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

(11) **EP 1 031 669 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
25.11.2009 Bulletin 2009/48

(51) Int Cl.:
E04B 1/24 *(2006.01)* ***E04B 9/12*** *(2006.01)*
E04B 5/14 *(2006.01)* ***E04B 1/58*** *(2006.01)*

(21) Application number: **99200494.5**

(22) Date of filing: **22.02.1999**

(54) **Building frames with sigma-profile**

Gebäuderahmen mit Sigma-Profilen

Cadres de profilés en sigma pour bâtiments

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB IT LI NL

(43) Date of publication of application:
30.08.2000 Bulletin 2000/35

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Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to elongate structural elements which may be fitted together to form a frame which may be used in the construction of buildings, e.g. for the construction of floors, intermediate platforms and ceilings, vertical walls including external, internal and partitioning walls or portal or roof frames.

TECHNICAL BACKGROUND

[0002] A structural element for erecting buildings, and also for erecting building models is described in DE 3 532 846 including a bar-type frame having a U-profile, which is open at the top, as base profile and a U-profile, which is open at the bottom, as top profile and also having posts and struts which connect base and top profiles and compromise a C-profile. The base profiles and the top profiles are configured such that they can be plugged together, and fixed, in each case at their ends via plug-in connectors to form a top frame corresponding to the building outline. The base profiles and the top profiles are provided in each case with a number of plug-in shoes which corresponds to the number of the posts provided, which shoes are held displaceably and fixedly on the relevant base or head profile and into which the posts are plugged by their free ends.

[0003] DE 806 388 describes a method to couple crossing U-profiles. In the web of one of the profiles, tongues are provided, to which the second profile is coupled by welding. FR 2 098 274 discloses a frame comprising two U-profiles, which web of the profile is provided with a number of tongues directed inwards the recess of the U-profile. Secondary profiles, provided in a substantially perpendicular direction to the U-profiles, extend into the recess of the U-profile. The secondary profiles are coupled to the U-profiles by welding the outer ends of the secondary profiles to the tongues.

[0004] One disadvantage of the known method of inserting one member into the open space of a U-or C-profile member and using bolts or screws to locate the two together is that bolt heads or nuts are left on the outside of the frame. Also special shoes and connecting pieces are required which increase the number of parts, make the installation more time consuming as it is sometimes necessary to fumble about to obtain the correct location of small connection pieces while holding two or more structural elements in place, provide the possibility of danger to persons working below if loose connectors or shoes are allowed to fall, and provide additional points where bolts may loosen resulting in connections becoming loose and unreliable. Finally, placing bolts through the flanges of U-shaped profiles is not mechanically very strong.

[0005] It is the object of the present invention to provide a frame particularly for buildings which avoids at least some of the disadvantages of known devices.

[0006] In particular, the present invention provides a frame which can be easily and reliably put together on site, which involves less parts, in particular less small parts which can be easily dropped, provides a clean surface to the members of the frame uninterrupted by bolt heads and is strong and rigid.

SUMMARY OF THE INVENTION

[0007] The present invention relates to a frame as claimed which includes elongate structural elements with a longitudinal web and at least two longitudinal flanges which extend away from the web at an angle, the flanges extending from the at least the same side of the web and the web and flanges forming a longitudinal recess between the flanges, and a plurality of transverse tongues spaced along the web and extending from the web into the recess, the tongues being formed integrally with, and from the same material as, the web. Preferably the tongues do not extend further than the envelope of the flanges and web which encloses the recess. The plane of the transverse tongues may be a right angles to the web.

[0008] The frame comprises at least two first elongate structural elements, each first structural element having a longitudinal web and at least two longitudinal flanges which extend substantially at an angle form the web, the flanges extending from at least the same side of the web and the web and flanges forming a longitudinal recess between the flanges; a plurality of transverse tongues spaced along the web and extending from the web into the recess, the tongues being formed integrally with, and from the same material as, the web; and a plurality of second elongate structural element having two ends, each end of the second elongate structural element being connected directly to one of the tongues of one of the first structural elements. Preferably, at least one of the outer longitudinal edges of second structural element is flush with an outer longitudinal edge of the first structural element. Where the frame has been connected together with nuts and bolts it is demountable into its component parts.

[0009] The present invention will now be described with reference to the following drawings.

DETAILED DESCRIPTION OF THE DRAWINGS

[0010]

Figs. 1A to 1H show structural profiles which may be used with the present invention.

Fig. 2 shows schematically a first embodiment of the present invention.

Figs. 3A and B show suitable end preparation of secondary beams for use with the first embodiment.

Fig. 4 shows schematically a second embodiment of the present invention.

Fig. 5 shows a suitable end preparation of a secondary beam for use with the second embodiment.

Fig. 6 shows a frame constructed in accordance with an embodiment of the present invention.

Fig. 7 shows a suitable transport arrangement of main beams.

Fig. 8 is a cross-sectional representation of a main beam.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

[0011] The present invention will be described with respect to certain embodiments and certain drawings but the invention is not limited thereto but only by the claims. The drawings are schematic.

[0012] Fig. 1 shows certain structural profiles which may be used with the present invention. Fig. 1A shows an "H"-profile, Fig. B shows a "C"-profile made up of three socalled "Sigma"-profiles, Fig. 1C shows a very simple "C"-profile in which the flanges 4 on both sides of the web 2 have the same length whereas Fig. 1D shows a simple "C"-profile in which one flange 4A is larger than the other flange 4B. Fig. 1E to 1H show in cross section further structural profiles which may be used with the present invention. Fig. 1E is often referred to as a "C-plus"-profile, Fig. 1F is a "C"-profile, Fig. 1G is a "Sigma"-profile and Fig. 1H is a "Sigma plus"-profile.

[0013] All the profiles of Fig. 1 include a web 2 and two flanges 4 which extend away from the web 2 at substantially a right angle with respect to web 2. The two flanges 4 extend away from web 2 at least on one side of web 2. As can be seen from Fig. 1B and Fig. 1G and 1H the web 2 need not be a completely flat web but may be corrugated or recessed either longitudinally or laterally in any suitable manner including the provision of holes. Further, as can be seen from Fig. 1B, Fig. 1E, Fig. 1H and Fig. 1A the flanges 4 may also include additional shapes such as longitudinal or lateral recesses or folds or seams or holes. The present invention also includes the use of "U"-profiles which may be looked upon as an arcuate web 2 with two flanges 4 attached thereto. Further, the present invention includes structural members with more than two flanges (Fig. 1A may be considered to have four flanges).

