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(54) **SCAFFOLDING SYSTEM**

(57) Scaffolding system of the type comprising beam and post elements, which are connected together by means of interconnectors and form the main skeleton of the scaffolding, wherein the beam and post elements are

produced from a composite material, and the interconnectors are produced from a reinforced thermoplastic polymer.

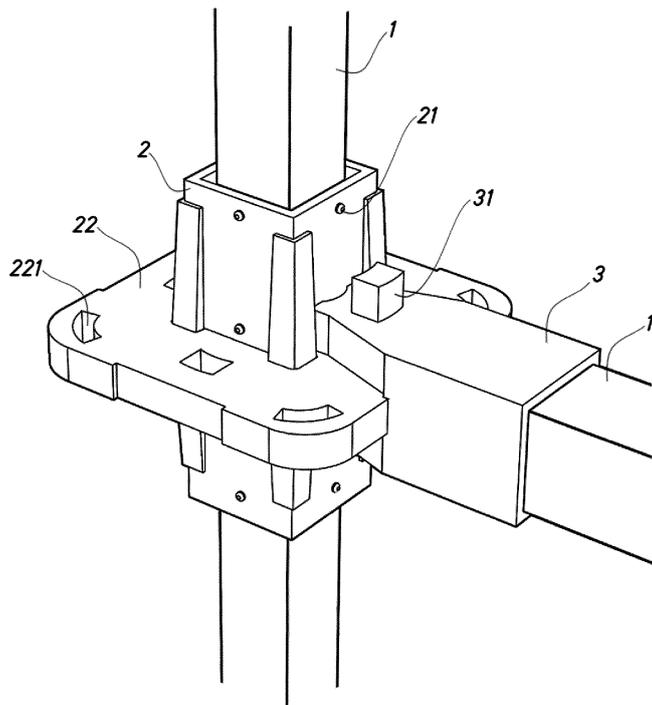


Fig.1

EP 3 029 216 A1

Description

[0001] The present invention relates to a scaffolding system, i.e. a system of parts used for the creation of scaffoldings.

[0002] The scaffolding systems currently known are made from carbon steel. The supporting elements (beam and post elements) are formed by a tubular profile that comprises, generally welded, the interconnection elements or interconnectors. The most typical interconnection element consists of a circular flange with transverse holes.

[0003] Due to the need for installation and uninstallation during the performance of works, the need to over-size the elements and the need for them to be capable of being used on numerous different occasions, the said elements are made almost exclusively from carbon steel and are rather heavy.

[0004] Consequently, the creation of new scaffolding systems that are lighter in weight but offer the same operational advantages of carbon-steel systems is a problem to which a solution has been sought for at least the last 40 years.

[0005] The French patent document FR2229015 of 1974 discloses a scaffolding and protective barrier creation system based on beam and post elements formed by a tubular profile made from PVC (polyvinyl chloride), PP (polypropylene), PA (polyamide), PC (polycarbonate), ABS (acrylonitrile butadiene styrene) or polyethylene (PE) which has four slotted fins that run along the entire length of the profile. This solution entails high production costs, since it requires the injection-moulding of large components, and its mechanical properties are clearly inferior to those of carbon steel, making it impracticable for this system to replace the scaffolding systems currently used for working at height.

[0006] The patent document PCT WO95/16838 discloses a scaffolding system in which the beam and post elements consist of cylindrical elements (tubes) made from reinforced thermoplastics. More specifically, the tubes comprise an inner layer of fibreglass-reinforced polymer, a layer of polymer fibre-reinforced thermoplastic surrounding the inner layer, and an additional coating treatment. The interconnecting elements are components that surround the beam or post elements, attached to the same with adhesive, and comprise two circular flanges with a plurality of holes. The system appears to be expensive to manufacture and does not offer the same mechanical performance.

[0007] Consequently, materials other than carbon steel have not been successful, and the use of synthetic materials has been limited to the other elements of the scaffolding, particularly gangplanks and barriers, as well as other elements with no structural function.

[0008] An aim of the present invention is to disclose an innovative scaffolding solution that uses new and lighter materials with mechanical properties similar to those of scaffolding systems whose main skeleton is formed

by beam and post elements made from carbon steel, in such a way that the new system can be a commercial alternative to such systems.

[0009] In particular, the present invention discloses a scaffolding system of the type that comprises beam and post elements, joined together by means of interconnectors, that form the main skeleton of the scaffolding, in which the beam and post elements are made from a composite material, preferably of flat-faced transverse cross-section, and more preferably of square cross-section, and the interconnectors are made from a reinforced thermoplastic polymer.

[0010] Preferably, the interconnectors are attached to the post elements by riveting or screwing. Attachment by riveting is preferable. These types of attachment avoid the mechanical weakness that can occur with the adhesive attachments known in the prior art. They also offer the advantage that the attachment cannot be dismantled. The polygonal shape of the post and beam elements cooperates synergistically with the riveted or screwed joint by offering flat surfaces on which to create the attachment.

[0011] The preferred composite materials of the present invention are those made from a metal, polymer or ceramic base to which other reinforcing material is added.

[0012] Preferably, the beam and post elements will be made from composite materials whose mechanical properties, particularly Young's modulus, elastic modulus and toughness, are close within a reasonable range to the properties of 4% carbon steel, as hitherto used in conventional scaffolding systems, thus maximising the effort to reduce the density of the new material.

[0013] Especially preferred composite materials are mineral-reinforced polyester resin and fibreglass-reinforced epoxy resin.

[0014] The aim of the profiles thus obtained is to strengthen the mechanical properties of the final component as far as possible. The geometry of its transverse cross-section makes it possible to optimise the said properties, which must be capable of withstanding axial, traction and compression stresses over component distances of several metres.

[0015] However, due to the need to strengthen their mechanical properties as far as possible, the profiles made from these composite materials cannot assume adequate complex geometries to ensure a secure attachment between components. This limitation is accentuated due to their systems of manufacture, such as pultrusion.

[0016] This gives rise to the need to incorporate other types of additional components which, by means of a mechanical attachment to the structural composite profile, allows the components to be joined together in order to begin the assembly of the structure.

[0017] The interconnecting components, which we will call rosettes and joints, are made from a mineral-reinforced thermoplastic polymer such as fibreglass-rein-

forced polypropylene.

