

DECLARATION IN SUPPORT OF A
CONVENTION APPLICATION FOR A PATENT

In support of the Convention Application made for a
patent for an invention entitled:

Support and Securing System for Long Supporting Beams

Title of Invention

I/We Marc Edouard Irigoyen and Pierre Michel Patrick Bourrier

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do solemnly and sincerely declare as follows:—

Full name(s) of
Applicant(s)

1. I am/We are the applicant(s) for the patent
(or, in the case of an application by a body corporate)
1. I am/We are authorised by

the applicant(s) for the patent to make this declaration on
its/their behalf.

2. The basic application(s) as defined by Section 141 of the
Act was/were made

Basic Country(ies)

in France

Priority Date(s)

on 23 February, 1987

Basic Applicant(s)

by MARC EDOUARD IRIGOYEN and PIERRE MICHEL PATRICK
BOURRIER

Full name(s) and
address(es) of
inventor(s)

3. I am/We are the actual inventor(s) of the invention referred
to in the basic application(s)
(or where a person other than the inventor is the applicant)

3.

of

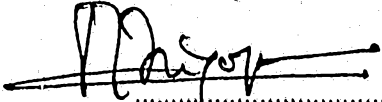
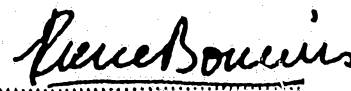
(respectively) —

is/are the actual inventor(s) of the invention and the facts upon
which the applicant(s) is/are entitled to make the application are
as follows:

Set out how Applicant(s)
derive title from actual
inventor(s) e.g. The
Applicant(s) is/are the
assignee(s) of the
invention from the
inventor(s)

4. The basic application(s) referred to in paragraph 2 of this
Declaration was/were the first application(s) made in a Convention
country in respect of the invention(s) the subject of the application.

Declared at Paris this 12 day of October, 19 88

To: The Commissioner of Patents

Signature of Declarant(s)

11/81

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(51)⁵ **G01R 031/318**

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(56) Prior Art Documents
US 4260293
BE 516495

(57) Claim

1. Improved system for supporting and attaching long-span laminate or composite material beams on and to metal supporting posts, characterised in that a post is provided with at least one buttress leg member articulated at its lower end to an articulation shaft attached to the corresponding post and the upper end of which is provided with a two-wing channel on which bears a corner strengthening member attached to the end of a long-span beam through the intermediary of contact members with which said corner strengthening member is provided, whereby the vertical reaction force R_v to the weight of the beam is transferred into a buttress force R_p on the axis of the corresponding leg member which produces a horizontal longitudinal stress force R_H in the corresponding long-span beam.

2. Improved system according to claim 1, characterised in that an intermediate post comprises two buttress leg members symmetrically disposed and pivoted relative to the longitudinal axis of symmetry of the post and each adapted to receive the end of a long-span beam, whereby the two buttress forces in the two leg members balance each other.

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(10) 604104

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3. Improved system according to claim 1, characterised in that an end post comprises a single buttress leg member adapted to receive the end of the end long-span beam of the structure, the second buttress leg member being replaced by a bracing leg member balancing the buttress force R_p applied to the post by the buttress leg member.

PCT

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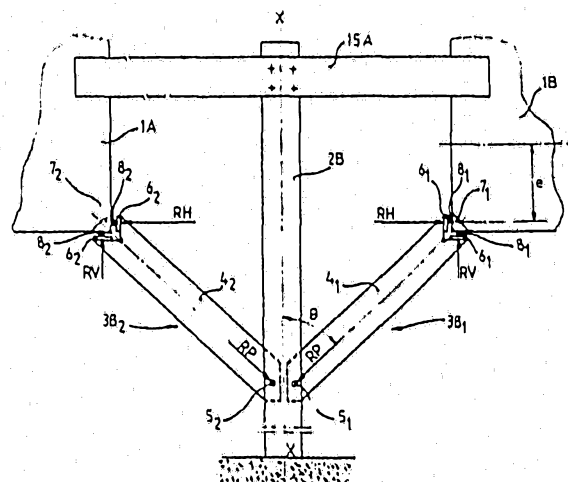
PATENT OFFICE

(54) Title: SUPPORT AND SECURING SYSTEM FOR LONG SUPPORTING BEAMS

(54) Titre: SYSTEME D'APPUI ET D'ACCROCHAGE DE POUTRES DE LONGUE PORTEE

(57) Abstract

Improved system ensuring the support and securing of long support beams of wood core plywood or composite materials (1A, 1B...) on metal support posts (2B...), characterized by the fact that each post is provided with at least one scaffolding strut (3B₁, 3B₂...) articulated at its lower end on a hinge pin (5₁, 5₂...), integral with the adjoining post, the upper end being provided with a receiving angle (6₁, 6₂...) which bears a corner piece (7₁, 7₂), integral with the end of a long supporting beam (1A, 1B...) by means of contact pieces (8₁, 8₂...) fitted to said corner piece; the vertical reaction of the weight of the beam R_V is thereby transferred, by the application of load to the scaffolding R_P, to the axis of the integral strut (3B₁, 3B₂), said load creating a horizontal load of longitudinal stress R_H in the adjoining long supporting beam.



