidden junction between first and second light building panels having a filling of flexible material and having at least one edge surface adapted to form a hidden junction upon assembly alongside an adjacent similar building panel fitting therewith, comprising connecting at least one of said light building panels to a supporting structure (9) with a removable or non-removable connection, and forming said hidden junction with a load distributing means element (5), a connecting means element (6), and a connecting lip (8), **characterised in that** the load distributing means element has a bent configuration in a central part before assembly and is flattened on assembly to give a more even load distribution. 20 25 30

Patentansprüche 35

1. Leichte Bauplatte mit einer Füllung aus einem flexiblen Material und mindestens einer Randoberfläche, die so ausgebildet ist, dass sie entlang einer benachbarten, ähnlichen und damit zusammenpassenden Bauplatte einen verdeckten Anschluss bildet, wenn zumindest eine der leichten Bauplatten mit einer Trägerstruktur (9) über eine entfernbare oder nicht entfernbare Verbindung verbunden ist, wobei der verdeckte Anschluss ein Lastverteilungselement (5), ein Verbindungselement (6) und eine Verbindungslippe (8) aufweist, **dadurch gekennzeichnet, dass** das Lastverteilungselement (5) in einem zentralen Bereich gebogen ist, um den Vorteil eines Flachdrückens des Elements (5) und einer hierdurch bedingten gleichmäßigeren Lastverteilung zu nutzen. 40 45 50
2. Leichte Bauplatte gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Füllmaterial Mineralwolle ist. 55
3. Leichte Bauplatte gemäß Anspruch 1 oder 2, da-

durch gekennzeichnet, dass mindestens ein verdecktes Anschlusselement (5, 6, 8) zum Verbinden mit der benachbarten, ähnlichen Platte ausgestaltet ist.

4. Leichte Bauplatte gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** Mittel (4) zum Schutz der Verbindung vorgesehen sind.
5. Leichte Bauplatte gemäß Anspruch 4, **dadurch gekennzeichnet, dass** das Lastverteilungselement (5) so ausgebildet ist, dass es nach der Montage durch die Schutzmittel (4) verdeckt ist.
6. Leichte Bauplatte gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Platten über Schutzmittel (4) und die Verbindungslippe (8) nach ihrer Montage derart überlappen, dass ein Eintreten von Regenwasser und Luft durch den Plattenanschluss wesentlich beschränkt ist.
7. Leichte Bauplatte gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Lastverteilungselement (5) an seinem Rand und / oder in einem zentralen Bereich verstärkt ist.
8. Leichte Bauplatte gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ihre Gestaltung eine Lastübertragung von einem Rand der Platte, die nicht mit der Trägerstruktur (9) verbunden ist, auf den Rand der Platte, die unmittelbar mit einer Trägerstruktur (9) verbunden ist, über ein Lippe-Nut-System an einer inneren oder äußeren Seite der Platte ermöglicht.
9. Anordnung einer ersten und einer hierzu benachbarten zweiten leichten Bauplatte gemäß einem der vorhergehenden Ansprüche, wobei mindestens eine der leichten Bauplatten mit einer Trägerstruktur (9) über eine entfernbare oder nicht entfernbare Verbindung verbunden ist und die Platten über einen verdeckten Anschluss, der ein Lastverteilungselement (5), ein Verbindungselement (6) und eine Verbindungslippe (8) aufweist, miteinander verbunden sind, **dadurch gekennzeichnet, dass** das Lastverteilungselement (5) vor der Montage in einem zentralen Bereich von gebogener Gestalt ist, um den Vorteil des Flachdrückens des Elements (5) bei der Montage und eine hierdurch bedingte gleichmäßigere Lastverteilung zu nutzen.
10. Anordnung gemäß Anspruch 9, **dadurch gekennzeichnet, dass** sie sowohl für eine horizontale als auch eine vertikale Montage der Platten ausgestaltet ist.