[0014] Fig. 2 is a schematic representation of a first embodiment of the present invention. A structural element 6 (the main beam) has a profile similar to that described with respect to any of the profiles of Fig. 1. It includes a web 2 and at least two flanges 4 which extend away from the web parallel to each other and substantially at right angles to web 2 when referred to the plane in which the web 2 lies as well as extending at right angles to the longitudinal axis of the element 6. The flanges 4 extend away from the web at least on one side of the web 2 to form a longitudinal recess therebetween. The structural element 6 is preferably a cold-rolled or cold-drawn metal profile, particularly one made of steel which may be galvanised or painted or coated with any suitable corrosion protection such as plastic coatings and including combinations of galvanising and paint. At a plurality of predetermined positions along the structural element 6 tongues 10 are formed in the web 2, for example by stamping and bending the web material to form each tongue 10. Hence, the tongue 10 is integral with web 2 and made from the same material. The join-line between tongue 10 and web 2 runs in the plane of the web 2 and substantially perpendicular to the longitudinal direction of the structural element 6. This will be referred to in accordance with the present invention as the provision of transverse tongues 10 in web 2.

[0015] Where the tongue has been bent from the web 2 a hole 12 is left. The tongue 10 is bent towards the side of web 2 from which the flanges 4 extend. Preferably, the web material is a ductile material such as steel which allows such a bend without significant affect on the mechanical properties of the tongue 10. For instance, steel with a yield stress between 250 and 420 MPa is suitable. Preferably, the profile of the main beam 6 has at least a longitudinal flat section between the two flanges 4 from which the tongues 10 may be easily formed. Particularly suitable profiles are "C", "C-plus", "Sigma" and "Sigma-plus". As shown the plane in which tongue 10 lies is perpendicular to the longitudinal direction of structural element but the present invention is not limited thereto.

[0016] Preferably the length of tongue 10 is not sufficient to extend beyond a line joining the ends or extremities of flanges 4. This means that the tongue 10 lies within the envelope defined by web 2 and flanges 4. After the formation of the tongues 10 structural element 6 may be placed flat onto a surface either with the outer side of the web 2 downwards on the substrate or the flanges 4 onto the substrate and tongue 10 will not touch, mark or damage any such substrate. Further, the use of the web material of a main beam has the advantage that the tongue 10 has a material thickness which provides considerable mechanical strength. In the formation of a frame such as a wall, floor or ceiling frame about 80% of the frame is made from lighter weight secondary beams which join two main beams 6 together. The low percentage of main beams 6 means that these can be made from flat strip having a considerable thickness without increasing the overall weight of the frame significantly. The material used for a main beam 6 may be steel with a thickness of between 3 and 4mm whereas secondary joining beams may have a material thickness of between 1.5 and 2mm. The use of the web 2 of main beams 6 to form the tongues 10 is therefore superior to forming tongues or fastening tabs in the lighter gauge secondary beams.

[0017] Tongues 10 may be provided with circular or oval fixing holes 11 or similar fixing devices which are preferably pre-punched in tongue 10 before it is stamped out and bent from web 2. The punching and bending of tongue 10 may be done in flat metal sheet prior to the cold-rolling process which forms the profile structural element 6 or tongue 10 may be stamped into web 2 and bent after profile structural element 6 has been formed.

[0018] In order to attach a secondary beam 8 at right angles to a main beam 6 as part of the construction of a rectangular frame the secondary beam 8 is bolted to the tongue 10. Secondary beam 8 has a sigma or sigma+ profile. The secondary beam 8 is be prepared so that it may slide into the recess formed by web 2 and flanges 4 of the main beam 6. As shown in Fig. 3A and 3B this is carried out by removing a portion of one of the flanges 14 so that secondary beam 8 slides into the recess formed between flanges 4 and web 2 of the main beam 6. Two or more suitably located holes 16 are provided which match holes 11 of tongue 10 and which may be used for securing the secondary beam 8 to the main beam 6 using bolts or rivets or similar. When the exact dimensions of the frame are known beforehand, the preparation of the ends of the secondary beams 8 may be made in advance. The ends of the secondary beam 8 may be dimensioned so that the end face of secondary beam 8 abuts the inside of web 2. Thus, the length of tongue 10 may be relatively short. When the secondary beam 8 is loaded in a direction parallel to and transverse to the web 12 of the secondary beam 8, the bending moment caused by the spatial distance between web 2 of the main beam and the centre line of holes 11 is reduced to a minimum. This reduces the torsional load on the main beam 6. Any attempt of the main beam 6 to rotate will be stopped by the end face of secondary beam 8 touching the web 2 and/or the outer edges of the secondary beam 6 touching one of the flanges 4 of the main beam and preventing further rotation.

[0019] The asymmetrical end preparation of secondary beams 8 as shown in Figs. 3A and B allows one flange 14 (the upper one in the drawings) of the secondary beam 8 to be flush with the upper flange 4 of the main beam 6. This provides one flat surface, without bolt heads onto which a floor or ceiling boards may be laid or placed directly.

[0020] A second embodiment of the present invention is shown schematically in Fig. 4 and 5. The reference numerals used in Fig. 4 and 5 which are identical to the reference numbers of Fig. 2 and 3 relate to the same components. The main difference between the second embodiment and the first embodiment is shown in Fig. 5 and is caused by the fact that the secondary beam 8 has the same width as the main beam 6. Both flanges 14 of the secondary beam 8 are removed at an end portion in order to produce a jointing tab with holes 16 for connection to the tongue 10 through holes 11 of the main beam. The advantage of the second embodiment is that the secondary beam 8 is located symmetrically with respect to the main beam 6 whereas the secondary beam 8 of the first embodiment is not located symmetrically with respect to the main beam 6. Thus both sides of a frame constructed in this manner are flat. One disadvantage of the second embodiment is that the tab at the end of the secondary beam 8 which is connected to the tongue 10 may be less rigid than the similar tab for connection to the tongue 10 of the first embodiment because in the second embodiment both stiffening flanges 14 are removed. For this reason it is preferred if web 12 of the secondary member 8 in accordance with the second embodiment has itself a three-dimensional reinforcing structure so that the tab used for connection to tongue 10 maintains more rigidity than a simple flat sheet of metal. For this reason a profile such as a "Sigma" profile is used in the invention.