(57) Abrégé

Système perfectionné permettant d'assurer l'appui et l'accrochage de poutres de longue portée en lamellé-collé ou matériaux composites (1A, 1B...) sur des poteaux de support métalliques (2B...), caractérisé en ce que chaque poteau est muni d'au moins une jambe d'arc boutement (3B₁, 3B₂...) articulée à son extrémité inférieure sur un axe d'articulation (5₁, 5₂...) solidaire du poteau correspondant et dont l'extrémité supérieure est munie d'une cornière de réception (6₁, 6₂...) sur laquelle vient porter un embout de coin (7₁, 7₂) solidaire de l'extrémité d'une poutre de longue portée (1A, 1B...), par l'intermédiaire de pièces de contact (8₁, 8₂...) dont est muni ledit embout, grâce à quoi la réaction verticale du poids de la poutre R_V est transférée en un effort d'arc boutement R_P dans l'axe de la jambe correspondante (3B₁, 3B₂), lequel effort crée un effort horizontal de contrainte longitudinale R_H dans la poutre correspondante de longue portée.

Support and attachment system for long-span beams

First of all, it must be borne in mind that in the public works and construction industry the possibility of using long-span beams constitutes an indispensable advantage, in particular in that it enables wide-mesh lattice floors to be constructed.

The present invention is generally concerned with the construction of long spans such as those found in large commercial premises and in industrial buildings, through the combination of, on the one hand, long-span beams, preferably of adhesively bonded laminate material or composite material, to the exclusion of metal materials and concrete, constituting the parallel sides of a lattice with conventional crossmembers and, on the other hand, supporting structural steelwork.

To be more specific, the present invention concerns an improved system for supporting and attaching long-span laminated or composite material beams on and to metal support posts, the system being designed to transfer the vertical reaction force to the weight of the beam into a buttress force in the corresponding post and so to create a horizontal longitudinal stress force in the beam which increases the permissible span for said beam.

The improved system in accordance with the invention is characterized in that each post is provided with at least one buttress leg member articulated at its lower end to an articulation shaft attached to the corresponding post and the upper end of which is provided with a two-wing channel on which bears a corner strengthening member attached to the end of a long-span beam through contact members on said corner strengthening member, whereby the vertical reaction force to the weight of the beam is converted to a



buttress force on the axis of the corresponding buttress leg member which produces a horizontal longitudinal compression force in the corresponding long-span beam.

Other characteristics and advantages of the present invention will emerge from the following description of it given by way of preferred example only and with reference to the appended diagrammatic drawings showing one possible embodiment of said invention.

In the drawings:

Figure 1 is a diagram showing in a particularly simple way the basic principle of the invention;

Figure 2 is a detail view to a much larger scale showing in elevation the upper part of an intermediate post with two buttress leg members receiving the ends of two long-span beams;

Figure 3 is a plan view of the aforementioned assembly;

Figure 4 is a detail view to a larger scale showing in elevation the device for attachment and



pivoting of the base of one of the buttress arm members to an intermediate post like that of figures 2 and 3;

Figure 5 is a detail view of the attachment and pivoting device from figure 4 shown in plan, partially cut away and in horizontal cross-section on the line V-V in said figure 4;

Figure 6 is a view of the buttress arm member proper in transverse cross-section on the line VI-VI in figure 4;

Figure 7 is a view in elevation of the upper end of the buttress arm member from figures 4, 5 and 6, showing how it is adapted to receive the end of a long-span beam;

Figure 8 is a plan view of the end of said arm member as shown in figure 7; and

Figure 9 is a detail view in elevation showing how each of the end posts is adapted to compensate the lateral force exerted by the long-span beam on the post in question.

Referring first of all to the diagram in figure 1 showing the principle of the invention, it will be remembered that the invention is generally concerned with constructing long spans through combining:

- on the one hand, long-span beams such as 1A, 1B, 1C, etc of adhesive bonded laminate or composite material, to the exclusion of metal materials and concrete, constituting the parallel longitudinal sides of a lattice; and
- on the other hand, supporting structural steelwork consisting of H-section posts such as 2A, 2B, 2C, etc.

As has already been mentioned, the invention is more specifically concerned with the improved system for supporting and attaching the beams 1A, 1B, 1C, etc on and to the corresponding posts 2A, 2B, 2C, etc.

As can be seen in figure 1, each supporting



system comprises a double support system, namely $3A_1$, $3A_2$ for post 2A and beam 1A; $3B_1$, $3B_2$ for post 2B and beams 1B and 1A; $3C_1$, $3C_2$ for post 2C and beams 1C and 1B; and so on up to the last post of the run (not shown) at the other end of the aligned beams.

There will now be explained with reference to figures 2 through 9 how each system is adapted to transfer the vertical reaction force to the weight of the beam into a buttressing force on the corresponding post and so to create in said beam a horizontal longitudinal stress force which increases the maximum possible span for a beam of this type.

Referring first of all and specifically to the double support system $3B_1$, $3B_2$ for the post 2B and the beams 1A and 1B which are shown in figures 2 through 8, it is seen that the system is symmetrical relative to the longitudinal axis of symmetry XX of the post, in this instance the post 2B, comprising two identical buttress leg members 4_1 , 4_2 articulated at their lower end on a shaft 5_1 , 5_2 pinned to the post 2B, free of any friction forces or other moment of force, and to be described in more detail later. These buttress leg members are provided at their upper end with supports in the form of two-wing channels 6_1 , 6_2 .

