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㉙ **Support structure.**

㉚ In order to provide easy assembly of a good roof (or floor) support structure, the structure is a type of space frame type, having upper rafters 1 connected to lower chords 2 by inclined struts 3. The rafters 1 and chords 2 are all formed of back-to-back booms 6, 8, and the flattened ends of the struts 3 are vertical and clamped between the booms 6, 8 by horizontal securing bolts 7, 9.

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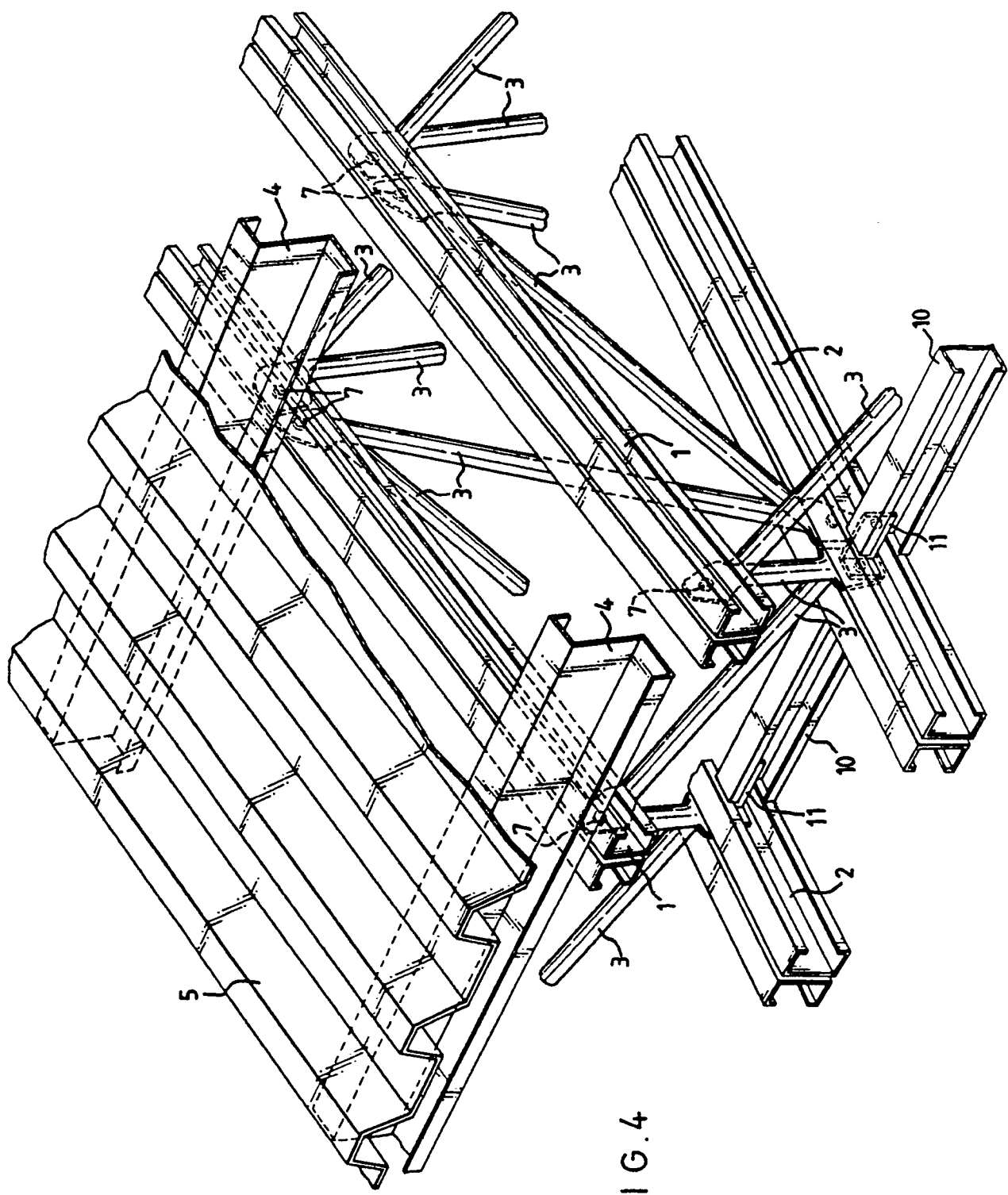