[0021] Certain advantages of the present invention may be understood from the above description. First of all because the tongues 10 do not extend beyond the envelope formed by the flanges 4 and web 2 of the structural element 6, the tongue 10 is not easily damaged during transport. Additionally, structural elements 6 may be stacked together as shown in Fig. 7 in a nested way allowing the minimum volume for transport. The tongues 10 can be offset longitudinally to avoid tongues from two beams colliding directly.

[0022] A further advantage of the present invention is that there are no bolt or rivet heads which project from the web 2 of the main beam 6 on the side which is remote from flanges 4. This allows frames 18 to be placed together as shown schematically in Fig. 6. Each frame 18 consists of two main beams 6 attached by cross members 8 which are secondary beams and which are connected to the main beams 6 by the tongues 10 as has been described with respect to the first and second embodiments. To provide alternative arrangements at the ends of the main beams 6, the holes 12 may be alternatingly placed in front of and behind the tongue 10 in the longitudinal direction of the main beam 6. The end of a main beam 6 may be chosen so that a hole 12 is removed when the main beam 6 is cut to length leaving the tongue 10 firmly attached to the main part of the web 2 immediately at the end of the main beam 6. These frames 18 may be placed together with no space between the abutting main members 6 as shown schematically in the enlarged cross section of the beams 6 joining in the centre of Fig. 6. Further, the lack of bolt heads means that other coatings, panels or materials may be applied to the outer surface of web 2 without being disturbed by bolt heads.

[0023] Secondary beam 8 is joined directly to the tongue 10 which is a part of main beam 6. Hence, secondary beam 8 is joined directly to main beam 6. No loose connecting pieces other than bolts or rivets are used to form the frame 18 which reduces the number of parts, speeds up installation and avoids having to carry or fit structural connectors which may be a danger to others or may get lost or stolen or used on other jobs.

[0024] A further advantage may be appreciated when the frame 18 is used horizontally as a floor support and carries a load, e.g. up to 500 kg/m^2. Loads on the secondary beams 8 are transferred to the main beams 6 by means of transverse tongues 10. When frame 18 is used horizontally the transverse tongues 10 extend horizontally into the recess between flanges 4 with the plane of tongue 10 being vertical. The downward force on the tongue 10 by the secondary beam 8 is supported by the

full width of the tongue 10 where it joins web 2. This design feature combined with the fact that the thickness of the main beam web 2 is preferably larger than the thickness of the secondary web 12 and that the distance of the bolts or rivets to the web 2 is small means that a frame 18 made in accordance with the present invention has a greater load bearing capability, alternatively can be made with lighter gauge material for a given maximum loading.

[0025] A suitable cross-section profile of a main beam 6 is shown in Fig. 8. The width W of the web 2 may be typically 140 to 350 mm and the width B of the flange 4 may be typically 60 to 120 mm The ratio W/B is preferably 2 or more, typically 2.5 to 5. When the web material is steel the thickness of the material is typically 1.5 to 4mm. The width of the tongue 8 is typically 30% to 60% of W. The length of the tongue Y is typically less than 70% of W, for example 30 to 70% W. These dimensions specify a relatively slim profile to the main beam 6. As the tongue 10 does not extend beyond the envelope of the flanges 4 and the web2, the length of the tongue 10 is relatively short. As explained above this reduces the torsion on the main beam 6 when frame 18 is horizontal and vertical loads placed on the secondary beams 8 are transferred from the secondary beam 8 to the main beam 6. It is preferred if the main beam profile is a C or C+ profile and the secondary beam has a Sigma or Sigma + profile.

[0026] Although the present invention has been described with respect to certain embodiments and drawings the present invention is not limited thereto but includes modifications as would be known to the skilled person.

[0027] The plane of transverse tongues 10 has been described as extending at right angles to the web 2 into the recess between the flanges 4 but the present invention is not limited thereto. The plane of at least some of the transverse tongues 10 may be placed at a different angle. For instance, the plane may be placed at 45° or 60° to the web 2. These angled tongues 10 may be used to connect secondary beams 8 at an angle of 45° or 60° to the main beams 6, respectively while keeping the secondary beam 8 and the main beam 6 in the same plane. This may provide a locking or bracing of the frame 18 as it introduces a triangular structure so that it is more rigid with respect to lateral forces. It is preferred if the angled tongues 10 are made from the same material as the web 2 and only bent through an acute angle so that the holes 11 in the tongues 10 may be accessed through the holes 12 in web 2. Holes 12 may be used for other purposes, e.g. for cables pipes, and other services which need to be introduced under the floor or in the ceiling of a building.

[0028] Further, the invention has been described mainly with respect to a main beam with only two flanges on one side of the web. The present invention also includes the use of more than two flanges. For instance, with a metal profile as shown in Fig, 1A with an "H"-profile, the tongues 10 may be formed alternatingly extending into the longitudinal recess between the flanges on one side of the central web and in the recess between the flanges on the other side of the central web. With such a main beam it is possible to connect secondary members alternatingly to one side of the H and to the other, thus forming a frame with a central "H"-profile main beam and secondary beams extending from both sides of the H profile beam in opposite directions.

[0029] The structural elements 6, 8 have been described as being made from metal but they may also be made from any suitable structural material, e.g. glass-fibre or carbon fibre reinforced plastics.