Corner strengthening members 7_1 , 7_2 are attached, adhesively bonded, bolted or riveted, for example to the bottom corner of the corresponding beams 1B, 1A, these corner strengthening members comprising members 8_1 , 8_2 through which they contact the corresponding two-wing channels 6_1 , 6_2 .

Before proceeding with a more detailed description of the buttress leg members, it can be seen immediately that, for each of these leg members, the vertical reaction force R_v to the weight of the beam



1B or 1A is transferred into a buttress force R_p in the corresponding leg member which creates in the beam 1B or 1A a horizontal longitudinal stress force R_H which increases the permissible span for said beam.

5 It is important to note that, because of the way in which the support system is designed, the forces exerted are obliged to pass through specific points, namely the articulation shaft 5_1 , 5_2 for the thrust R_p on the buttress leg member 4_1 , 4_2 , the contact
10 members 8_1 and 8_2 for the vertical reaction force R_v (in practise 30 T for 24 m spans), and the horizontal abutment providing the longitudinal stress $M = R_H \cdot e$ in the beam, where e is the shortest distance between the point through which the horizontal stress
15 R_H passes and the neutral fiber of the beam 1B.

There will now be described in detail, with specific reference to figures 4 through 8, how each of the buttress leg members 4_1 , 4_2 in figure 2 can be implemented in an advantageous way.

20 As these leg members have to be designed to resist buckling, each is made (see figure 6) by welding longitudinal at 9 two asymmetrical channel members 10A, 10B. The members comprise at their lower end, cut to form an asymmetrical point (see figure 4), an
25 orifice 11A, 11B enabling the leg member as a whole to pivot on the support shaft 5_1 pinned in orifices 12A, 12B formed in the flanges of the H-section post 2B.

To spread localized stresses there are fixed to the surfaces of the leg member and to the surfaces of
30 the flanges of the post concerned anti-buckling reinforcing plates, for example the lateral plates 13A and 13B on the leg member proper and plates 14A and 14B on the flanges of the post.

It has already been seen, from the description



relating to figure 2, that the beam 1B bears at its end on the upper end of the corresponding leg member 4_1 and that the supporting system is designed, in accordance with the invention, so that the applied
5 forces R_V , R_H and R_P are obliged to pass through specific points to make the calculation and control of the forces concerned as easy and accurate as possible.

Figures 7 and 8 show to a larger scale the preferred embodiment of the invention.

10 In this case, the end of the beam 1B is fitted with a corner strengthening member 7_1 with two flanges at right angles each fitted with a contact cylinder (or half-cylinder) 8_1 which bears on the corresponding member 6_1 of the two-wing support channel welded to
15 the upper end of the buttress leg member 4_1 . It is seen immediately that in this case the vertical and horizontal forces R_V and R_H and the points at which they are applied are perfectly determined and controllable immediately the beam 1B is placed (see
20 figure 1) on the buttress leg members $3B_1$ and $3C_2$ of the posts 2B and 2C.

The horizontal stress generated in the beam 1B in this way increases the maximum possible span for this type of beam, as already mentioned.

25 It is also seen that there will be automatic compensation of any aging of the material constituting the beam, preferably adhesively bonded laminate or composite materials such as woven polyester, tubes, fibers, etc, to the exclusion of metal and concrete.

30 It is evident that it would be possible to use a leg member/corner strengthening member articulation whereby the corner strengthening member on which the beam is placed would be articulated to the buttress leg member, but that this solution would have undoubted
35 a priori assembly and use problems.



Moreover, consideration might be given to the corner strengthening member 7_1 comprising only a single contact cylinder of large radius resting on the two wings of the two-wing channel 6_1 on the buttress leg member, but here again this solution would involve problems of fixing the single cylinder to the corner strengthening member and controlling the distances to the points of application of the vertical force R_V and horizontal force R_H .

There is no doubt that the preferred solution previously described is significantly superior in that the points through which said forces are obliged to pass are perfectly defined by the contact cylinders 8_1 of the corner strengthening member 7_1 resting on the two-wing channel 6_1 of the arm member 4_1 .

Given that, as has just been seen, the beams 1B and 1A are simply rested through their corner strengthening members 7_1 , 7_2 on the buttress leg members 4_1 , 4_2 , the post 2B is extended upwardly and provided at the top (see figures 2 and 3) with two anti-toppling beams 15A, 15B which are riveted at their center to the flanges of the H-section post 2B and embrace laterally the ends of the aligned beams 1B and 1A.

Also, the same anti-toppling beams may be linked by plates such as 16A, 16B and serve as supports for equipment such as air conditioning, heating or other equipment.

The angle θ between the buttress leg member 4_1 and the vertical axis of symmetry XX of the post 2B is determined according to the characteristics of the component parts of the long-span structure to be built (beams, posts, minimum ceiling height, etc).

Mathematical theory requires that the center of gravity of the long-span beam 1B, the geometric center



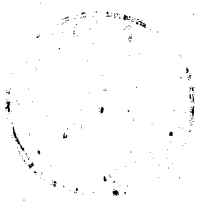
of the corner strengthening member 7_1 with which said beam is provided and the geometric center of the articulation 5_1 on the post 2B are disposed on the same circular arc.