FIG. 4

SUPPORT STRUCTURE

Background of the Invention

The present invention relates to a roof or floor support structure having an upper elongate member, a lower elongate member, and interconnecting members interconnecting the upper and lower members, the interconnecting members forming a zig-zag array as seen looking horizontally at right angles to the upper and lower members.

Such structures are known, and reference can be made to US 3 336 718, AU 421 180, US 2 284 898 and WO 8200311.

The Invention

According to the invention, the upper elongate member comprises or is formed of two parallel components fixed together side-by-side and the upper ends of the interconnecting members are clamped between and secured to the components of the upper member. The invention extends to a building incorporating the structure.

Claims 2 to 11 set forth preferred and/or optional features of the invention.

The invention can provide a support structure in the form of an assembly made up of parts which can be transported relatively easily and each of which can be lifted by two men. The parts can be assembled without welding, on the ground beneath the final position, or nearby, for craning into position. Nonetheless, due to having the interconnecting member ends sandwiched between the components of the upper and lower members, joints can be formed which match the strength of the members joined together, using readily-available materials suited to mass production. A superior Vee formation can be provided and the upper member, which will be in compression, can be suitably strengthened by forming it of the double components.

The invention is particularly suited to forming a type of space frame, in which the upper members are laterally offset with respect to the lower members, and also to forming a pitched roof construction in which the upper members are inclined to the horizontal and support the roof. The invention can provide a simple adaptation of a truss to a space frame. As no welding is required during manufacture or erection, pre-galvanising and factory-applied finishes can be employed.

Preferred Embodiments

The invention will be further described, by way of example, with reference to the accompanying drawings, in which :—

Figure 1 is a view of a roof support structure, look-

ing parallel to the ridge, as seen in the section I-I of Figure 2 ;

Figure 2 is a section along the line II-II of Figure 1 ;

Figure 3 corresponds to Figure 2, but shows a different structure ;

Figure 4 is an isometric view of the structure of Figure 3 ; and

Figure 5 is a schematic end view of a building having the roof support structure of Figures 1 and 2 or of Figures 3 and 4.

Figures 1 and 2

The roof support structure of Figures 1 and 2 has spaced, parallel, inclined upper members or rafters 1 ; though the upper members 1 are shown inclined in Figure 1 and 2, in an alternative construction, they could be horizontal. There is a single lower member or chord 2, and there are inclined interconnecting members or diagonal struts 3 interconnecting the rafters 1 and chord 2, the struts 3 extending at an angle to the vertical so that, as seen looking in Figure 1, they form a zig-zag array. As is clearer in Figure 5, the nodes or connection zones between the struts 3 and the rafters 1 and chords 2 are equi-spaced along the rafters 1 or chords 2, so that the inclination of the struts 3 increases towards the central part of the building or ridge of the roof i.e. each strut 3 is slightly steeper than the previous one. At least the major part of the chord 2 is at a level below the rafters 1. At the eaves, the rafters 1 can be brought down to the same level as the chord 2, or can be at a higher level as shown in Figure 5, the latter being preferred. The chord 2 is positioned half way between the rafters 1, as seen looking from above. Rafters 1 will be spaced along the whole length of the building, and each pair of rafters 1 will be associated with a chord 2, forming parallel trusses. As shown, the rafters 1 support roof support members or purlins 4 which serve to interconnect and space the rafters 1 and also support a roof cladding 5 ; as the nodes are equi-spaced along the rafters 1, the purlins 4 can be equi-spaced and positioned above the nodes.

