

**EUROPEAN PATENT SPECIFICATION**

- ④⑤ Date of publication of patent specification: **01.10.86**      ⑤① Int. Cl.<sup>4</sup>: **E 04 B 1/32, E 04 B 1/344,**  
**E 04 C 3/08, E 04 C 3/40,**  
**E 04 H 15/00**
- ②① Application number: **82302595.2**
- ②② Date of filing: **20.05.82**

**⑤④ Construction method.**

③⑩ Priority: **21.05.81 ZA 813421**

④③ Date of publication of application:  
**01.12.82 Bulletin 82/48**

④⑤ Publication of the grant of the patent:  
**01.10.86 Bulletin 86/40**

⑧④ Designated Contracting States:  
**BE CH DE FR GB IT LI LU NL SE**

⑤⑥ References cited:  
**EP-A-0 020 770**  
**AU-A-5 978 065**  
**AU-B- 425 337**  
**DE-A-2 059 829**  
**DE-A-2 646 050**  
**FR-A-1 315 078**  
**FR-A-2 137 123**  
**FR-A-2 327 369**  
**FR-A-2 351 220**  
**GB-A- 117 994**  
**US-A-2 797 696**  
**US-A-3 080 875**  
**US-A-3 283 464**

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## Description

This invention relates to a method of erecting a structure using constructional elements which are connectable to base plates and joined to each other in an end to end relationship.

FR—A—2,351,220 described and illustrates a method of erecting a structure comprising the steps of pivotally connecting a constructional element to a first base member, connecting additional constructional elements by hoisting the free end of the connected constructional element to a height sufficient to allow the connection of the additional element to the free end and connecting the free end of the last constructional element to a second base member.

FR—A—1,315,078 describes and illustrates a method of erecting an arched structure in which a number of prefabricated constructional elements are connected to each other, starting on opposed sides of the arch.

The method of the present comprises the steps of attaching two or more first base plates to a base for the structure, pivotally connecting two adjacent first constructional elements to their respective first base plates and rigidly connecting the first constructional elements to each other by means of a purlin, fixing connectors to the free ends of the first constructional elements, hoisting the free ends of the first constructional elements and rigidly connecting the connectors to two or more additional constructional elements, rigidly connecting the additional constructional elements to additional purlins and connecting the free ends of the last constructional elements to a pair of second base plates attached to the base.

In a preferred form of the invention, the structure is arch-like and the method comprises the preliminary step of cutting the ends of the constructional elements at a predetermined angle, which will depend on the curvature of the arch.

The method includes the additional step of rigidly securing the structure to the base plates once erected.

The structure of the invention may be erected, along with a number of similar structures, in the arrangement of a building and, if necessary, the constructional elements may be connected to one another at least in pairs by means of tension members. The method therefore includes the additional steps of erecting a plurality of structures in a predetermined arrangement to form a structural whole or building frame and cladding the building frame.

The optional tension members will be referred to as "cross bracing" or "ties", for the sake of clarity and to distinguish the same from the purlins. The structural elements used as purlins may be the same as the constructional elements, but it will be appreciated that suitable structural elements of a different shape may also be used.

In addition to the purlins connecting adjacent constructional elements, the structure may be cross braced.

The constructional element used for carrying out the invention preferably comprises an expanded extruded beam, preferably of metal, which includes a box section on either end of a profiled web, the web being cut, between the profiles at predetermined intervals and expanded.

In a preferred form of the invention each constructional element is optionally provided, along an upper edge thereof, with channels adapted to receive the enlarged edge of a flexible sheet member.

The connector used for carrying out the invention preferably comprises an extrusion of H-section, the bar of the H being adapted to abut the ends of the constructional elements in use and the legs of the H being adapted to receive the ends of the constructional elements in use.

The legs of the H and the ends of the constructional elements are preferably formed with holes adapted to receive bolts.

The bottom connectors may be of H-section, but the remaining connector H-section extrusions may conveniently be provided with at least one bracket on the side of the H, preferably extruded integrally with the H-section. The bracket preferably comprises a channel with opposed walls adapted to receive the end of the purlin therebetween.