5 In practise, the angle θ must be between 30° and 60° and preferably equal to 45° , as this is much simpler from the practical constructional point of view.

According to another characteristic of the invention, the end posts like the post 2A in figures 1 and 9, where the effect of the horizontal force R_H which is produced in the part 1A and which is transferred into a buttressing force R_p on the post 2A is not balanced by the symmetrically opposed action of another beam, as is the case, for example, with the post 15 2B, have to be compensated, as here, by a bracing leg member $3A_2$ which is riveted at its upper end to the flanges of the post 2A and is aligned with the buttressing leg member $3A_1$ with its lower end resting on the ground, as clearly seen in figure 1. In this way 20 the assembly is perfectly balanced.

Generally speaking, the invention proposes an improved system for supporting and attaching long-span laminate or composite material beams on and to metal supporting posts, comprising on each post at least one 25 buttress leg member articulated at its lower end to said post and by which one end of a long-span beam is supported by the post, contact members on the beam or at the upper end of the buttress leg member, and bearing members at the upper end of the buttress leg member or 30 on the beam on which the contact members bear, the arrangement of the contact members and the bearing members being such that the weight of the beam produces a longitudinal compression force along the axis of the leg member which produces a longitudinal compression 35 force on the beam.

It is to be understood that the present invention is in no way limited to the embodiment described and shown, but to the contrary encompasses any variants thereon within the competence of those skilled in the art.



The claims defining the invention are as follows:

1. Improved system for supporting and attaching long-span laminate or composite material beams on and to metal supporting posts, characterised in that a post is provided with at least one buttress leg member articulated at its lower end to an articulation shaft attached to the corresponding post and the upper end of which is provided with a two-wing channel on which bears a corner strengthening member attached to the end of a long-span beam through the intermediary of contact members with which said corner strengthening member is provided, whereby the vertical reaction force R_v to the weight of the beam is transferred into a buttress force R_p on the axis of the corresponding leg member which produces a horizontal longitudinal stress force R_H in the corresponding long-span beam.

2. Improved system according to claim 1, characterised in that an intermediate post comprises two buttress leg members symmetrically disposed and pivoted relative to the longitudinal axis of symmetry of the post and each adapted to receive the end of a long-span beam, whereby the two buttress forces in the two leg members balance each other.

3. Improved system according to claim 1, characterised in that an end post comprises a single buttress leg member adapted to receive the end of the end long-span beam of the structure, the second buttress leg member being replaced by a bracing leg member balancing the buttress force R_p applied to the post by the buttress leg member.

4. Improved system according to any one of claims 1 to 3, characterised in that the contact members with which the corner strengthening member of the long-span beam provided comprise two small-diameter cylindrical members orthogonal to a beam and adapted to bear on respective wings of the two-wing channel attached to the upper end of the buttress leg member, these contacts constituting points through which the forces are obliged to pass.

5. Improved system according to claim 4, characterised in that, in one embodiment, the corner strengthening member of the beam is provided with a single larger diameter contact cylinder orthogonal to the beam which bears on both wings of the two-wing channel attached to the upper end of the buttress leg member along two separate generatrices of said cylinder, these contacts constituting points through which the forces are obliged to pass.



6. Improved system according to any one of claims 1 to 5, characterised in that each buttress leg member is made by welding longitudinally two asymmetrical U-shaped cross-section members and in that, facing the articulations between leg member and post, anti-buckling reinforcing plates are fixed to the lateral surfaces of the leg member and to the lateral surfaces of the flanges of the post.

7. Improved system according to any one of claims 1 to 6, characterised in that transverse anti-toppling beams are attached to the top of each support post and embrace laterally the ends of two aligned beams on the same post, these transverse beams being adapted to support technical equipment such as air conditioning, heating or other equipment.

8. Improved system according to any one of claims 1 to 7, characterised in that the longitudinal axis of each buttress leg member is at an angle to the longitudinal axis of symmetry of the corresponding post between 30° and 60° and preferably substantially 45°.

9. A support for a long-span laminate or composite material beam, substantially as hereinbefore described with reference to the drawing figures.