Each rafter 1 is formed of two parallel components or booms 6 extending side-by-side and fixed together by securing members or bolts 7 which also connect the struts 3 to the rafters 1. Likewise, the chord 2 is formed of two parallel components or booms 8 extending side-by-side and fixed together by securing members in the form of bolts 9 which also connect the struts 3 to the chord 2. The struts 3 are tubular, with flattened ends which extend at a suitable angle to the axis of the respective strut 3, and the flattened ends are clamped between the respective com-

ponents 6, 8 and are thereby secured rigidly to the respective rafters 1 and chord 2, the bolts 7, 9 serving to locate.

As can be seen in Figure 2, pairs of the struts 3 are in V-formation (and register with, i.e. are superimposed on, each other as seen in Figure 1); in each pair, the upper ends are connected to respective rafters 1, and the lower ends are connected to the chord 2 by a single bolt 9. On the other hand, adjacent struts 3 which are inclined to each other as seen in Figure 1 have their respective upper or lower ends adjacent to each other but not overlapping, and the adjacent ends are connected to the rafters 1, or chord 2, as appropriate, by separate bolts 7, 9. As illustrated, each end of each strut 3 is secured by a single bolt 7, 9 which would be satisfactory, particularly for spans of 25 m or less. For longer spans, one can use two bolts 7, 9 per strut end, spaced along the axis of the strut 3, or four bolts 7, 9 in a parallelogram configuration with two sides parallel to the axis of the strut 3 and two sides parallel to the axis of the rafter 1 or chord 2.

Though not shown, rectangular washer plates are inserted between the respective booms 6, 8 and the ends of the struts 3, to resist any tendency of the booms 6, 8 to buckle. The washer plates are large enough to receive both bolts 7, 9 of a node illustrated, or all bolts of a node if more than two bolts are used.

The truss formed by the members 1, 2, 3 could have spans of say 7 to 100 m, but in practice one would use the trusses for spans of around 25 to 30 m. The truss illustrated could be for a span of 25 m, and the components 6, 8 could be back-to-back 165 mm x 63.5 mm "C" section cold-rolled galvanised steel booms of 3 mm gauge, the struts 3 being of 76 mm diameter hollow section galvanised steel tubing of 3 mm gauge; the bolts 7, 9 could be 20 mm diameter bolts. The washer plates can be 12 mm thick.

Figures 3 and 4

Figures 3 and 4 show that a type of space frame can be formed by interconnecting the chords 2 by short connecting members 10 using cleats 11. The connecting members 10 can be formed of parallel side-by-side components in a way similar to the members 1, 2.

In a variation which is not illustrated, the components 8 can be directly below the components 6 to form a linear truss. There need be no horizontal connections between adjacent components 8, but parallel trusses can be laid across the top of the components 6, at right angles to the lower trusses, and fixed to the lower trusses by suitable connection plates. If the aspect ratio of the building (ratio of length to width) is greater than about 2 : 1, the linear trusses or the structure as in Figures 1 and 2 is preferred.

Figure 5

The remainder of the building is shown in Figure 5. Any suitable walls or stanchions 12 can be used to support the roof structure, and can bear beneath the left hand end portions of the lower members 2 as seen in Figure 1, wall cladding 13 being taken up to the level of the roof cladding 5 at the eaves.

The present invention has been described above purely by way of example, and modifications can be made within the spirit of the invention.