Claims

1. A frame (18) comprising:

at least two main elongate structural elements (6), each main structural element having at least two first longitudinal flanges (4) with a first longitudinal web (2) therebetween, the first longitudinal flanges extending substantially at right angles to the first web, the first longitudinal flanges extending from at least the same side of the first web and the first web and flanges forming a longitudinal recess between the first longitudinal flanges;

a plurality of transverse tongues (10) spaced along each first web and extending from the first web into the recess, the tongues being formed integrally with, and from the same material as, the first web;

a plurality of secondary elongate structural elements (8) held between the two main elongate structural elements, each secondary elongate structural element having two ends, each end of a secondary elongate structural element being directly connected to one of the tongues of a corresponding one of the main structural elements, the secondary elongate structural elements having at least two second longitudinal flanges (14) with a second longitudinal web (12) therebetween, the second longitudinal flanges extending from the same side and at right angles to the second web;

said frame is **characterised in that**

the secondary elongate element having a "Sigma" or "Sigma +" profile;

an outer surface, remote from the second web, of at least one of the second longitudinal flanges of the secondary elongate structural element being aligned with an outer surface, remote from the first web, of a corresponding one of the first longitudinal flanges;

a portion of the at least one of the second longitudinal flanges of the plurality of the secondary elongate structural elements being removed at the respective end of the secondary elongate structural elements to form tabs, each tab ex-

tending into the longitudinal recess of the corresponding first elongate structural element, holes (16) in the tabs being aligned with holes (11) in the tongues to which they are connected for connecting with a fixing device, and each tab including a three-dimensional reinforcing structure.

2. The frame (18) according to claim 1, wherein the tabs and tongues (10) are connected by rivets or bolts.

3. The frame (18) according to claim 1 or 2, wherein an outer surface of each of the two first longitudinal flanges is aligned with a respective outer surface of each of the second longitudinal flanges.

4. The frame (18) according to any previous claim, wherein the three-dimensional reinforcing structure is formed by the web of the Sigma profile secondary elongate structural element (8).

5. The frame (18) according to any previous claim, wherein the first web (2) has a longitudinal flat portion between the first longitudinal flanges (4) and the transverse tongues (10) are made from the flat portion.

6. The frame (18) according to any previous claim, wherein the main structural element (6) has an "H", a "C", a "C-plus", a "Sigma" or a "Sigma-plus" profile.

7. The frame (18) in accordance with any previous claim, wherein the transverse tongues (10) do not extend into the longitudinal recess further than the envelope of the first longitudinal flanges (4) and the first web (2) which encloses the recess.

8. The frame (18) in accordance with any previous claim wherein the outer surfaces of the main structural element (6) is free of bolt heads or nuts or rivets.

9. The frame (18) in accordance with any previous claim wherein the end faces of the ends of the secondary structural elements (8) abut the inside of the first web (2) of the main structural elements (6).

10. The frame(18) according to any previous claim, used as a load bearing frame in the construction of a floor, wall, ceiling, portal frame or roof frame of a building.

11. The frame (18) according to any previous claim, the main elongate structural elements (6) are cold-rolled or cold-drawn elongate structural elements.

12. The frame (18) according to any previous claim, the main elongate structural elements (6) have a material thickness of between 3 mm and 4 mm.

13. The frame (18) according to any previous claim, the secondary elongate structural elements (8) have a material thickness of between 1.5 mm and 2 mm.

Patentansprüche

1. Rahmenwerk (18), umfassend:

mindestens zwei längliche Hauptbauelemente (6), wobei jedes Hauptbauelement mindestens zwei erste längliche Flansche (4) mit einem ersten länglichen Steg (2) dazwischen aufweist, wobei sich die ersten länglichen Flansche im Wesentlichen in rechten Winkeln zu dem ersten Steg erstrecken, wobei die ersten länglichen Flansche von mindestens derselben Seite des ersten Steges abstehen und der erste Steg und die Flansche eine längliche Vertiefung zwischen den ersten länglichen Flanschen bilden;
mehrere Querzungen (10), die entlang dem ersten Steg beabstandet sind und sich von dem ersten Steg in die Vertiefung erstrecken, wobei die Zungen integral mit dem ersten Steg und aus demselben Material wie dieser gebildet sind;
mehrere zweite längliche sekundäre Bauelemente (8), die zwischen den zwei länglichen Hauptbauelementen gehalten werden, wobei die länglichen sekundären Bauelemente zwei Enden aufweisen, wobei jedes Ende des länglichen sekundären Bauelements direkt an eine der Zungen eines entsprechenden der Hauptbauelemente angeschlossen ist, wobei die länglichen sekundären Bauelemente mindestens zwei zweite längliche Flansche (14) mit einem zweiten länglichen Steg (12) dazwischen aufweisen, wobei die zweiten länglichen Flansche von derselben Seite und in rechten Winkeln zu dem zweiten Steg abstehen;
wobei das Rahmenwerk **dadurch gekennzeichnet ist, dass**
das sekundäre längliche Element ein "Sigma"- oder "Sigma+"-Profil aufweist;
eine Außenfläche, fern von dem zweiten Steg, von mindestens einem der zweiten länglichen Flansche des länglichen sekundären Bauelements mit einer Außenfläche, fern von dem ersten Steg, eines entsprechenden der ersten länglichen Flansche ausgerichtet ist;
ein Abschnitt des mindestens einen der zweiten länglichen Flansche der Vielzahl der sekundären länglichen Strukturelemente an dem jeweiligen Ende der sekundären länglichen Bauelemente entfernt ist, um Laschen zu bilden, wobei sich jede Lasche in die längliche Vertiefung des entsprechenden ersten länglichen Bauelements erstreckt, wobei Löcher (16) in den La-

schen mit Löchern (11) in den Zungen ausgerichtet sind, mit welchen sie mit einer Befestigungsvorrichtung verbunden sind, und jede Lasche eine dreidimensionale Verstärkungsstruktur aufweist.

2. Rahmenwerk (18) nach Anspruch 1, wobei die Laschen und Zungen (10) durch Nieten oder Bolzen verbunden sind.

3. Rahmenwerk (18) nach Anspruch 1 oder 2, wobei eine Außenfläche jedes der zwei ersten länglichen Flansche mit einer jeweiligen Außenfläche jedes der zweiten länglichen Flansche ausgerichtet ist.

4. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei die dreidimensionale Verstärkungsstruktur durch den Steg des sekundären länglichen Bauelements (8) mit dem Sigma-Profil gebildet ist.

5. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei der erste Steg (2) einen länglichen flachen Abschnitt zwischen den ersten länglichen Flanschen (4) aufweist und die Querzungen (10) aus dem flachen Abschnitt bestehen.

6. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei das Hauptbauelement (6) ein "H"-, ein "C"- ein "C-plus"-, ein "Sigma"- oder ein "Sigma-plus"- Profil aufweist.

7. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei sich die Querzungen (10) nicht weiter in die längliche Vertiefung erstrecken als die Ummantelung der ersten länglichen Flansche (4) und des ersten Steges (2), die die Vertiefung umschließt.

8. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei die Außenflächen des Hauptstrukturelements (6) frei von Bolzenköpfen oder Muttern oder Nieten sind.

9. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei die Endflächen der Enden der sekundären Bauelemente (8) an der Innenseite des ersten Steges (2) der Hauptbauelemente (6) liegen.

10. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, das als Last tragendes Rahmenwerk in der Konstruktion eines Bodens, einer Wand, einer Decke, eines Portalrahmens oder eines Dachrahmens eines Gebäudes verwendet wird.

11. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei die länglichen Hauptbauelemente (6) kalt gewalzte oder kalt gezogene längliche Bauelemente sind.

12. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei die länglichen Hauptbauelemente (6) eine Materialdicke zwischen 3 mm und 4 mm haben.

13. Rahmenwerk (18) nach einem der vorangehenden Ansprüche, wobei die sekundären länglichen Bauelemente (8) eine Materialdicke zwischen 1,5 mm und 2 mm haben.

Revendications

1. Cadre (18) comprenant :

au moins deux éléments structurels allongés principaux (6), chaque élément structurel principal ayant au moins deux premières brides longitudinales (4) avec une première âme longitudinale (2) entre ces dernières, les premières brides longitudinales s'étendant sensiblement à angle droit par rapport à la première âme, les premières brides longitudinales s'étendant à partir d'au moins le même côté de la première âme, et la première âme et les brides formant une partie en retrait longitudinale entre les premières brides longitudinales ;
une pluralité de languettes transversales (10) espacées le long de chaque première âme et s'étendant à partir de la première âme dans la partie en retrait, les languettes étant formées d'un seul tenant avec la première âme et de la même matière que cette dernière ;
une pluralité d'éléments structurels allongés secondaires (S) maintenus entre les deux éléments structurels allongés principaux, chaque élément structurel allongé secondaire ayant deux extrémités, chaque extrémité d'un élément structurel allongé secondaire étant directement reliée à une des languettes d'un élément correspondant des éléments structurels principaux, les éléments structurels allongés secondaires ayant au moins deux secondes brides longitudinales (14) avec une seconde âme longitudinale (12) entre ces dernières, les secondes brides longitudinales s'étendant à partir du même côté et à angle droit par rapport à la seconde âme ;
ledit cadre est **caractérisé en ce que** :

l'élément allongé secondaire a un profil en « Sigma » ou en « Sigma + » ;
une surface extérieure, distante de la seconde âme, d'au moins une des secondes brides longitudinales des éléments structurels allongés secondaires est alignée sur

une surface extérieure, distante de la première âme, d'une bride correspondante des premières brides longitudinales ;
une partie de l'au moins une des secondes brides longitudinales de la pluralité des éléments structurels allongés secondaires est enlevée au niveau de l'extrémité respective des éléments structurels allongés secondaires pour former des pattes, chaque patte s'étendant dans la partie en retrait longitudinale du premier élément structurel allongé correspondant, des trous (16) dans les pattes étant alignés sur des trous (11) dans les languettes auxquelles elles sont reliées pour connexion à un dispositif de fixation, et chaque patte incluant une structure de renfort tridimensionnelle.

2. Cadre (18) selon la revendication 1, dans lequel les pattes et les languettes (10) sont reliées par des rivets ou des boulons.

3. Cadre (18) selon la revendication 1 ou 2, dans lequel une surface extérieure de chacune des deux premières brides longitudinales est alignée sur une surface extérieure respective de chacune des secondes brides longitudinales.

4. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel la structure de renfort tridimensionnelle est formée par l'âme de l'élément structurel allongé secondaire à profil en Sigma (8).

5. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel la première âme (2) a une partie plate longitudinale entre les premières brides longitudinales (4), et les languettes transversales (10) sont faites à partir de la partie plate.

6. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel l'élément structurel principal (6) a un profil en « H », en « C », en « C-plus », en « Sigma » ou en « Sigma-plus ».

7. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel les languettes transversales (10) ne s'étendent pas dans la partie en retrait longitudinale plus loin que l'enveloppe des premières brides longitudinales (4) et de la première âme (2) qui englobe la partie en retrait.

8. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel les surfaces extérieures de l'élément structurel principal (6) sont exemptes de têtes de boulon ou d'écrous ou de rivets.

9. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel les faces d'extrémité des extrémités des éléments structurels secondaires (8) butent contre l'intérieur de la première âme (2) des éléments structurels principaux (6).

10. Cadre (18) selon l'une quelconque des revendications précédentes, utilisé en tant que cadre porteur dans la structure d'un plancher, d'une paroi, d'un plafond, d'un portique ou d'une charpente de toiture d'un bâtiment.

11. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel les éléments structurels allongés principaux (6) sont des éléments structurels allongés laminés à froid ou étirés à froid.

12. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel les éléments structurels allongés principaux (6) ont une épaisseur de matière entre 3 mm et 4 mm.

13. Cadre (18) selon l'une quelconque des revendications précédentes, dans lequel les éléments structurels allongés secondaires (8) ont une épaisseur de matière entre 1,5 mm et 2 mm.