DATED this EIGHTEENTH day of JUNE 1990

Marc Edouard Irigoyen, Pierre Michel Patrick Bourrier

Patent Attorneys for the Applicants
SPRUSON & FERGUSON



FIG. 1

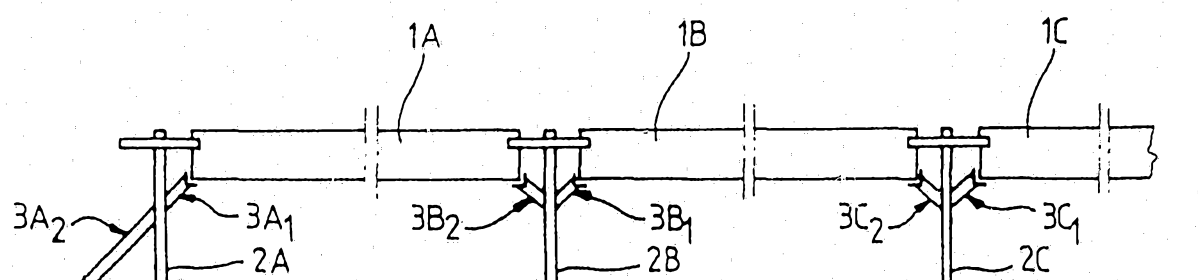