The connector may conveniently include a flange on the outside of the H which flange may be provided with means, preferably an aperture formed therein, to receive cross bracing elements.

A base connector may also be used comprising an extruded box section tube, adapted to fit within the legs of the H of the H-section connectors, which is integral with a wide base.

The base may be connected to the ground, a foundation or the like.

The above structure and the method of erecting it is ideally suited for larger industrial or agricultural buildings, or for large temporary structures. However the constructional elements and connectors can be scaled down for the construction of permanent or temporary domestic buildings.

In one such form the connectors are adapted to allow the hinging of the beams to a position where, in a dismantled form the beams, still connected to one another at their ends, lie adjacent one another. The purlins are preferably box-shaped and dimensioned to receive the ends of the beams therein in dismantled form, means being provided to connect an axle to the resultant flat structure to provide a trailable vehicle.

The invention is further described with reference to the accompanying drawings in which:—

Figure 1 is a diagrammatic sectional side elevation of an arch-like structure according to the invention;

Figure 2 is a plan view of a part of the structure showing the connector;

Figure 3 is a cross section through an unexpanded extruded beam;

Figure 4 is a cross section through an expanded beam;

Figure 5 is a side elevation of a part of an expanded beam;

Figure 6 is an end elevation of a base connection; and

Figure 7 is an end elevation of a light-weight temporary structure.

The structure or arch-like structure 10 shown in Figure 1 is part of the structural whole or frame of a building and comprises a plurality of constructional elements or beams 12 supported on base plates 14. The beams 12 are connected to one another by means of connectors 16. The arches 10 are erected in pairs, each arch in a pair being connected to the other by means of purlins 18 (shown in cross section in Figure 1) the purlins being the same beams as are used in constructing the arch 10 with the exception that the ends of the purlins are cut at right angles while the ends of the beams 12 are cut at a predetermined angle. This angle will, of course, depend on the curvature of the arch.

The arch is erected as follows:

The base 11 is prepared. This is normally a level site which is provided with a concrete screed and the base plates 14 are placed in position. A pair of first beams 12a are pivotally connected to their respective base plates 14 by means of bolts and nuts 20. The beams 12a are allowed to lie virtually flat on the ground. The connectors 16 are now attached to the ends of the beams 12a in a manner to be described below and the purlin 18 between the two beams 12a is connected to the connector 16. The next pair of beams 12b is now attached, each beam 12b in the pair being connected to its respective connector. To do this the free ends of the connected beams 12a are lifted clear of the ground to allow the rigid connection thereto of the next or additional beams 12b. It will be appreciated that the beams 12a need not be hoisted to their final position, it is sufficient merely to hoist them high enough for the free ends of the beams 12b to rest on the ground.

The next pair of connectors 16 is now attached to the free ends of the second connected beams 12b which are then hoisted just high enough for the connection thereto of the next pair of beams 12c. The hoisting apparatus being moved from the ends of the first beams 12a to the ends of the second beams 12b.

In this manner the whole arch 10 is erected by merely lifting the free ends of each connected beam pair to allow the attachment thereto of the next beam until the last pair of beams 12d are fixed in place which beams are then connected to the second base plates on the other side of the structure by means of bolts and nuts 22. The arch 10 may now be rigidly connected to the first base plate by means of bolts 23.

In this manner a plurality of arches may be erected according to a predetermined plan to provide a building frame comprising pairs of connected arches. The resulting pairs of arches may be connected to one another by means of ties or

cross bracing extending from flanges 30 which are arranged to project from the connectors 16.

The side elevation of Figure 1, being diagrammatic, does not show the diamond pattern of the webs which will be described below.