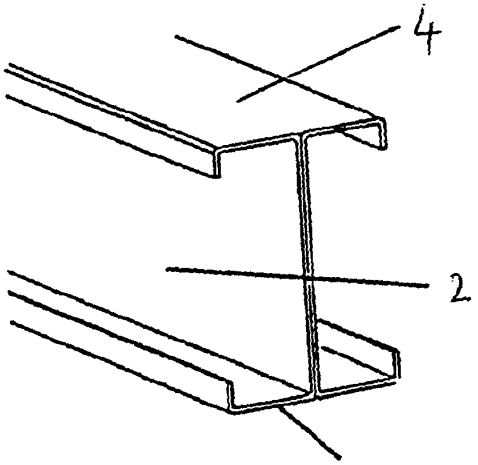

Fig. 1A

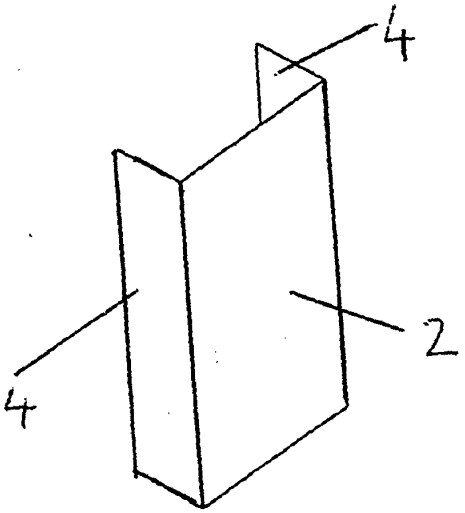

Fig. 1C

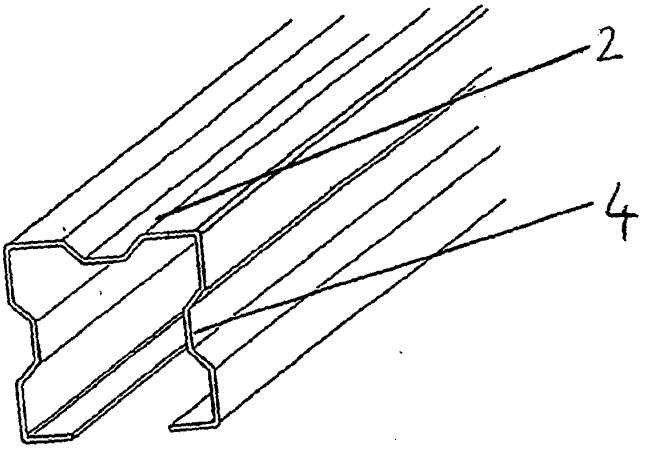

Fig. 1B

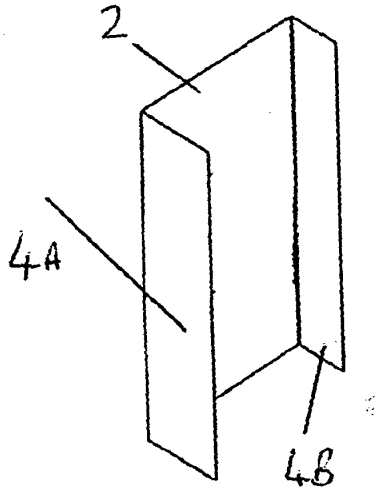

Fig. 1D

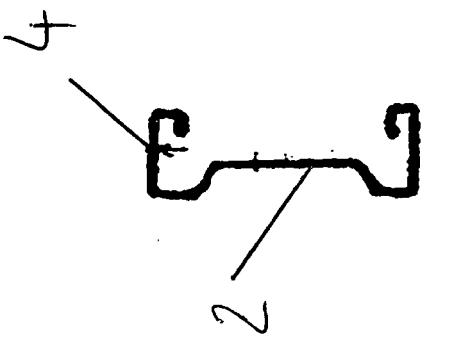

Fig. 1H

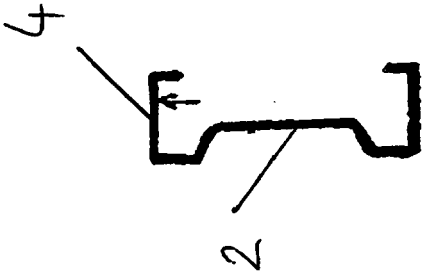

Fig. 1G