[0018] The geometry of the joints will be such that the said joints can grip and house the different structural profiles (principally beam and post elements). This feature presupposes a mechanical attachment between the structural profile and the joint that also makes it possible, by means of riveting and/or other attachment systems, to prevent any movement of one component with respect to the other. At the same time, the housings for the profiles make it possible to use pressure attachment systems. They also allow attachment by chemical means (adhesive) if desired.

[0019] Preferably, the system will comprise elongated elements of square profile as beam elements (horizontal structural elements that form the skeleton), post elements (vertical structural elements that form the skeleton) and diagonal elements (elements on the diagonal between beam and/or post elements). The system will also comprise elongated elements made from a composite material with a U-shaped profile for beam and other horizontal load-bearing elements, profiles with a double-U profile for horizontal load-bearing elements, and platform profiles which may be made from square or U-shaped profiles joined by a flat horizontal element, thus forming the gangplank or platform.

[0020] Consequently, a preferred embodiment of the present invention is based on the use of suitably selected materials and a determined structure, in which materials of greater directional working capacity are chosen for the beam and post elements, while for the interconnecting elements a different material is chosen that has greater flexibility and that, principally, allows flexibility in the design of the form of the interconnectors.

[0021] To allow a clearer understanding, by way of explanatory and non-limitative example, some drawings are attached of an embodiment of the scaffolding system that forms the subject of the present invention.

Figure 1 shows a perspective view of a node formed by a post element, an interconnector or joint and a beam element connected to the interconnector.

Figure 2 shows a perspective view of an elongated element of square cross-section that might form either a beam element or a post element.

Figure 3 shows a perspective view of an elongated element of square cross-section, made from a composite material, with two interconnectors at its ends, made from reinforced thermoplastic.

Figure 4 shows a perspective view of one of the interconnectors shown in Figure 3.

Figure 5 shows a rear perspective view of the interconnector of Figure 4.

Figure 6 shows a perspective view of a variant of the

elongated element of Figure 3, particularly suitable for use as a beam element, with an interconnector at the end.

Figure 7 shows a perspective view of a suitable element with pivoting interconnectors, particularly suitable for diagonal elements.

Figure 8 shows a perspective view of one of the interconnectors shown in Figure 7.

Figure 9 shows a perspective view of a U-shaped profile.

Figure 10 shows a perspective view of an interconnector functionally similar to that of Figure 4, suitable for receiving the U-shaped profile of Figure 9.

Figure 11 shows a structural element consisting of a U-shaped profile and two interconnectors.

Figure 12 shows a perspective view of a double U-shaped profile.

Figure 13 shows a perspective view of profiles forming a scaffolding gangplank.

Figure 1 shows an attachment between a post element (vertical) -1- and a beam element (horizontal) -1'- by means of a node formed by the union of different interconnectors -2-, -3-.

[0022] The node is formed by a rosette or joint -2- of prismatic form and square cross-section that grips the post element -1- by its exterior, being capable of sliding along the same, and that has a square flange -22- with a plurality of holes -221-. As can be seen, to the flange -22- is connected another interconnector or joint -3- situated at the end of the beam element -1'- . The connection is secured by a pin -31- that passes through corresponding holes in the joint -3- and the flange -22-. The rosette -2- and the joint -3- shown in the example are made from a reinforced thermoplastic material, in particular fibreglass-reinforced polypropylene. In the case shown, the rosette -2- is fixed to the post element -1- by means of rivets -21-.

[0023] Both the post element -1- and the beam element -1'- are formed in the example by a profile -19- of square cross-section made from a mineral-reinforced polyester resin or fibreglass-reinforced epoxy resin, as seen in Figure 2.

[0024] Figure 3 shows a beam element -1'- with two connectors or joints -3- at its ends, intended to be attached horizontally to a rosette -2-. As can be seen in Figures 3 to 5, these joints -3- have a horizontal slot -33- for receiving the flange of the rosette and a through hole -32- traversing the said slot, for receiving the pin -31- for connecting to the rosette -2-. At its rear, as can be seen

in Figure 5, the joint -3- has a groove arrangement -34- for receiving the profile -1'- that forms the beam element.

[0025] Figure 6 shows a production variant of the profile -1'- with a rabbet at the end -11- in the area intended to receive the joint -3-. With this variant, a constant transverse cross-section is achieved along the joint and profile, since the rabbet is occupied by the joint.

[0026] Figure 7 shows a diagonal structural element formed by a profile -1'-, which may be the same as the element that forms the beam element, and two diagonal joints -5- that have an articulation -54- and an articulated area -52- with a hole -53- for connecting to a rosette -2-. Thus, an oblique angle is formed between the profile -1'- and the flange -22- of the rosette -2-.

[0027] Figure 8 shows exclusively the diagonal joint -5-. The connecting area of the diagonal joint -5- also has a rectangular groove arrangement -59- for receiving the square profile -1'-.

[0028] Figure 9 shows a U-shaped profile -4-, also made from the composite materials indicated for the square profiles -1-, -1'-, which can be used for creating the aforesaid horizontal load-bearing elements. In this case, the profile has a transverse cross-section -41- with right angles, and also through holes -42- to lighten its weight.

[0029] Figure 10 shows a joint -3'- suitable for the U-shaped profile -4-. The joint is similar to that shown in Figure 5, with the same or similar elements marked with the same numbers. However, in this case the rear groove arrangement -34'- for receiving the profile is U-shaped.

[0030] Figure 11 shows a horizontal load-bearing element formed by the U-shaped profile -4- and two joints -3'- situated at its ends.

[0031] Figure 12 also shows a double U-shaped profile for creating horizontal load-bearing elements. This is formed by two U-shaped profiles -4-, -4'- arranged one above the other and joined by a plate -44-. The attachment between components may be made, for example, by means of adhesive.

[0032] Figure 13 shows a horizontal scaffolding gangway formed by two U-shaped profiles -4-, -4'- like those mentioned previously, arranged horizontally with respect to each other, joined on their upper edges by a horizontal sheet -45-, which in turn is covered by a non-slip sheet -46-.

[0033] By creating the elements shown, scaffoldings can be created in different configurations that are lighter than the carbon steel scaffoldings currently existing on the market and equally functional.

[0034] Although the invention has been described with respect to preferred embodiments, the said embodiments must not be regarded as limitative of the invention, which will be defined by the broadest interpretation of the following claims.