The connector 16 can be seen in greater detail in the plan view in Figure 2 where the H-section extrusion can be seen to comprise two pairs of legs 24 extending on either side of a cross bar 25. The extruded H-section 24 is cut to the desired length which is related to the depth of the beams 12, the ends of which fit between the legs 24 on either side of the cross bar 25. To secure the connector 16 to the beams 12, bolts and nuts 26 are located in appropriately positioned holes drilled into the box sections of the beams 12 and the legs 24 of the H. The H-section is extruded integrally with two channel formations 27, one on either side of the H. The channel formations 27 comprise two walls 28 adapted to receive the purlins 18, which are the same or similar to as the arch beams 12. The walls 28, in fact, provide the brackets to support the purlin beams 18 and are provided with appropriately positioned holes for bolts and nuts 29 which, once again, pass through the box sections of the beams 18.

In addition to the extruded legs 24 and brackets 28, flanges 30 are provided on either side of the connectors 16 and formed with the holes 32 for the cross bracing or tie rods which, in the completed building frame, will extend between the pair of arches and, if necessary, between the arches in a pair. It will be appreciated that, in situations where the arches in a pair are connected to one another by means of purlins extending between the two and without cross bracing, and where the cross bracing extends between adjacent pairs of arches, the brackets 28 need be provided only on one side of the H while the flange 30 need be provided only on the other side of the H.

The beams 12 are produced from an aluminium extrusion which is shown in Figure 3 to comprise a profiled web 34 with a box section 36, 38 on either side thereof. The upper box section 38 is optionally provided with a double sided channel section, the purpose of which will be described below.

To arrive at the shape shown in Figures 4 and 5, the profiled web 34 is cut between the profiles at predetermined intervals which will depend on the desired final shape of the beam. The cuts between adjacent profiles are staggered and the extrusion is then gripped by mechanical means at the box sections which are then pulled apart to expand the web into the diamond pattern shown in Figure 5. This process is well known and described in several South African patents to Jury and Spiers (Pty) Limited.

The beams 12 of the arches and the beams 18 of the purlins are both the same or similar as has been mentioned above. The ends of the beams 12 are cut at an angle which will, of course depend on the desired curvature of the arch, while the ends of the purlin beams 18 are cut at right angles

to the longitudinal axes thereof.

Figure 5 also shows the connector 16 in side elevation in position on a purlin 18 where it can be seen how the flange 30 on one side of the connector 16 fits between the ties 34a formed by the expanded web of the beam.

An alternative to the base 14 is the use of the base connector 114 shown in Figure 6. This connector has dimensions similar to the end of the beam 12 so that it fits within the legs H connector 16. The base connector 114 includes a wide base 114a with the tubular box section projection 114b which fits within the legs of the H as has been mentioned above. The projection 114b is jig drilled as are the other components of the system, for the location of bolts. The base may be provided with ground spikes (not shown) which may be cemented to the concrete base 100 of the building.

Figure 7 shows a light weight structure 200 embodying the principles of the invention. The structure comprises beams 202, connectors 204 and purlins 206.

A fabric cover 208 is provided and poles 210 spread the fabric on either side of the structure. Pegs or spikes 212 are provided to hold lines 214 which secure the poles and similar pegs hold the base plates 214 and the beams 202 in position.

The structure 200 can be dismantled and converted into a trailer by removing only some of the bolts in the connectors and folding or hinging the still connected beams with their free ends towards one another in zig zag fashion. The hinged beams are laid flat and the channel shaped purlins 206 are slid over the ends of the beams and the connectors and bolted into position forming a flat structure. An axle assembly (not shown) and a towbar assembly (not shown) are provided and once these are bolted in position the structure is converted to a trailable vehicle on which the fabric cover and other goods can be loaded. This structure 200 is useful as temporary garage, tent or the like.

Once the structure is erected and all the arches in the building frame are rigidly connected, the frame may be clad with conventional sheet material cladding such as roofing sheets. Alternatively sheets of flexible material or tarpaulins of canvas, plastics impregnated canvas or a synthetic textile may be used. Prior to their location on the structure, the sheets will be provided with rope reinforced edges or similarly enlarged edges along two sides thereof which are then drawn into the channels 42 and 44 provided along the upper box sections 38 of the beams 12 of two adjacent arches 10. The sheets will, of course, be drawn into the facing channels of two adjacent arches to span the space between the adjacent arches 10. With properly designed leaders, the sheets may be pulled, by means of ropes located in the channels 42 and 44, from one side of the frame completely over frame to the other side. If an appropriately sized rope reinforcing edge is used, the joints between the beams 12 and the sheet material should be water proof.