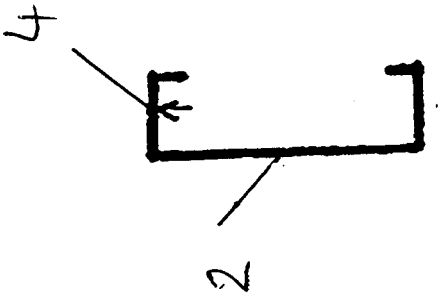

Fig. 1F

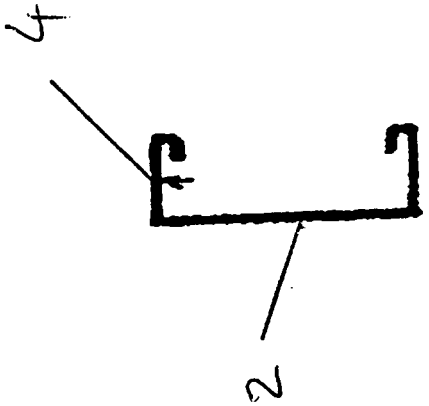

Fig. 1E

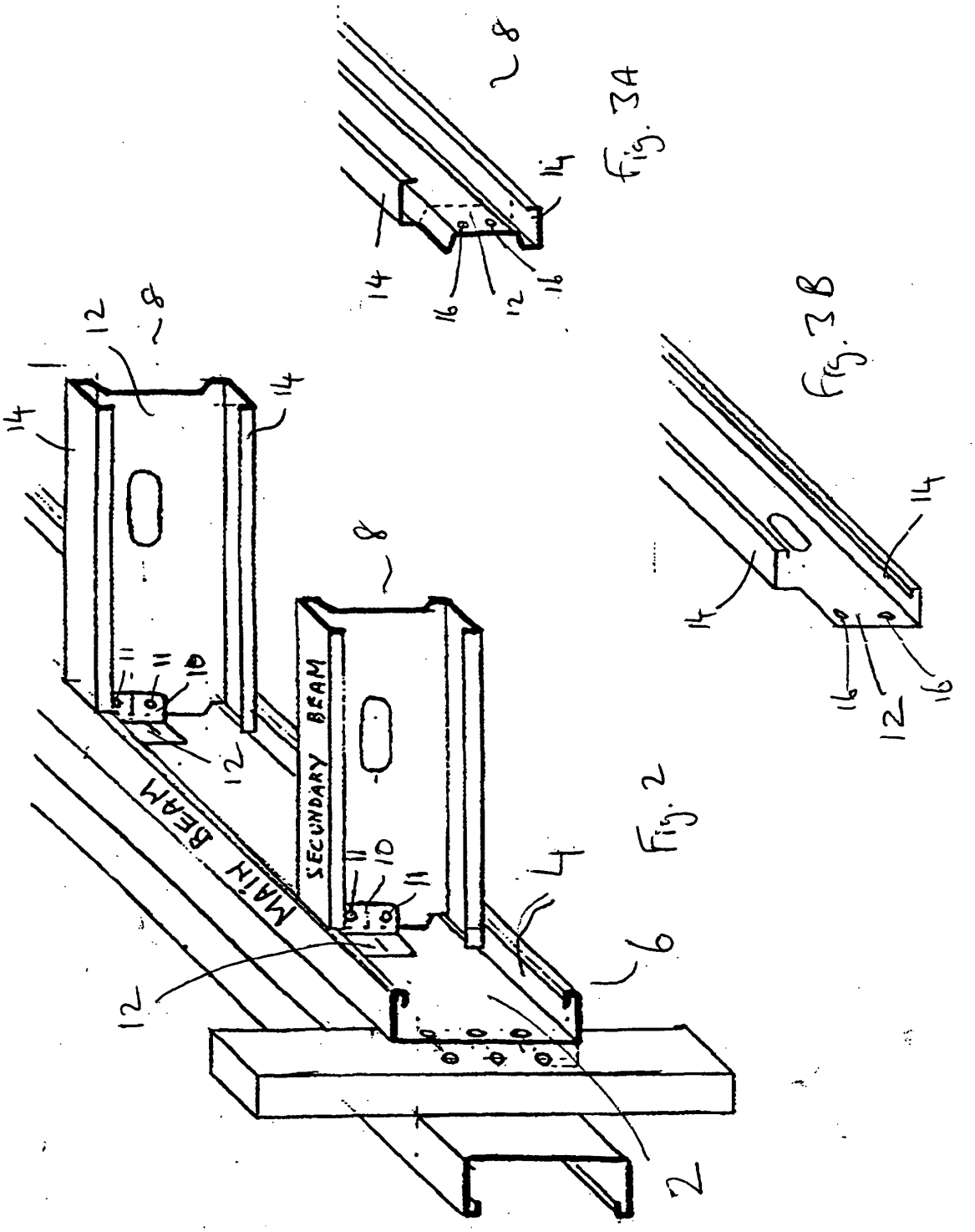

Fig. 2

Fig. 3A

Fig. 3B

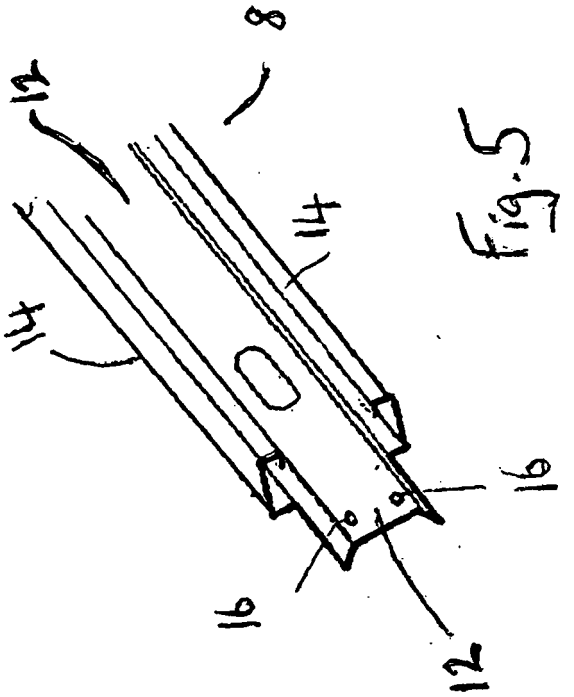
8
12
14
14
16
16
12

Fig. 5

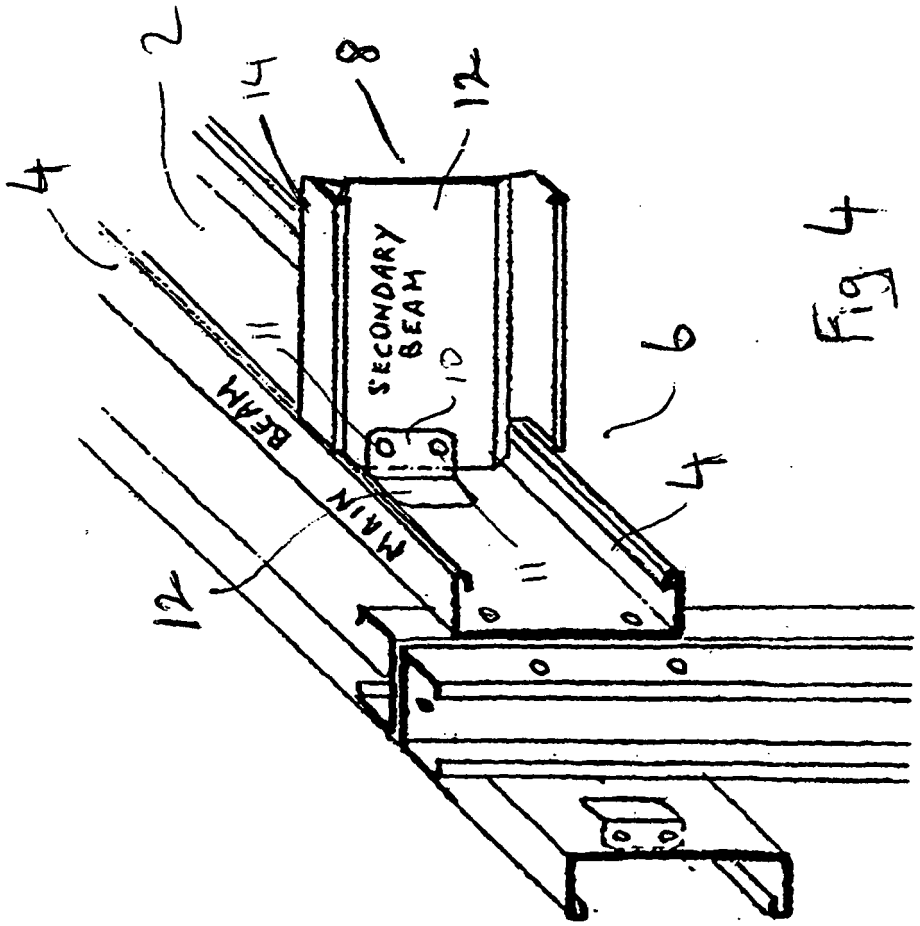
2
14
8
12
4
SECONDARY BEAM
BEAM
MAIN
10
11
11
6
4
12