Claims

1. Scaffolding system of the type that comprises beam and post elements, joined together by means of interconnectors, that form the main skeleton of the scaffolding, **characterised in that** the beam and post elements are made from a composite material, and the interconnectors are made from a reinforced thermoplastic polymer.
2. Scaffolding system according to claim 1, **characterised in that** the beam and post elements are profiles of flat-faced transverse cross-section.
3. Scaffolding system according to claim 2, **characterised in that** the transverse cross-section is square.
4. Scaffolding system according to any one of claims 1 to 3, **characterised in that** the interconnectors are attached to the post elements by riveting.
5. Scaffolding system according to any one of claims 1 to 3, **characterised in that** the interconnectors are attached by screwing.
6. System according to claim 4 or 5, **characterised in that** the interconnectors are also attached by another type of mechanical or chemical attachment.
7. System according to any one of claims 1 to 5, **characterised in that** the composite material is mineral-reinforced polyester resin or fibreglass-reinforced epoxy resin.
8. System according to any one of claims 1 to 6, **characterised in that** the reinforced polymer is a mineral-reinforced thermoplastic polymer.
9. System according to claim 7, **characterised in that** the reinforced polymer is fibreglass-reinforced polypropylene.

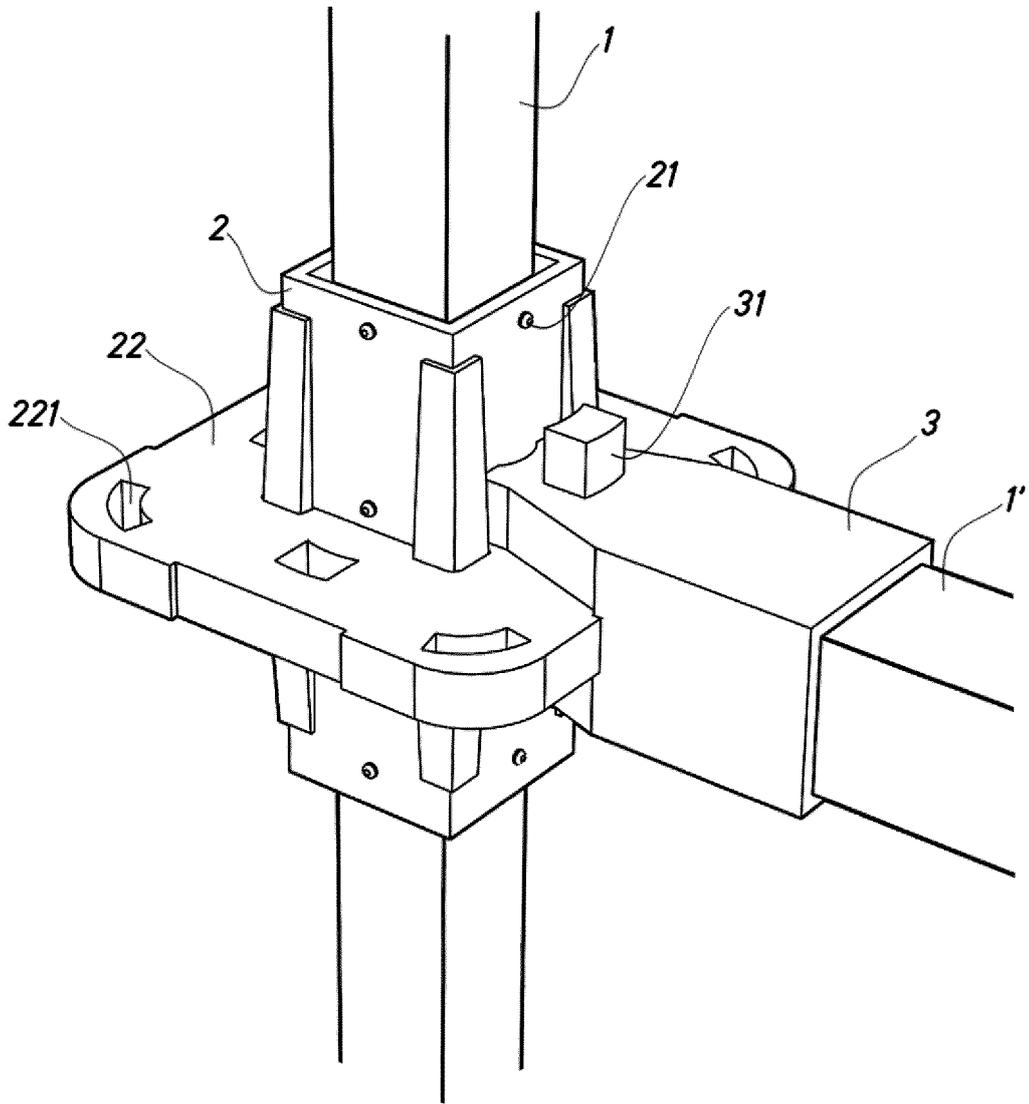


Fig.1

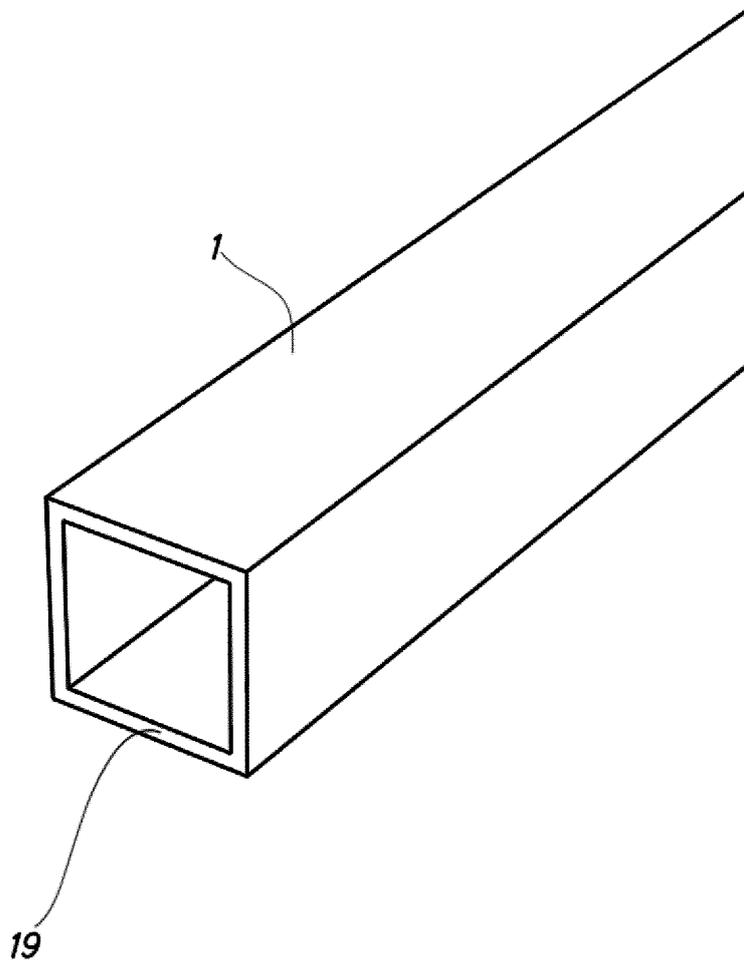


Fig.2

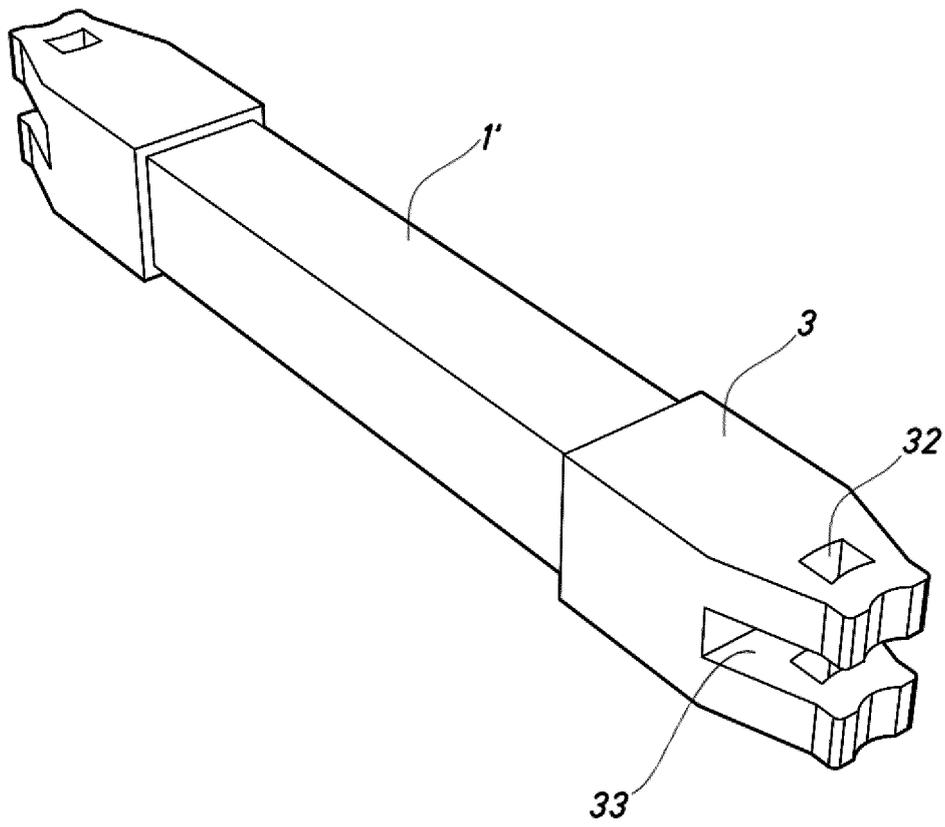


Fig.3

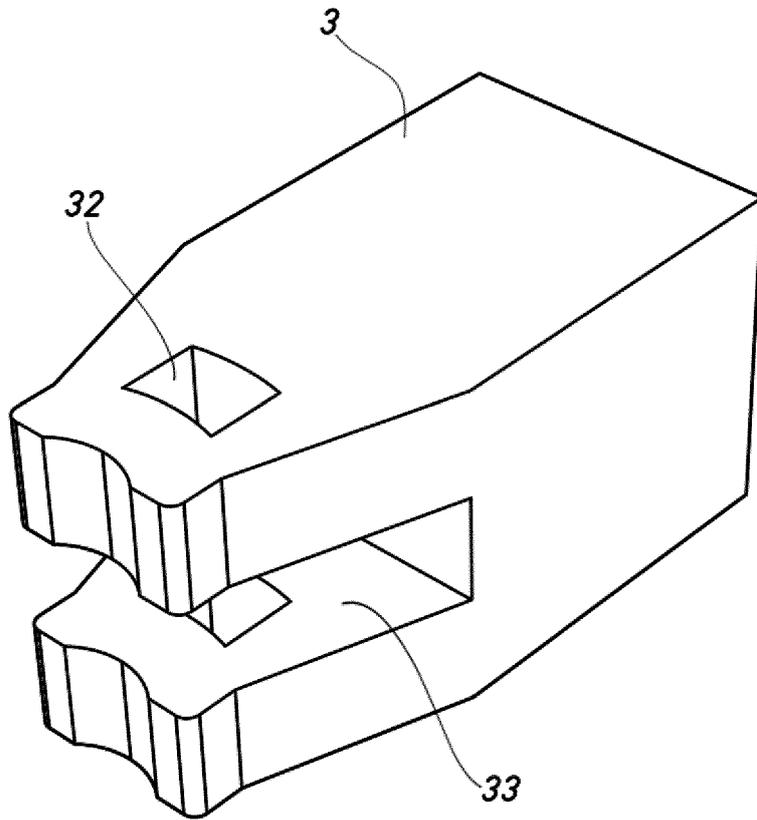


Fig. 4