It will be appreciated that the constructional elements and connectors can be mass produced and bolted together without scaffolding or the like. In addition, due to the simplicity of the elements involved, the structures can be erected largely with unskilled labour. The structural method and means provided is particularly suitable for temporary buildings as the building and building frames can be dismantled and re-erected rapidly some other place.

## Claims

1. A method of erecting a structure using constructional elements which are connectable to base plates and joined to each other in an end to end relationship, which method comprises the steps of attaching two or more first base plates to a base for the structure, pivotally connecting two adjacent first constructional elements to their respective first base plates and rigidly connecting the first constructional elements to each other by means of a purlin, fixing connectors to the free ends of the first constructional elements, hoisting the free ends of the first constructional elements and rigidly connecting the connectors to two or more additional constructional elements, rigidly connecting the additional constructional elements to additional purlins and connecting the free ends of the last constructional elements to a pair of second base plates attached to the base.

2. A method according to Claim 1 which includes the additional step of cutting the ends of the constructional elements at predetermined angles, each connector comprising an H-section member, in which the bar of the H is adapted to abut the ends of the constructional elements and the legs of the H are adapted to receive the ends of the constructional elements, and a bracket comprising a channel with opposed walls which is adapted to receive the ends of similar constructional elements therebetween.

## Patentansprüche

1. Verfahren zur Erreichung einer Konstruktion unter Verwendung von Konstruktionselementen, die an Bodenplatten befestigbar und in einer End-Zu-End-Beziehung aneinandergesetzt sind, wobei das Verfahren die Schritte aufweist: Befestigen von zwei oder mehr ersten Bodenplatten auf einem Fundament für die Konstruktion, drehbares Befestigen zweier nebeneinanderliegender erster Konstruktionselemente an ihre jeweiligen ersten Bodenplatten und starres Verbinden der ersten Konstruktionselemente miteinander mit Hilfe einer Pfette, Befestigen von Verbindungsstücken an den freien Enden der ersten Konstruktionselemente, Aufrichten der freien Enden der ersten Konstruktionselemente und starres Verbinden der Verbindungsstücke mit zwei oder mehr zusätzlichen Konstruktionselementen, starres Verbinden der zusätzlichen Konstruktionselemente mit zusätzlichen Pfetten und Befestigen der freien

Enden der letzten Konstruktionselemente an einem Paar von zweiten Bodenplatten, die auf dem Fundament befestigt sind.

2. Verfahren nach Anspruch 1, das den zusätzlichen Schritt des Anschneidens der Enden der Konstruktionselemente in vorbestimmten Winkeln einschließt, wobei jedes Verbindungsstück ein Bauteil mit H-Profil, bei dem der Querbalken des H dazu dient, an den Enden der Konstruktionselemente anzuliegen, und die Längsbalken des H dazu dienen, die Enden der Konstruktionselemente aufzunehmen, und einen Ausleger aufweist, der eine Rinne mit gegenüberliegenden Wänden aufweist, die dazu dient, zwischen diesen die Enden von ähnlichen Konstruktionselementen aufzunehmen.

#### Revendications

1. Méthode de montage d'une charpente utilisant des éléments de construction qui sont raccordable à des plaques de base et reliés entre eux bout à bout, qui comprend les étapes suivantes:

— On fixe deux ou plus de deux premières plaques de base sur une assise pour la charpente,

— on raccorde de façon pivotante deux premiers éléments de construction adjacents à leurs

premières plaques de base respectives et on raccorde rigidement les premiers éléments de construction entre eux au moyen d'une panne,

— On fixe des raccords aux extrémités libres des premiers éléments de construction,

— On lève les extrémités libres des premiers éléments de construction et on raccorde rigidement les raccords à deux ou plus de deux nouveaux éléments de construction,

— On raccorde rigidement les nouveaux éléments de construction à de nouvelles pannes et on raccorde les extrémités libres des derniers éléments de construction à une paire de secondes plaques de base fixées sur l'assise.