FIG. 2

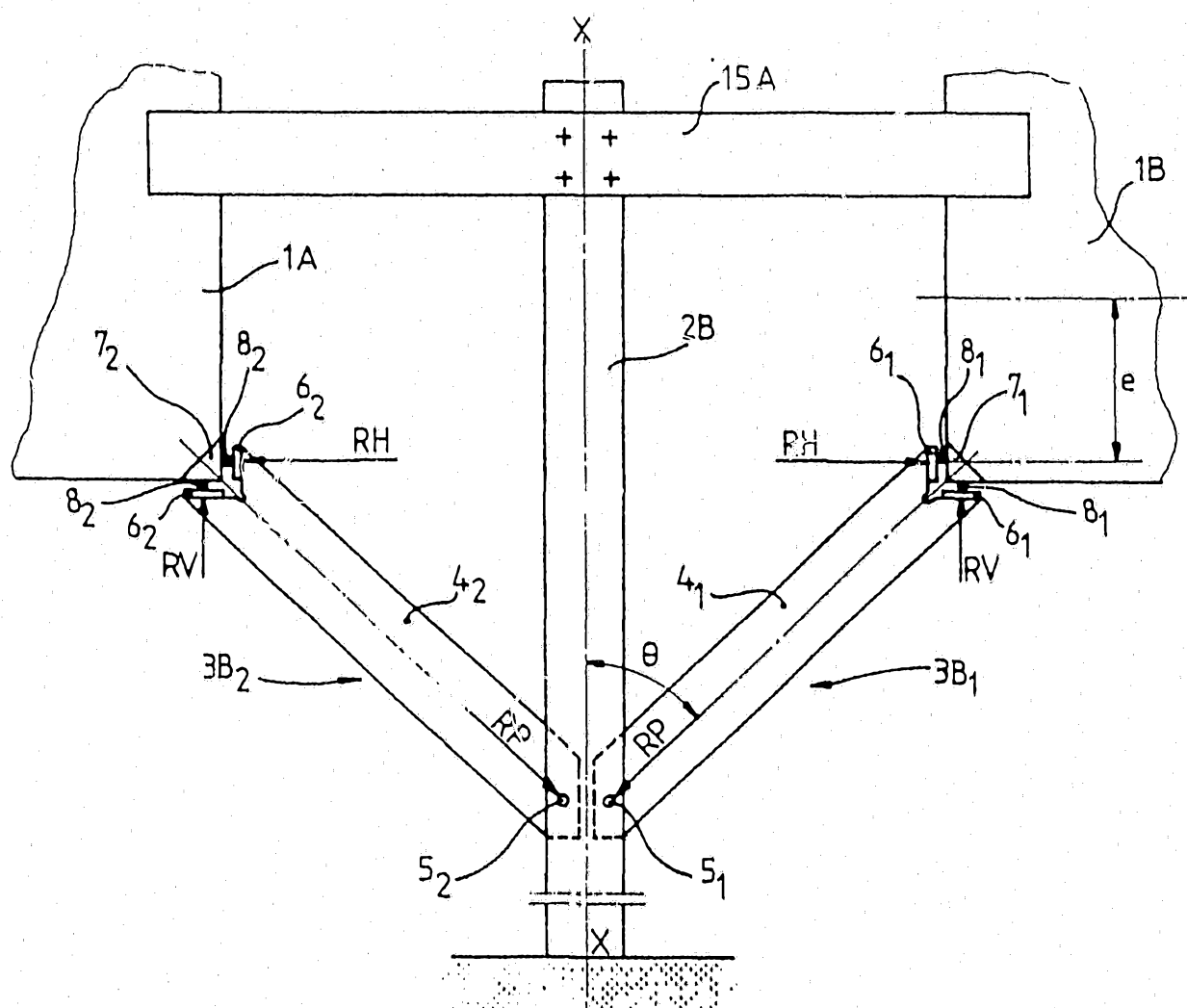


FIG. 3

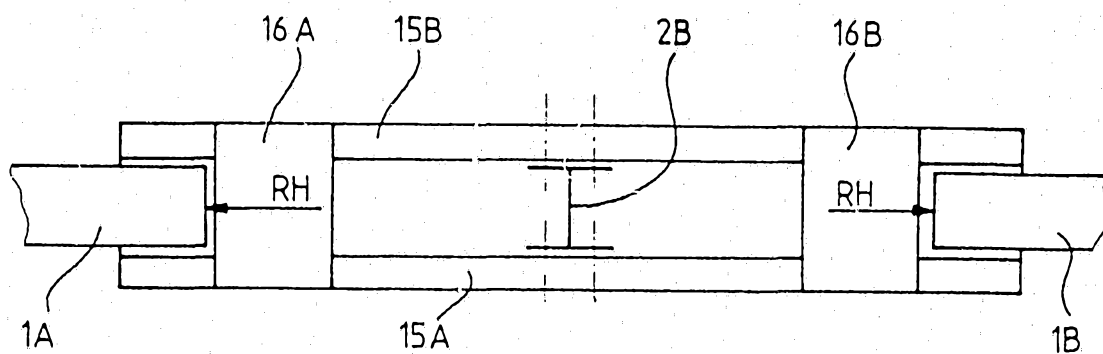


FIG. 9

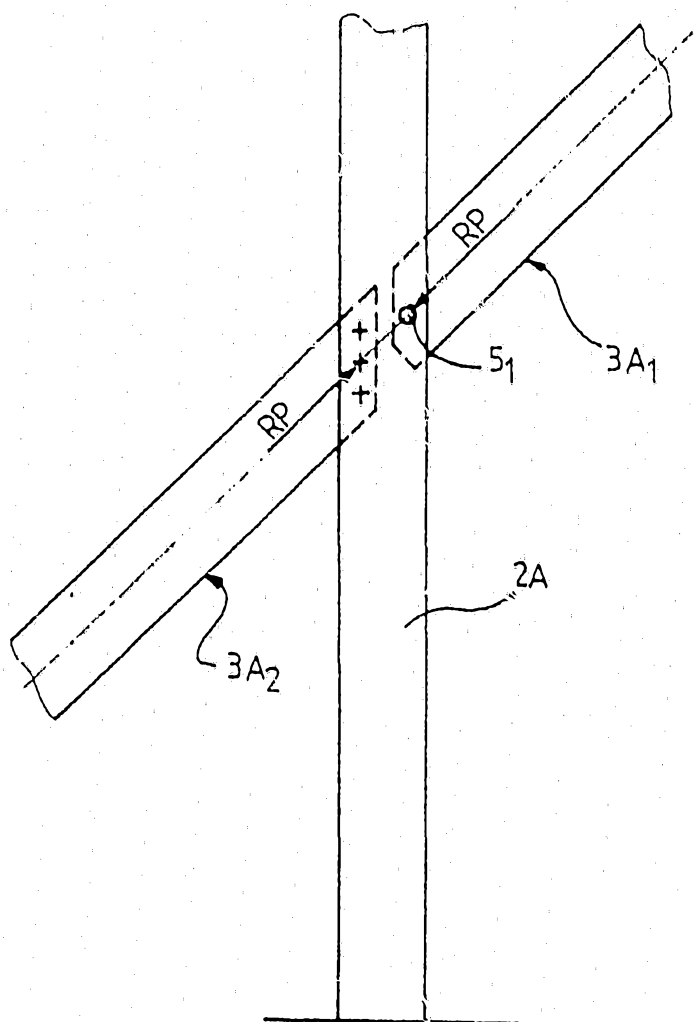


FIG. 4

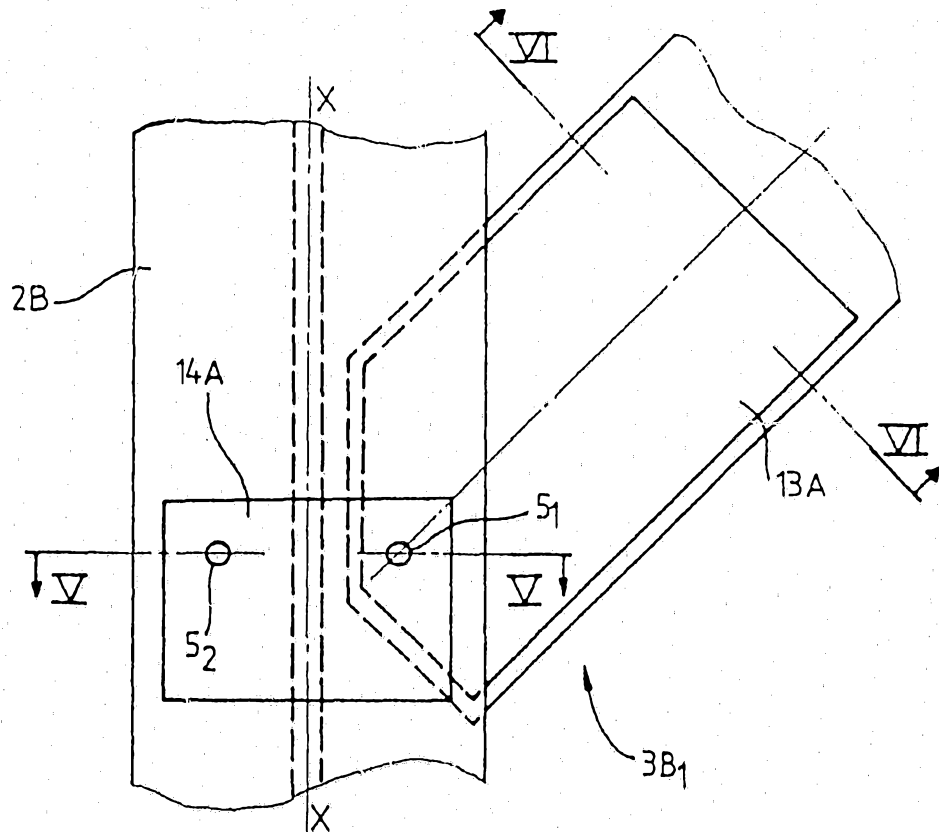