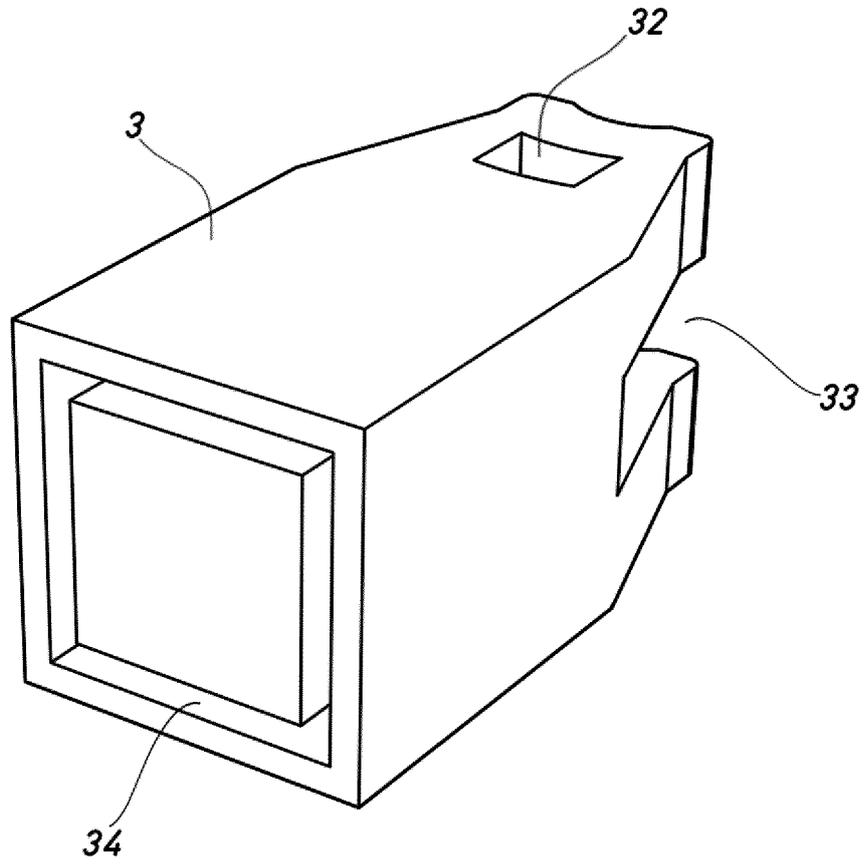


Fig.5

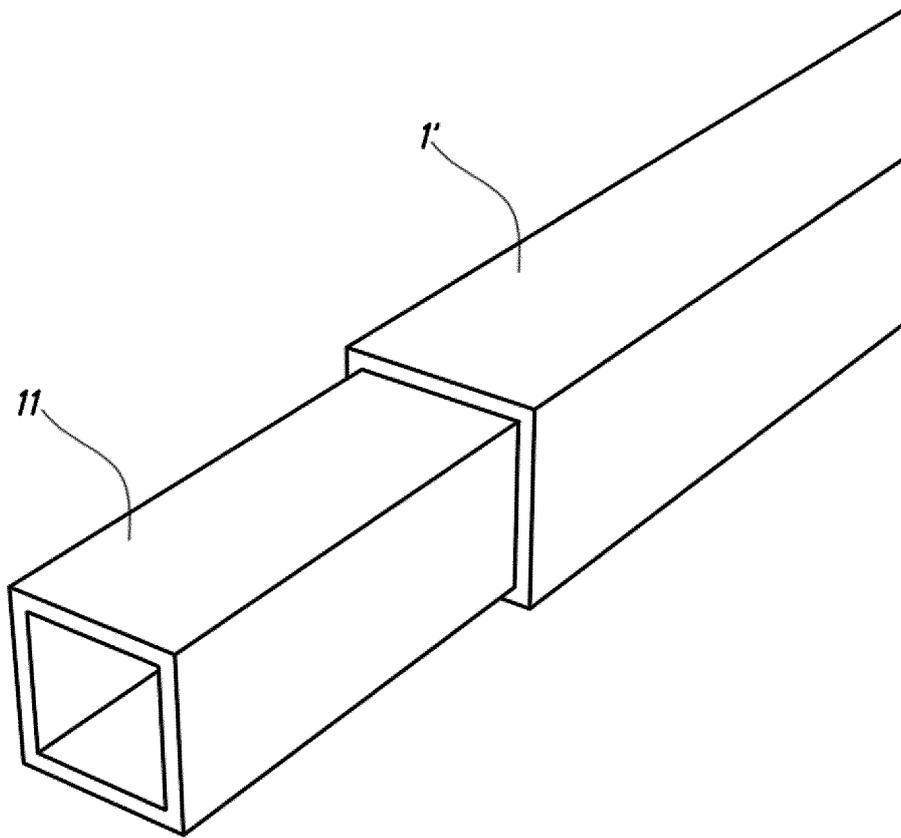


Fig.6

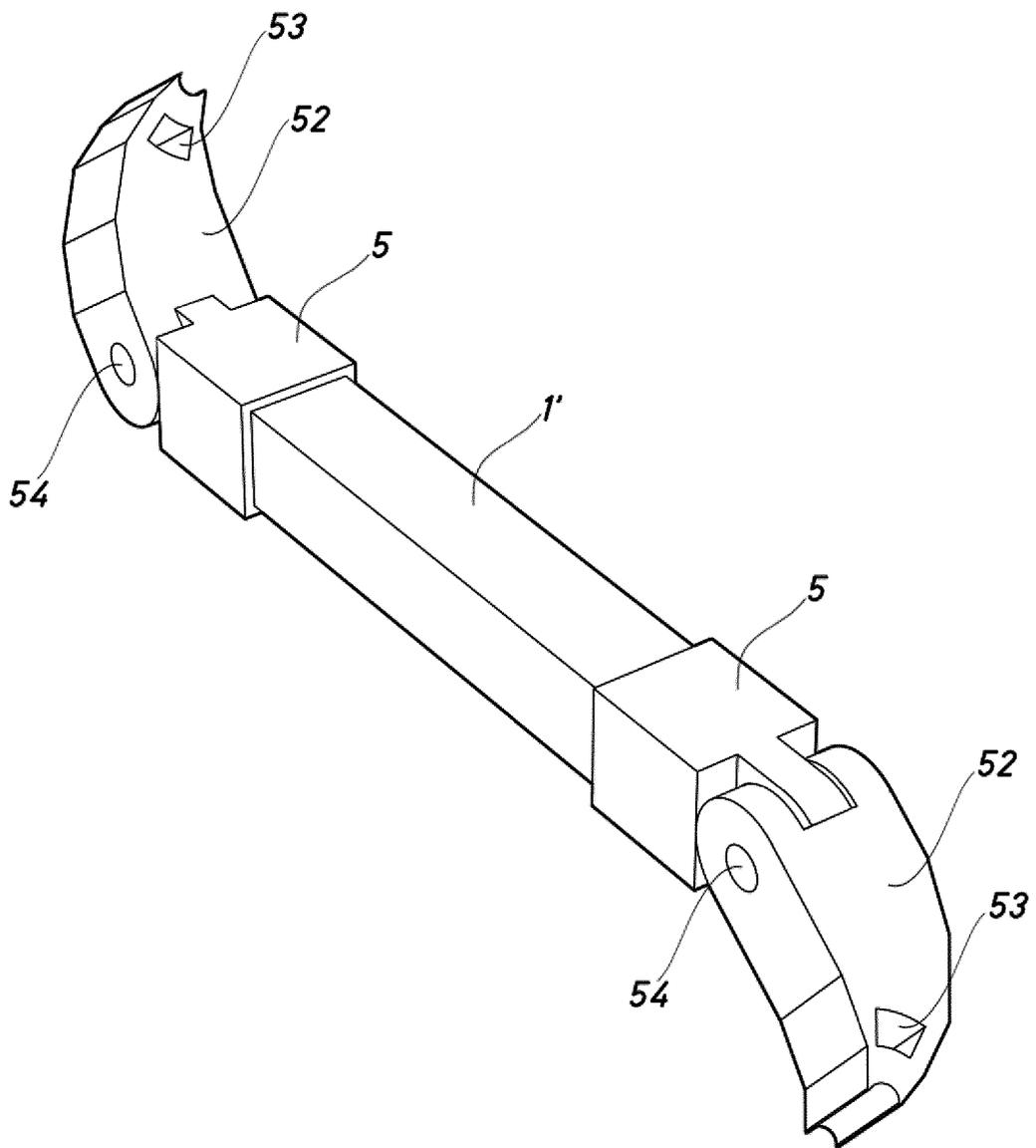


Fig. 7

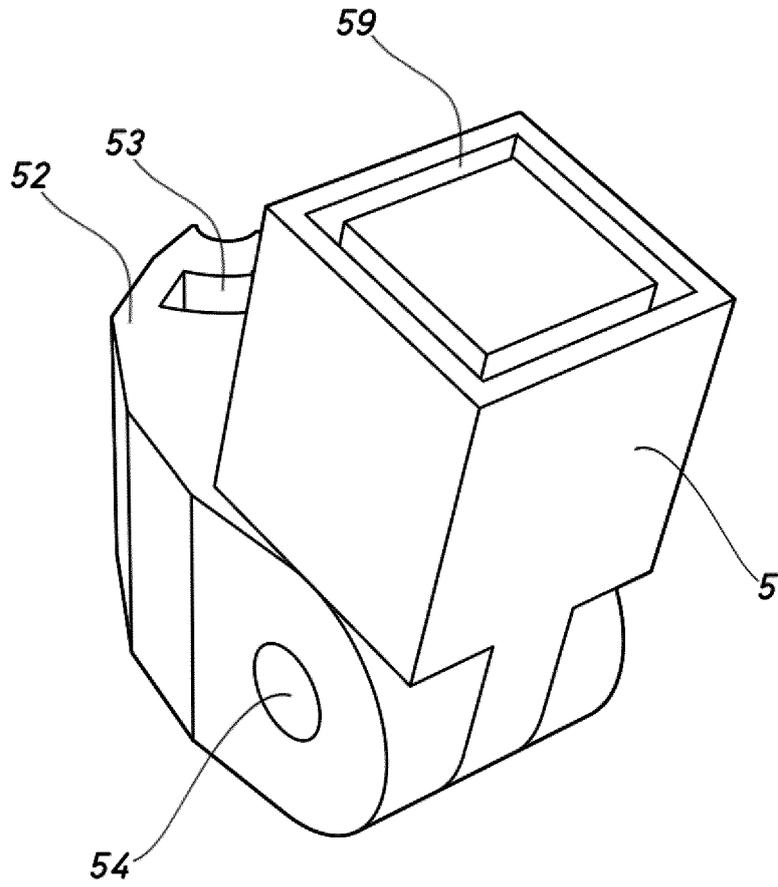


Fig. 8

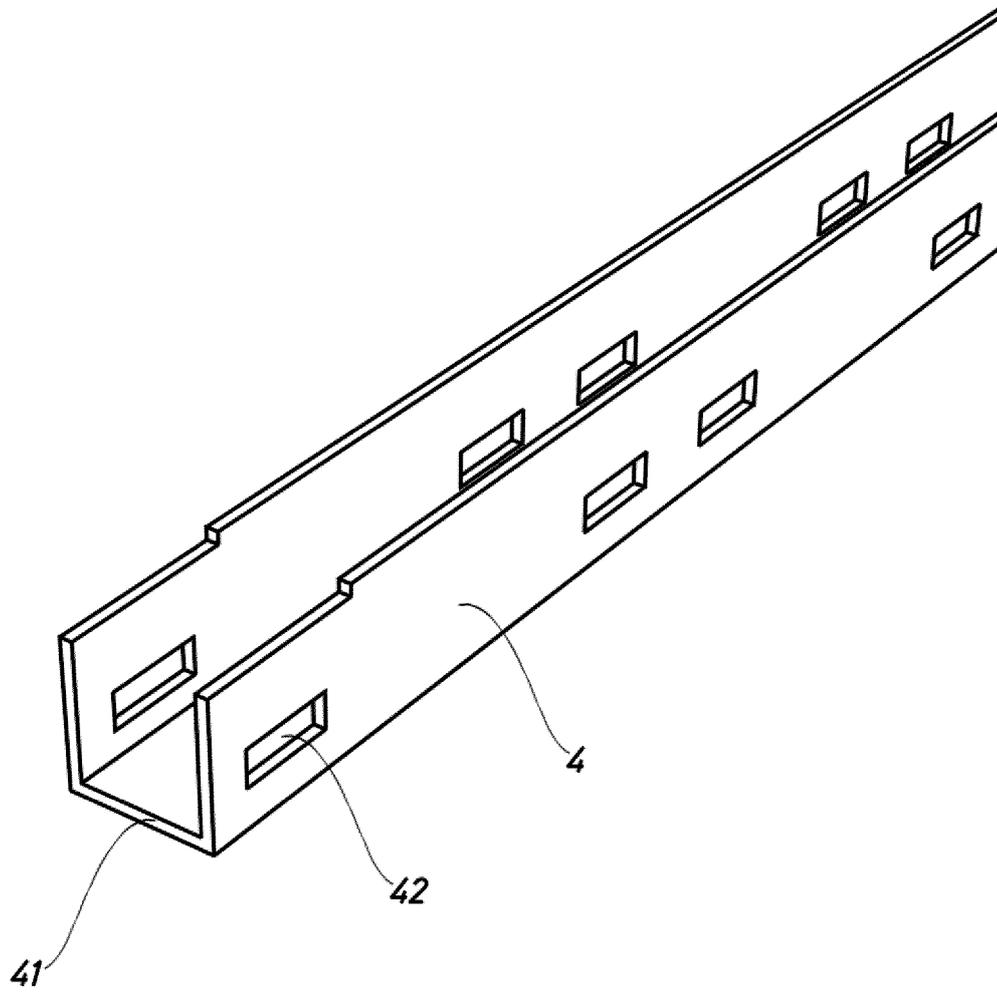


Fig.9

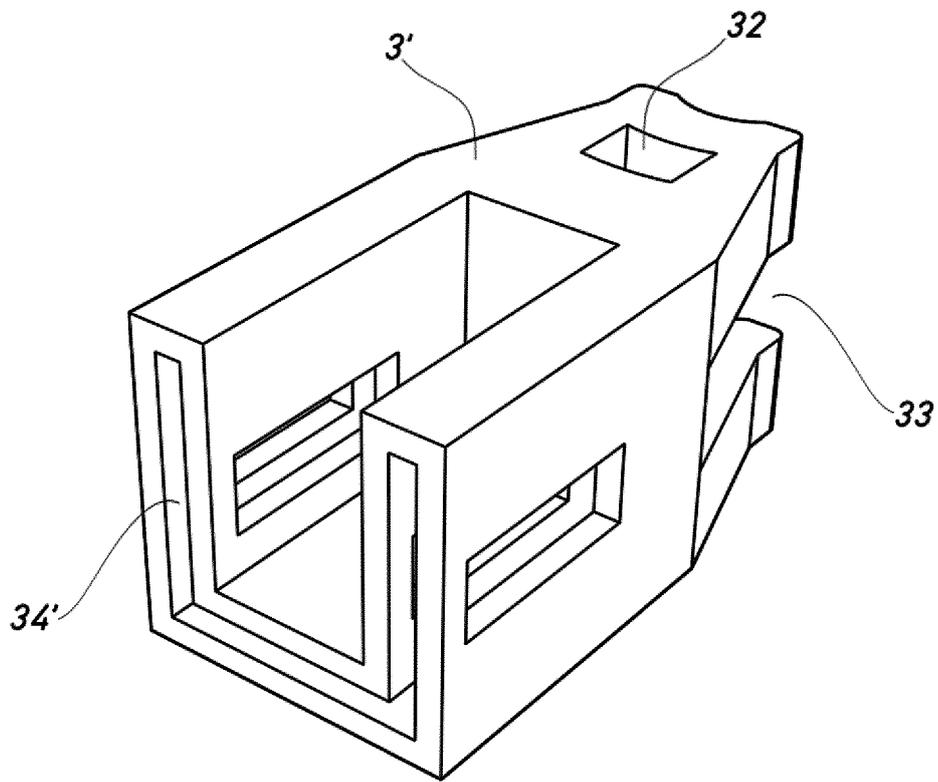


Fig.10

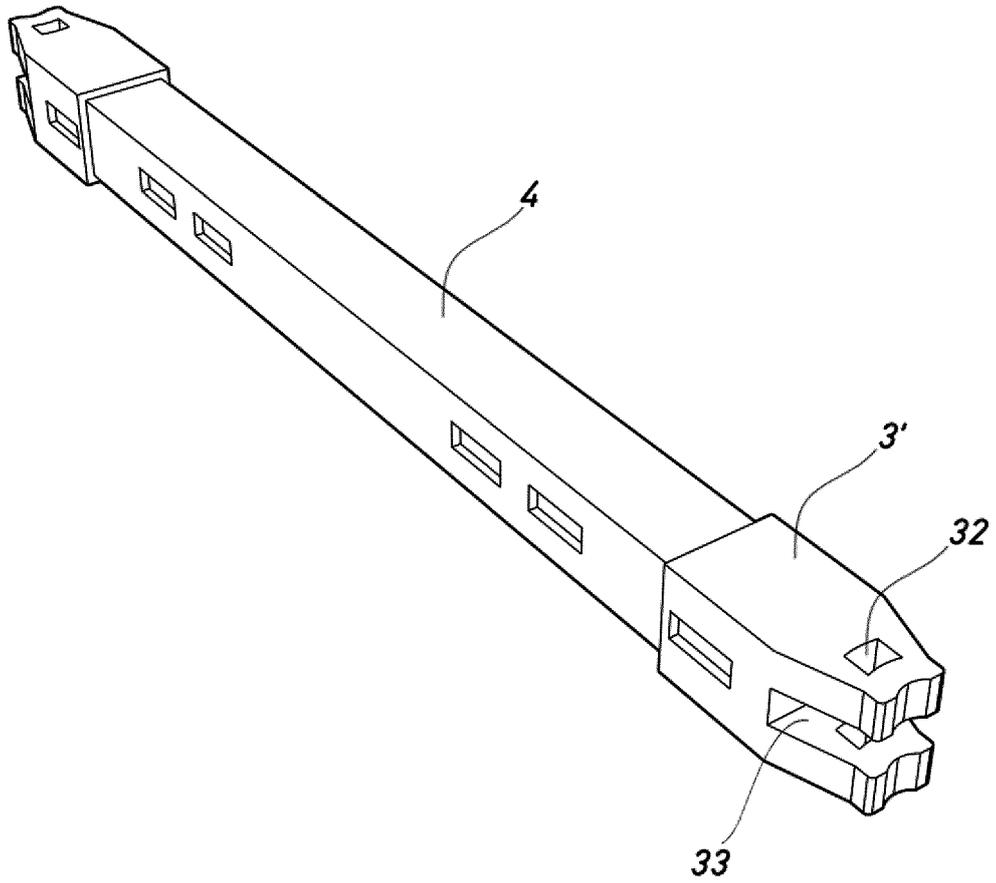


Fig.11

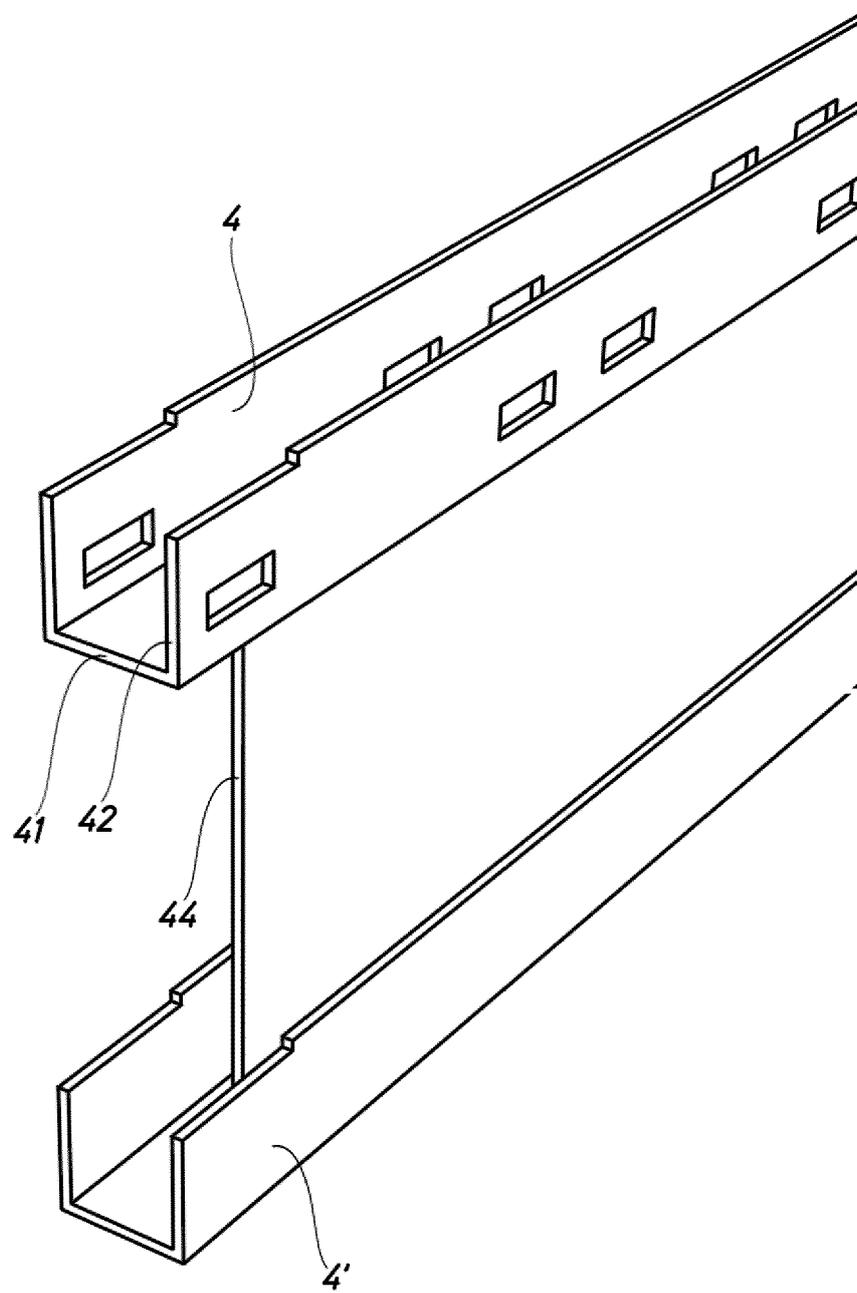


Fig.12

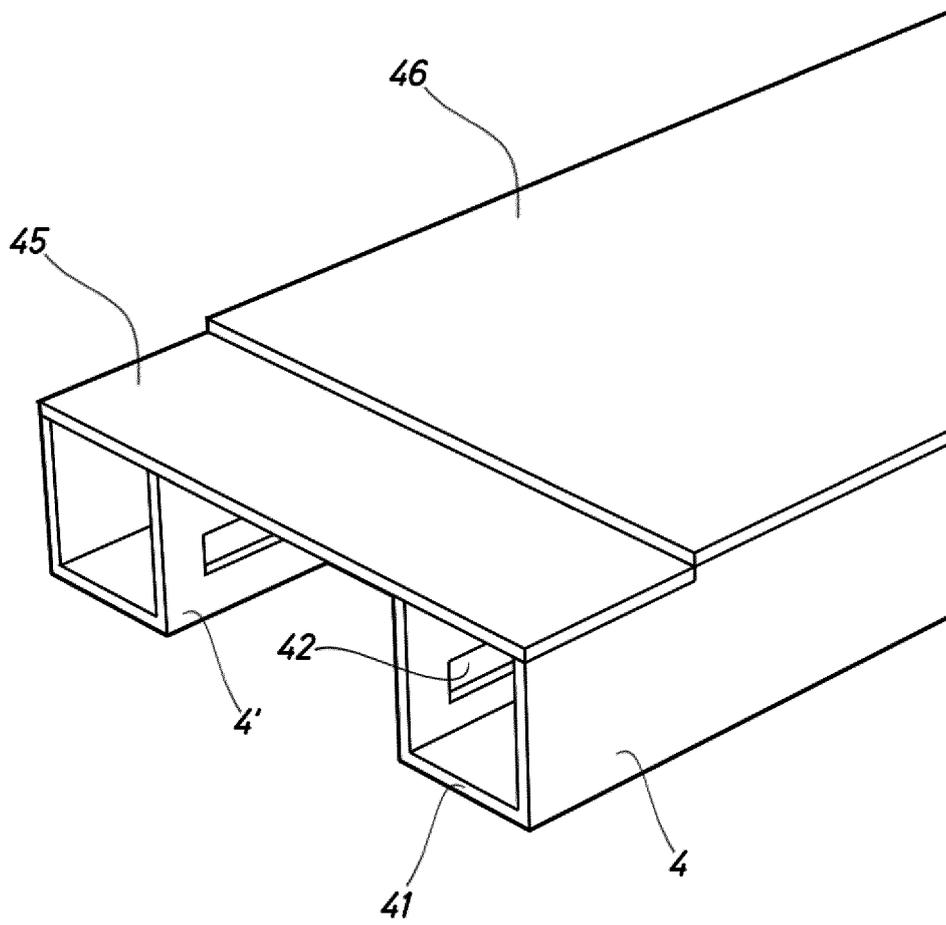


Fig.13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2014/070605

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A. CLASSIFICATION OF SUBJECT MATTER

E04G7/00 (2006.01)*E04G5/00* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

13/10/2014

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INTERNATIONAL SEARCH REPORT

International application No.
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