Claims

1. A roof or floor structure comprising an upper elongate member (1), a lower elongate member (2), and interconnecting members (3) interconnecting the upper and lower members (1, 2), the interconnecting members (3) forming a zig-zag array as seen looking horizontally at right angles to the upper and lower members (1, 2), characterised in that the upper member (1) comprises two parallel components (6, 6) fixed together side-by-side, and the upper ends of the interconnecting members (3) are clamped between and secured to the components (6, 6) of the upper member (1).
2. The structure of Claim 1, and wherein there are at least two parallel, horizontally-spaced upper members (1) with the lower member (2) positioned between them as seen looking from above, the lower ends of pairs of interconnecting members (3) being secured to the lower member (2) by a securing member (9) passing through both interconnecting members (3), the upper ends of the interconnecting members (3) of each said pair being secured to respective upper members (1).
3. The structure of Claim 1 or 2, wherein there are at least two parallel, horizontally-spaced lower members (2) with the upper member (1) positioned between them as seen looking from above, the upper ends of pairs of interconnecting members (3) being secured to the upper member (1) by at least one securing member (9) passing through both interconnecting members (3), the lower ends of the interconnecting members (3) of each said pair being secured to respective lower members (2).
4. The structure of Claim 2 or 3, wherein the upper and lower ends of the interconnecting members (3) extend vertically, and are secured to the components of the respective upper and lower members by securing members (9) which extend horizontally.

5. The structure of any of Claims 2 to 4, wherein the spaced upper members (1) and the spaced lower members (2) are interconnected by horizontal connecting members (10). 5
6. The structure of any of the preceding Claims, wherein pairs of the interconnecting members (3) register as seen looking horizontally at right angles to the upper and lower members (1, 2). 10
7. The structure of any of the preceding Claims, wherein adjacent interconnecting members (3) which are inclined to each other as seen looking horizontally at right angles to the upper and lower members (1, 2), have their upper or their lower ends adjacent to each other but not overlapping, and the adjacent ends are connected to the respective upper or lower member (1 or 2) by respective separate securing members (9). 15 20
8. The structure of any of the preceding Claims, wherein the upper member (1) is inclined to the horizontal, the structure being a roof support structure. 25
9. The structure of any of the preceding Claims, wherein the interconnecting members (3) are tubular, with flattened ends.
10. The structure of any of the preceding Claims, wherein the lower member (2) is formed of two parallel components (8, 8) fixed together side-by-side, the lower ends of the interconnecting members (3) being clamped between and secured to the components (8, 8) of the lower member (2). 30 35
11. The structure of any of the preceding Claims, wherein oppositely inclined interconnecting members (3) are connected to the upper member (1) at respective upper connection zones, and oppositely-inclined interconnecting members (3) are connected to the lower member (2) at respective lower connection zones, the upper connection zones being equi-spaced along said upper members (1), and the lower connection zones being equi-spaced along said lower members (2). 40 45
12. A building incorporating the structure of any of the preceding Claims. 50