FIG. 5

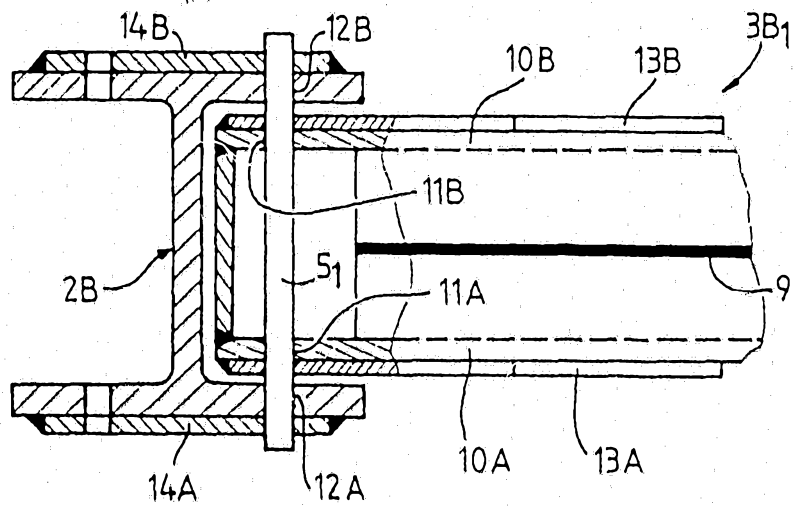


FIG. 6

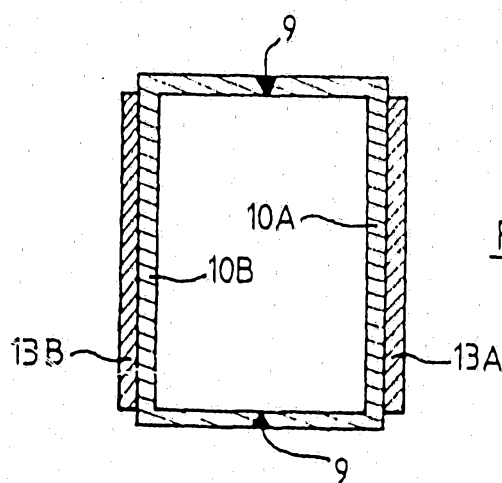


FIG. 7

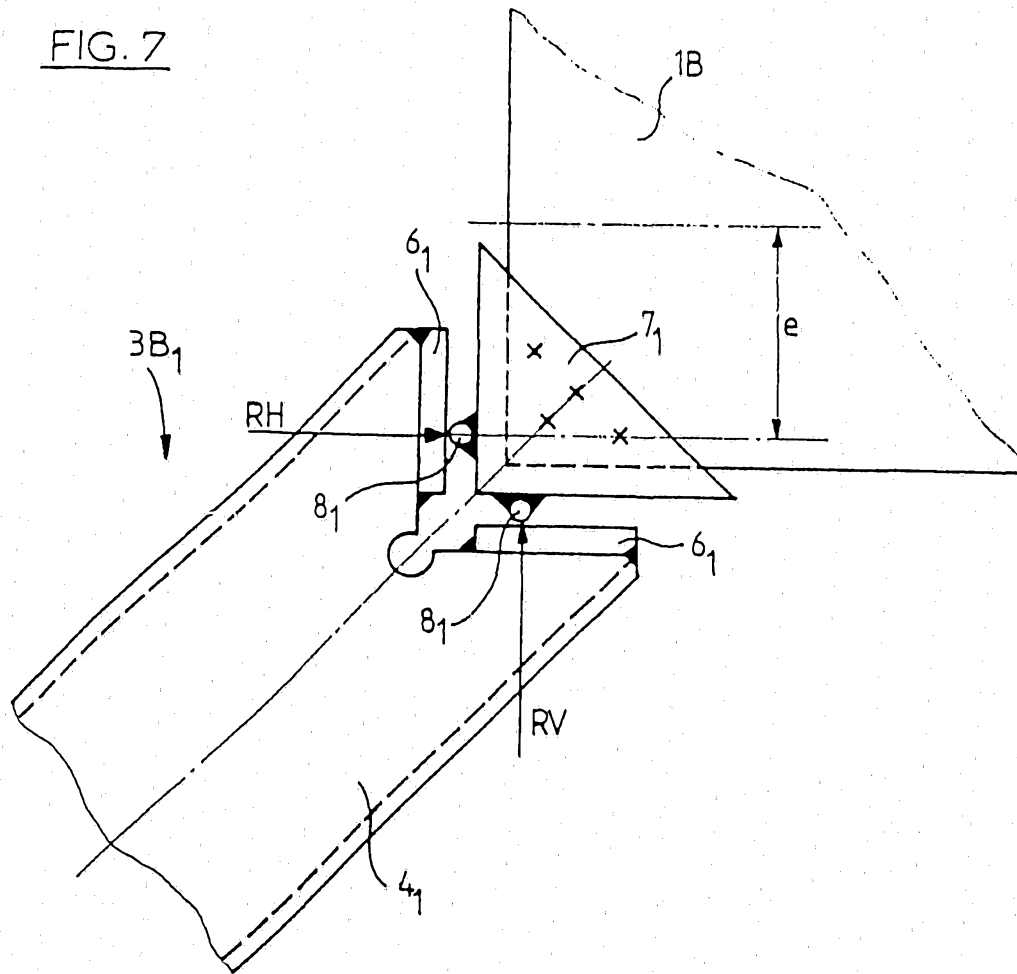
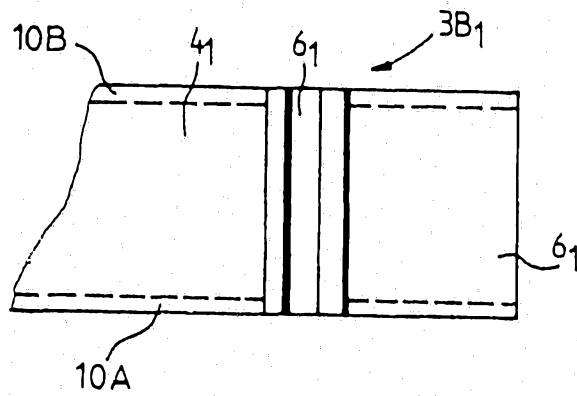