Fig 4

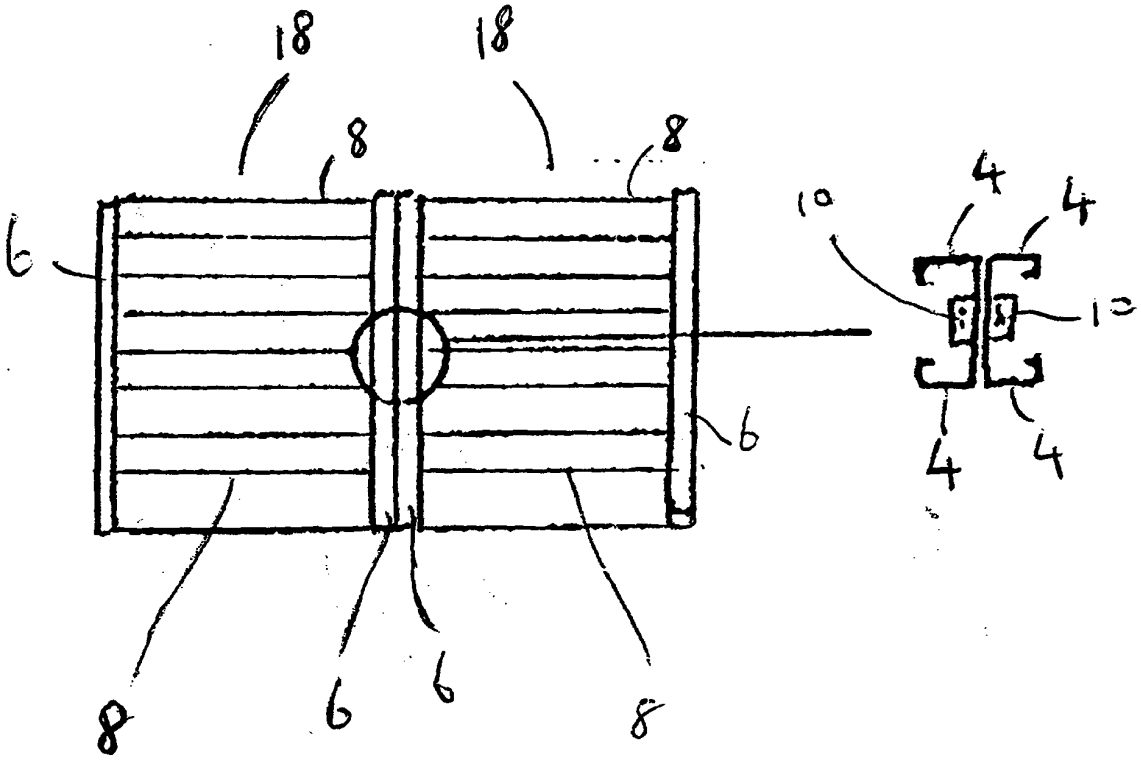

Fig. 6

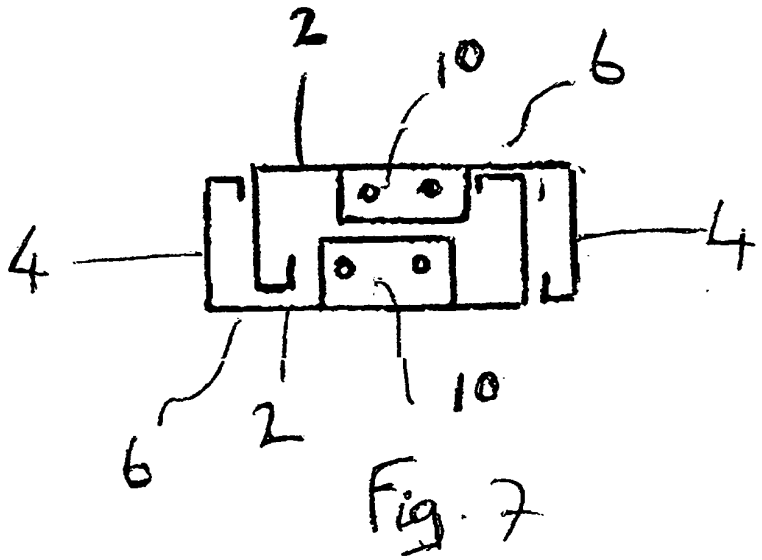

Fig. 7

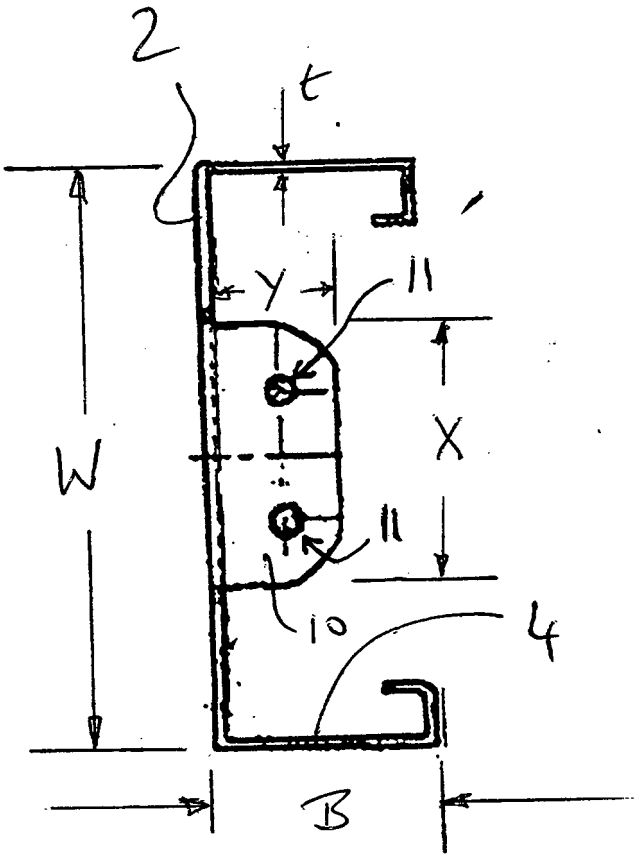

Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- DE 806388 **[0003]**
- FR 2098274 **[0003]**