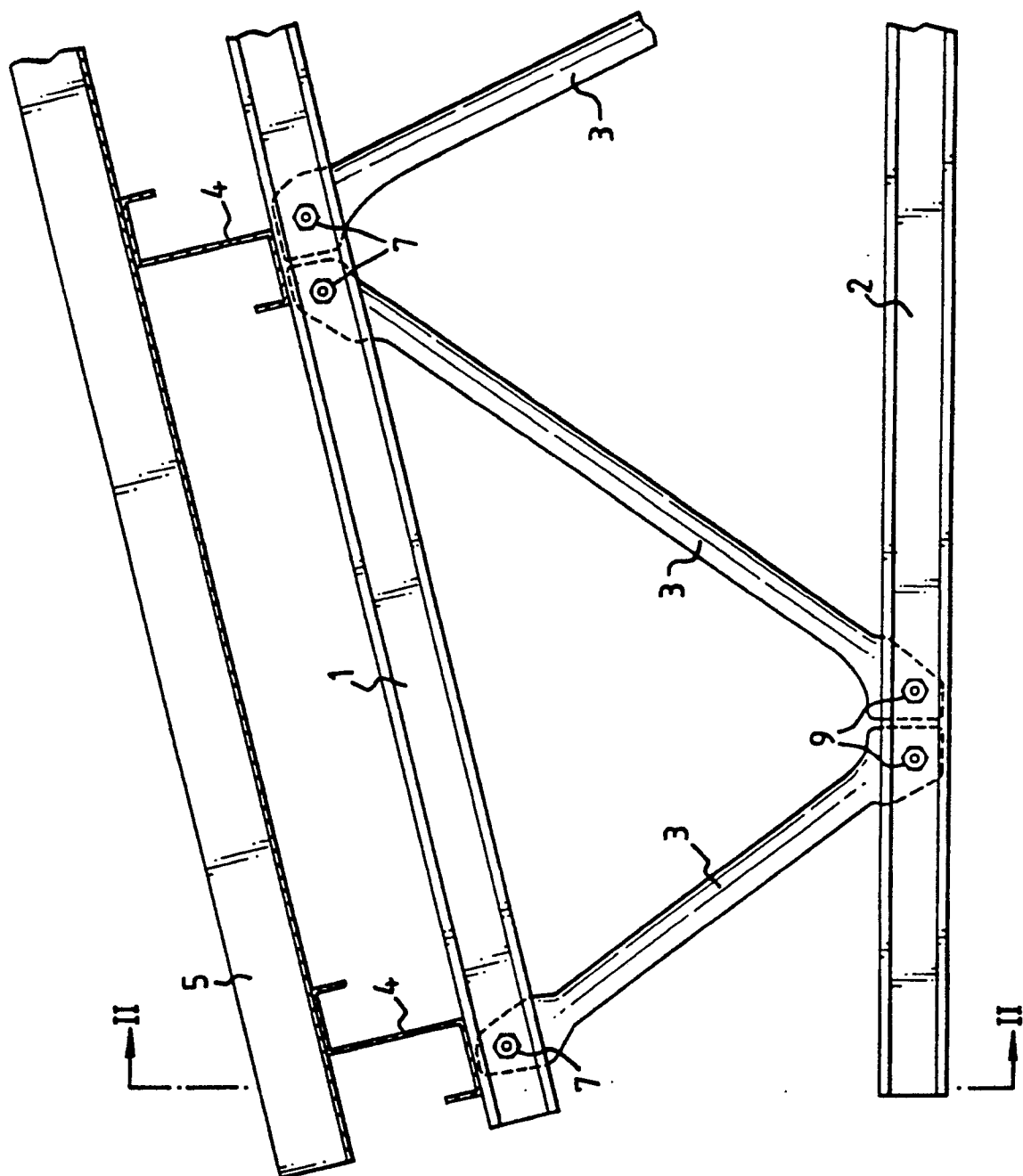