11. Anordnung gemäß Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** die Verbindung zwischen den Platten Schrauben (6) und zusätzliche Lastverteilungselemente (5) aufweist, die die Last von den Schrauben (6) über einen größeren Kontaktbereich verteilen. 5
12. Anordnung gemäß einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** Verstärkungen entlang des Anschlusses durch Verstärkungsmittel vorgesehen sind. 10
13. Anordnung gemäß einem der Ansprüche 9 bis 12, **dadurch gekennzeichnet, dass** sich ein einziges Verbindungselement (10) sowohl durch beide leichten Bauplatten als auch durch ein Lastverteilungselement (5) erstreckt. 15
14. Verfahren zum Erzeugen eines verdeckten Anschlusses zwischen einer ersten und einer zweiten Bauplatte, die eine Füllung aus flexiblem Material sowie mindestens eine Randoberfläche haben, die so ausgebildet ist, dass sie nach ihrer Montage entlang einer benachbarten, ähnlichen und dazu passenden Bauplatte einen verdeckten Anschluss bildet, bei dem mindestens eine der leichten Bauplatten mit einer Trägerstruktur (9) mit einer entfernbaren oder nicht entfernbaren Verbindung verbunden und ein verdeckter Anschluss mit einem Lastverteilungselement (5), einem Verbindungselement (6) und einer Verbindungsrippe (8) gebildet wird, **dadurch gekennzeichnet, dass** das Lastverteilungselement vor der Montage eine gebogene Konfiguration hat und bei der Montage flachgedrückt wird, um eine bessere Lastverteilung zu erzielen. 20 25 30 35

Revendications

1. Panneau de construction léger ayant un remplissage de matériau souple, et ayant au moins une surface de bord adaptée pour former une jonction cachée lors de l'assemblage le long d'un panneau de construction similaire adjacent s'adaptant avec celui-ci, lorsqu'au moins un desdits panneaux de construction légers est connecté à une structure de support (9) à l'aide d'une connexion amovible ou inamovible, ladite jonction cachée comportant un élément formant moyen de répartition de charge (5), un élément formant moyen de connexion (6) et une lèvre de connexion (8), **caractérisé en ce que** l'élément formant moyen de répartition de charge est incurvé dans une partie centrale pour tirer avantage d'un aplatissement dudit élément, et ainsi d'une répartition de charge plus régulière. 40 45 50 55
2. Panneau de construction léger selon la revendication 1, **caractérisé de plus en ce que** le matériau

de remplissage est de la laine minérale.