2. Méthode conforme à la revendication 1 qui comprend l'étape supplémentaire qui consiste en ce que l'on coupe les extrémités des éléments de construction à des angles prédéterminés, chaque raccord comportant une partie de section en forme de H, la barre du H étant adaptée pour venir en butée contre les extrémités des éléments de construction, les jambes du H étant adaptées pour recevoir les extrémités des éléments de construction, et un console comportant un canal à parois opposées adapté pour recevoir entre celles-ci les extrémités d'éléments de construction similaires.

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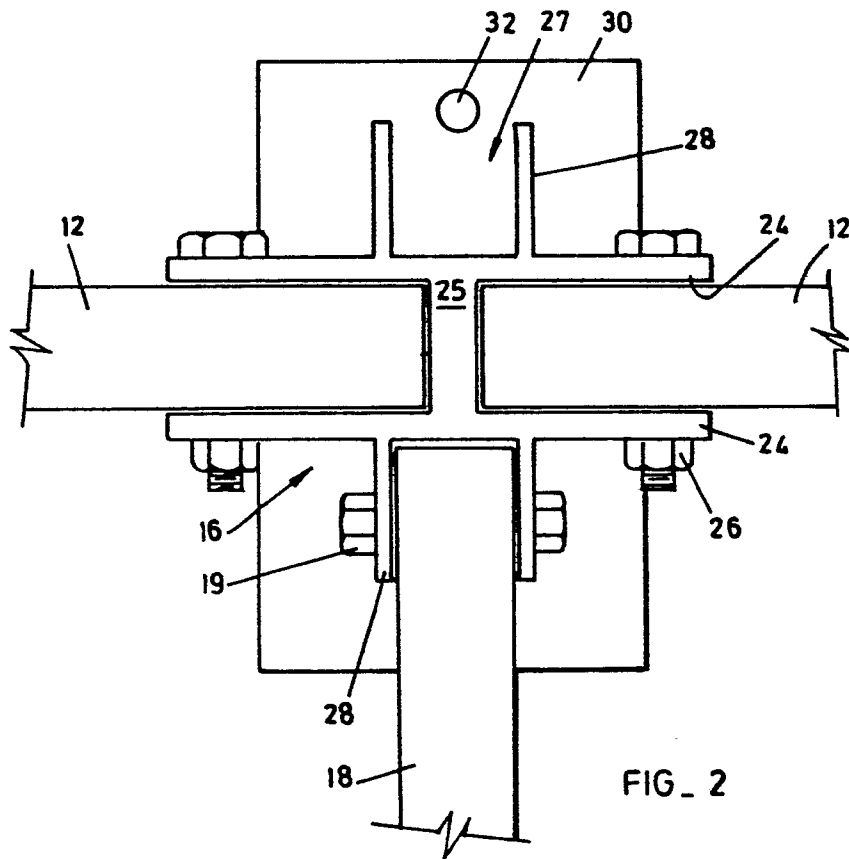
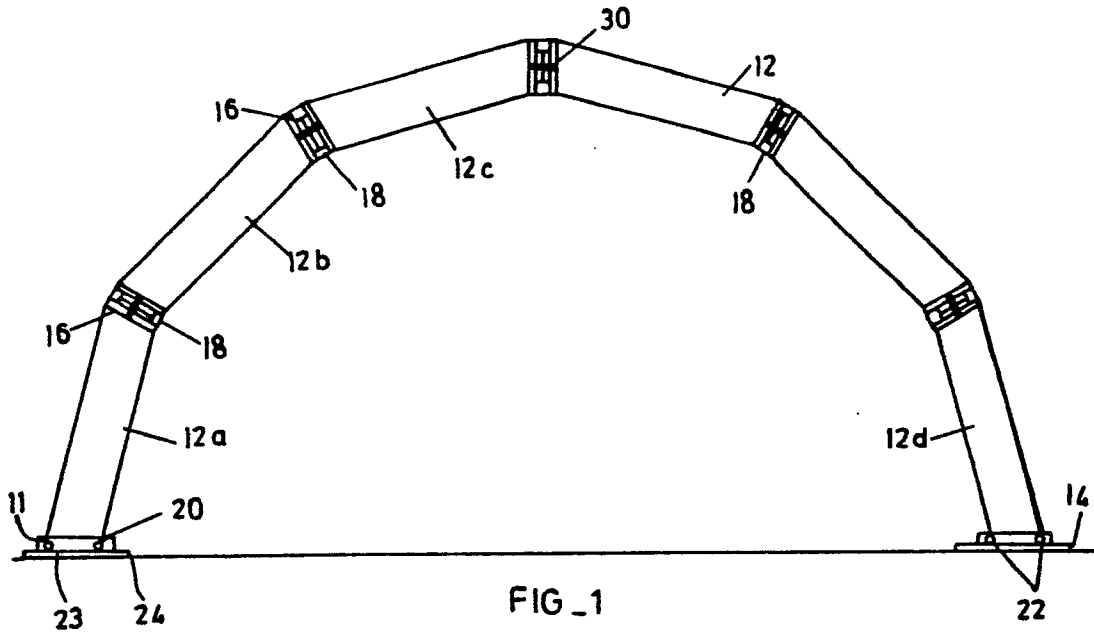
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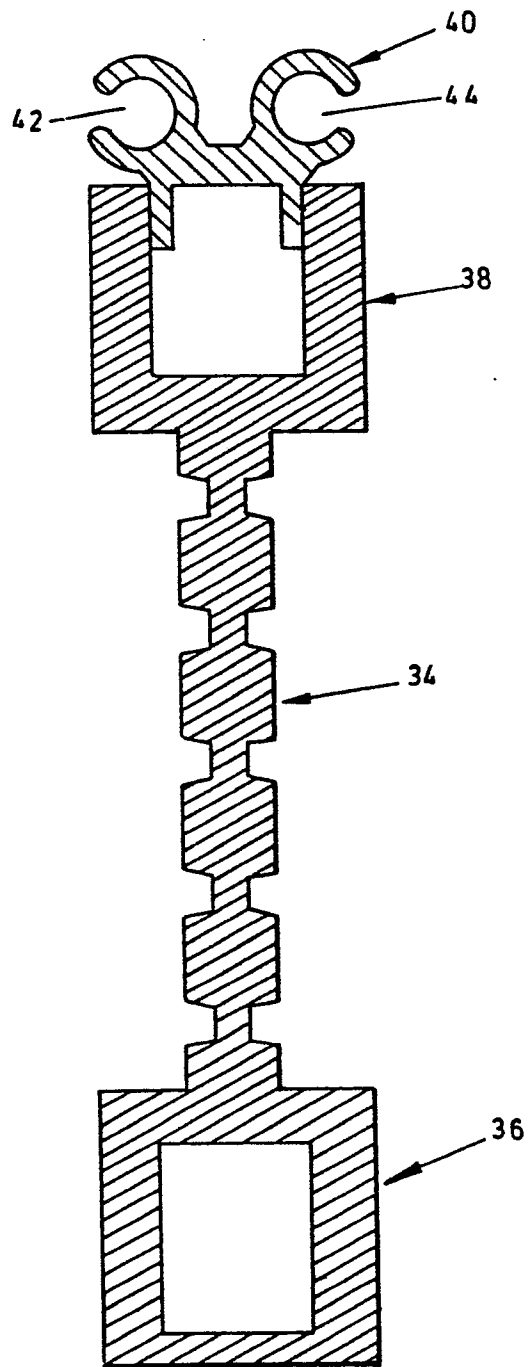
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FIG\_3