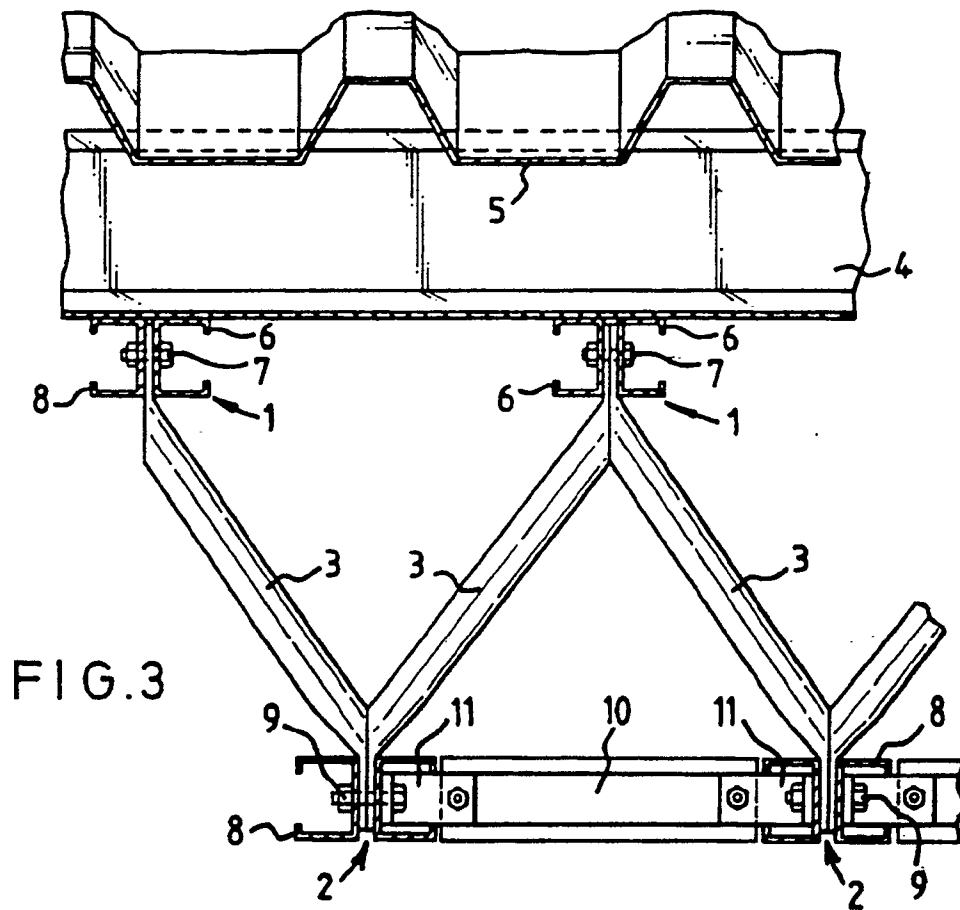
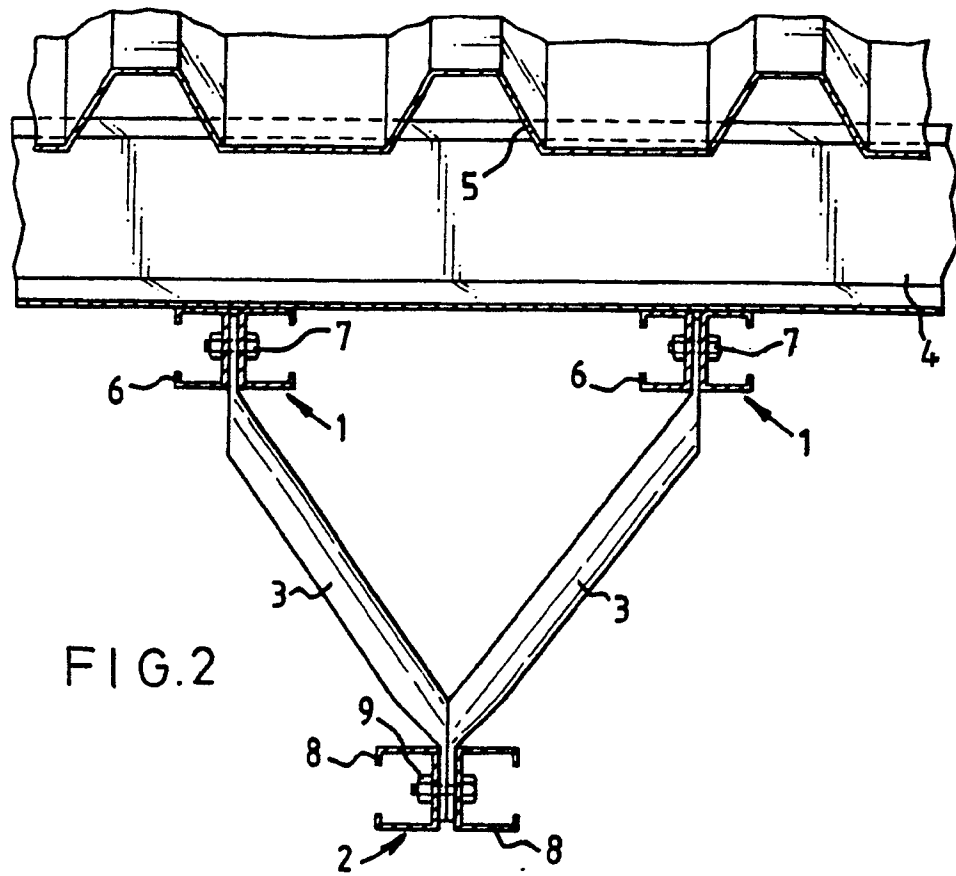