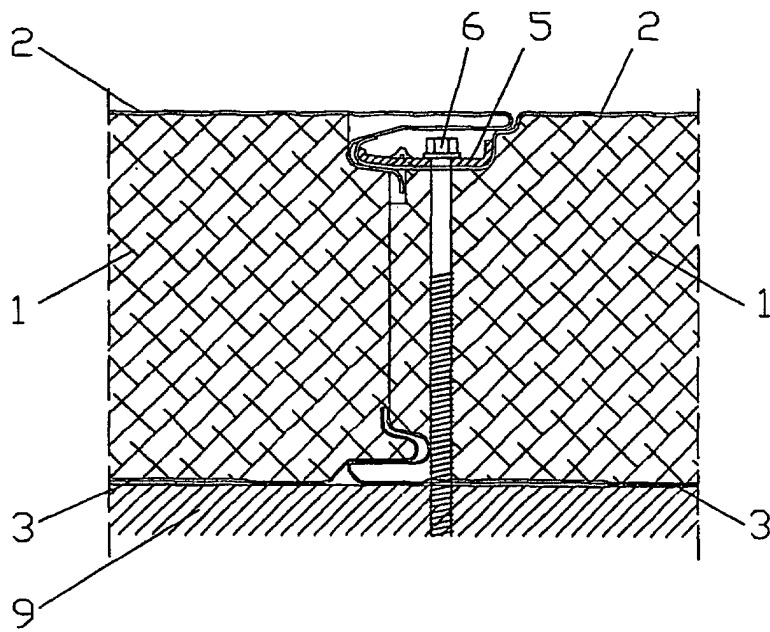
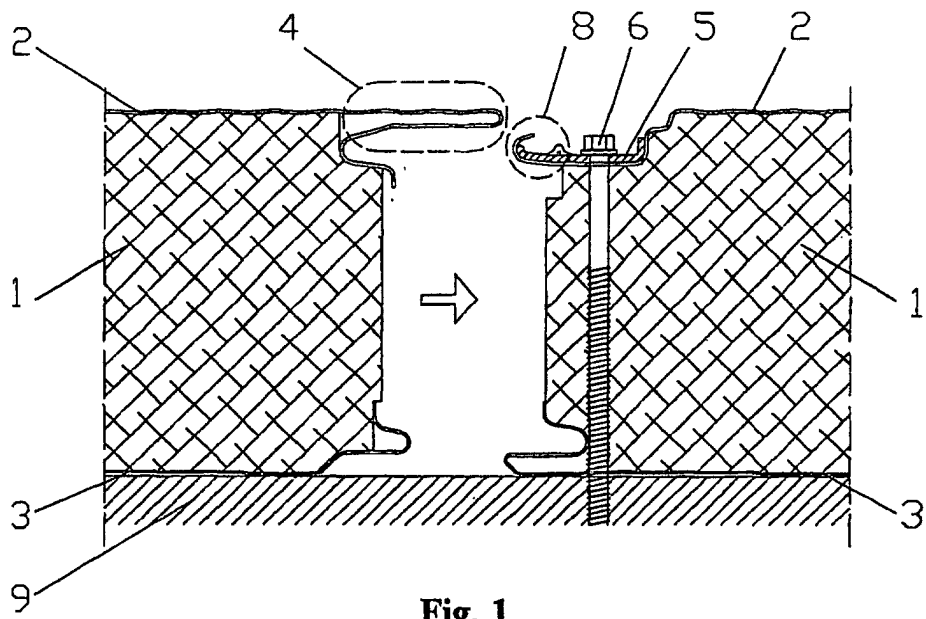
3. Panneau de construction léger selon la revendication 1 ou 2, **caractérisé de plus en ce qu'**au moins un élément de jonction cachée (5, 6, 8) a une forme adaptée pour connexion au panneau similaire adjacent.
4. Panneau de construction léger selon l'une quelconque des revendications précédentes, **caractérisé de plus en ce qu'il** a un moyen de protection (4) adapté pour protéger ladite connexion.
5. Panneau de construction léger selon la revendication 4, **caractérisé de plus en ce que** l'élément formant moyen de répartition de charge (5) est adapté pour être caché par ledit moyen de protection (4) lors de l'assemblage.
6. Panneau de construction léger selon l'une quelconque des revendications précédentes, **caractérisé de plus en ce que**, lors de l'assemblage, les panneaux se chevauchent par l'intermédiaire du moyen de protection (4) et de la lèvre de connexion (8), de manière à limiter de manière importante l'accès de l'eau de pluie et de l'air à la jonction des panneaux.
7. Panneau de construction léger selon l'une quelconque des revendications précédentes, **caractérisé de plus en ce que** l'élément formant moyen de répartition de charge (5) est renforcé sur son bord et/ou sa partie centrale.
8. Panneau de construction léger selon l'une quelconque des revendications précédentes, **caractérisé de plus en ce que** sa conception prévoit un transfert de charge à partir d'un bord du panneau qui n'est pas connecté à une structure de support (9) vers le bord du panneau connecté directement à une structure de support via un système de lèvre-gorge sur un côté intérieur ou extérieur du panneau.
9. Assemblage de premier et second panneaux de construction légers adjacents selon l'une quelconque des revendications précédentes, au moins un desdits panneaux de construction légers étant connecté à une structure de support (9) à l'aide d'une connexion amovible ou inamovible, les panneaux étant connectés ensemble par une jonction cachée comportant un élément formant moyen de répartition de charge (5), un élément formant moyen de connexion (6) et une lèvre de connexion (8), **caractérisé en ce que** l'élément formant moyen de répartition de charge a une configuration incurvée dans une partie centrale avant assemblage pour tirer avantage d'un aplatissement dudit élément lors d'un assemblage, et ainsi d'une répartition de charge plus régulière.