FIG. 8



INTERNATIONAL SEARCH REPORT

International Application No PCT/FR 88/00096

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. ⁴ E04B 1/36		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. ⁴	E04B;E04C	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	Polytechnisch Tijdschrift, Nr. 13-14, April 1947, (NL) "Een houten spant voor een noodkerk- gebouw", pages 174b-175b see the whole document ---	1
A	BE, A, 516495 (LEEMANS & BREDAT) 23 June 1953 see page 2, lines 17-41; figure 1 -----	1
[*] Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the International filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the International filing date but later than the priority date claimed "T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search 25 April 1988 (25.04.88)		Date of Mailing of this International Search Report 09 June 1988 (09.06.88)
International Searching Authority EUROPEAN PATENT OFFICE		Signature of Authorized Officer

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.

FR 8800096

SA 21126

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 27/05/88
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
BE-A- 516495		Aucun	

RAPPORT DE RECHERCHE INTERNATIONALE

Demande internationale N° PCT/FR 88/00096

I. CLASSEMENT DE L'INVENTION (si plusieurs symboles de classification sont applicables, les indiquer tous) ⁷		
Selon la classification internationale des brevets (CIB) ou à la fois selon la classification nationale et la CIB		
CIB ⁴ : E 04 B 1/36		
II. DOMAINES SUR LESQUELS LA RECHERCHE A PORTÉ		
Documentation minimale consultée ⁸		
Système de classification	Symboles de classification	
CIB ⁴	E 04 B; E 04 C	
Documentation consultée autre que la documentation minimale dans la mesure où de tels documents font partie des domaines sur lesquels la recherche a porté ⁹		
III. DOCUMENTS CONSIDÉRÉS COMME PERTINENTS ¹⁰		
Catégorie ¹¹	Identification des documents cités, ¹¹ avec indication, si nécessaire, des passages pertinents ¹²	N° des revendications visées ¹³
A	Polytechnisch Tijdschrift, no. 13-14, avril 1947, (NL), "Een houten spant voor een noodkerk-gebouw", pages 174b-175b voir le document en entier --	1
A	BE, A, 516495 (LEEMANS & BREDAT) 23 juin 1953 voir page 2, lignes 17-41; figure 1 -----	1
* Catégories spéciales de documents cités: ¹¹ « A » document définissant l'état général de la technique, non considéré comme particulièrement pertinent « E » document antérieur, mais publié à la date de dépôt international ou après cette date « L » document pouvant jeter un doute sur une revendication de priorité ou cité pour déterminer la date de publication d'une autre citation ou pour une raison spéciale (telle qu'indiquée) « O » document se référant à une divulgation orale, à un usage, à une exposition ou tous autres moyens « P » document publié avant la date de dépôt international, mais postérieurement à la date de priorité revendiquée « T » document ultérieur publié postérieurement à la date de dépôt international ou à la date de priorité et n'appartenant pas à l'état de la technique pertinent, mais cité pour comprendre le principe ou la théorie constituant la base de l'invention « X » document particulièrement pertinent: l'invention revendiquée ne peut être considérée comme nouvelle ou comme impliquant une activité inventive « Y » document particulièrement pertinent: l'invention revendiquée ne peut être considérée comme impliquant une activité inventive lorsque le document est associé à un ou plusieurs autres documents de même nature, cette combinaison étant évidente pour une personne du métier. « A » document qui fait partie de la même famille de brevets		
IV. CERTIFICATION		
Date à laquelle la recherche internationale a été effectivement achevée		Date d'expédition du présent rapport de recherche internationale
25 avril 1988		09.06.88
Administration chargée de la recherche internationale OFFICE EUROPEEN DES BREVETS		Signature du fonctionnaire autorisé P.C.G. VAN DER PUTTEN

ANNEXE AU RAPPORT DE RECHERCHE INTERNATIONALE
RELATIF A LA DEMANDE INTERNATIONALE NO.

FR 8800096
SA 21126

La présente annexe indique les membres de la famille de brevets relatifs aux documents brevets cités dans le rapport de recherche international visé ci-dessus.
Lesdits membres sont contenus au fichier informatique de l'Office européen des brevets à la date du 27/05/88
Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office européen des brevets.

Document brevet cité au rapport de recherche	Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
BE-A- 516495		Aucun	