10. Assemblage selon la revendication 9, adapté à la fois pour un assemblage horizontal et vertical des panneaux.
11. Assemblage selon la revendication 9 ou 10, **caractérisé de plus en ce que** la connexion entre les panneaux comporte des vis (6) et des éléments formant moyens de répartition de charge supplémentaires (5) pour répartir la charge à partir des vis sur une surface de contact plus grande. 5
10
12. Assemblage selon l'une quelconque des revendications 9 à 11, **caractérisé de plus en ce que** des renforcements sont fournis le long de la jonction par l'intermédiaire de moyens de renforcement. 15
13. Assemblage selon l'une quelconque des revendications 9 à 12, **caractérisé de plus en ce qu'un** élément de connexion unique (10) s'étend à travers les panneaux de construction légers et à travers un élément formant moyen de répartition de charge (5). 20
14. Procédé de fabrication d'une jonction cachée entre des premier et second panneaux de construction légers ayant un remplissage de matériau souple, et ayant au moins une surface de bord adaptée pour former une jonction cachée lors de l'assemblage le long d'un panneau de construction similaire adjacent s'adaptant avec celui-ci, comportant les étapes consistant à connecter au moins un desdits panneaux de construction légers à une structure de support (9) à l'aide d'une connexion amovible et inamovible, et à former ladite jonction cachée à l'aide d'un élément formant moyen de répartition de charge (5), d'un élément formant moyen de connexion (6), et d'une lèvre de connexion (8), **caractérisé en ce que** l'élément formant moyen de répartition de charge a une configuration incurvée dans une partie centrale avant assemblage, et est aplati lors de l'assemblage pour donner une répartition de charge plus régulière. 25
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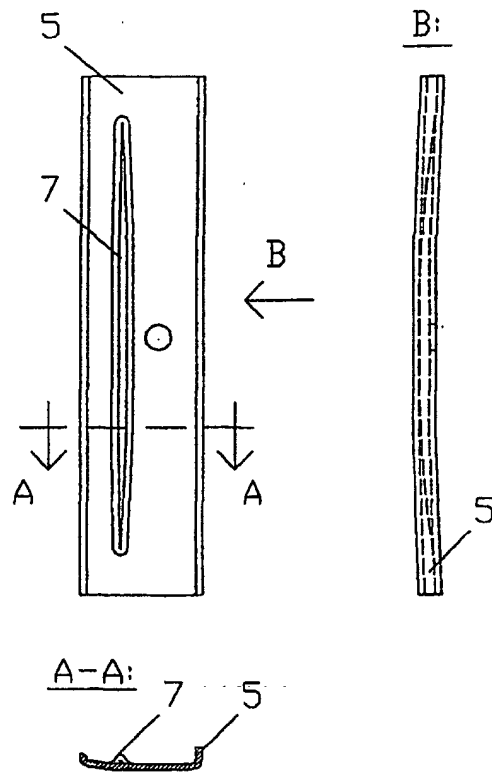


Fig. 3

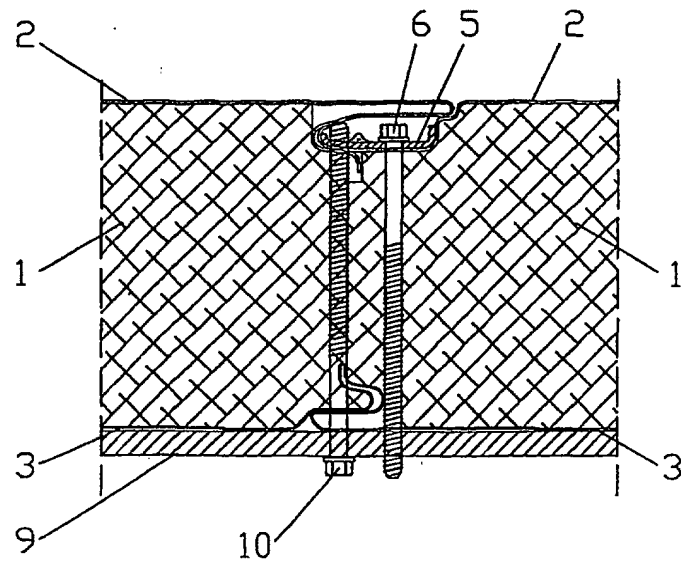


Fig. 4