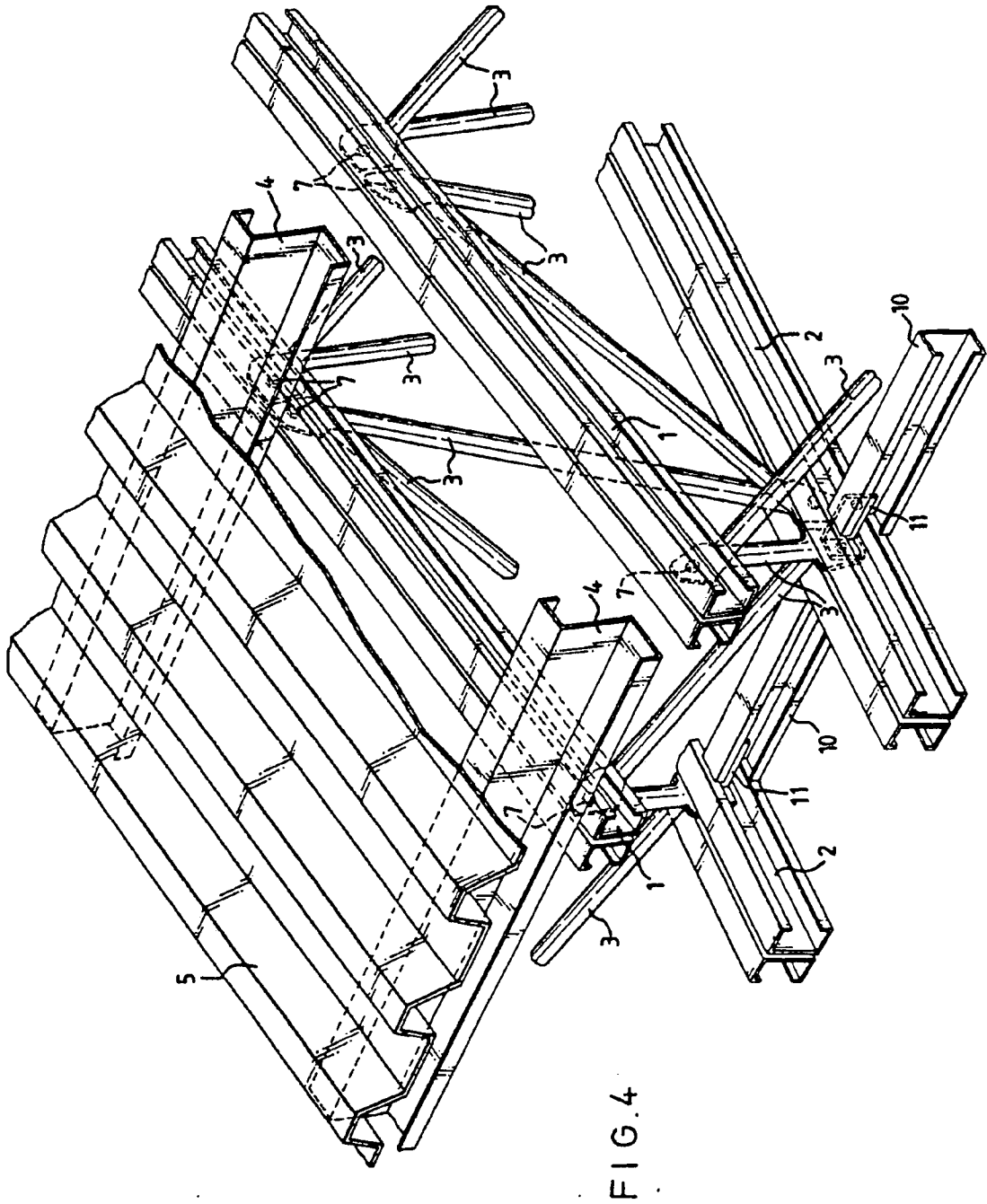


FIG.1





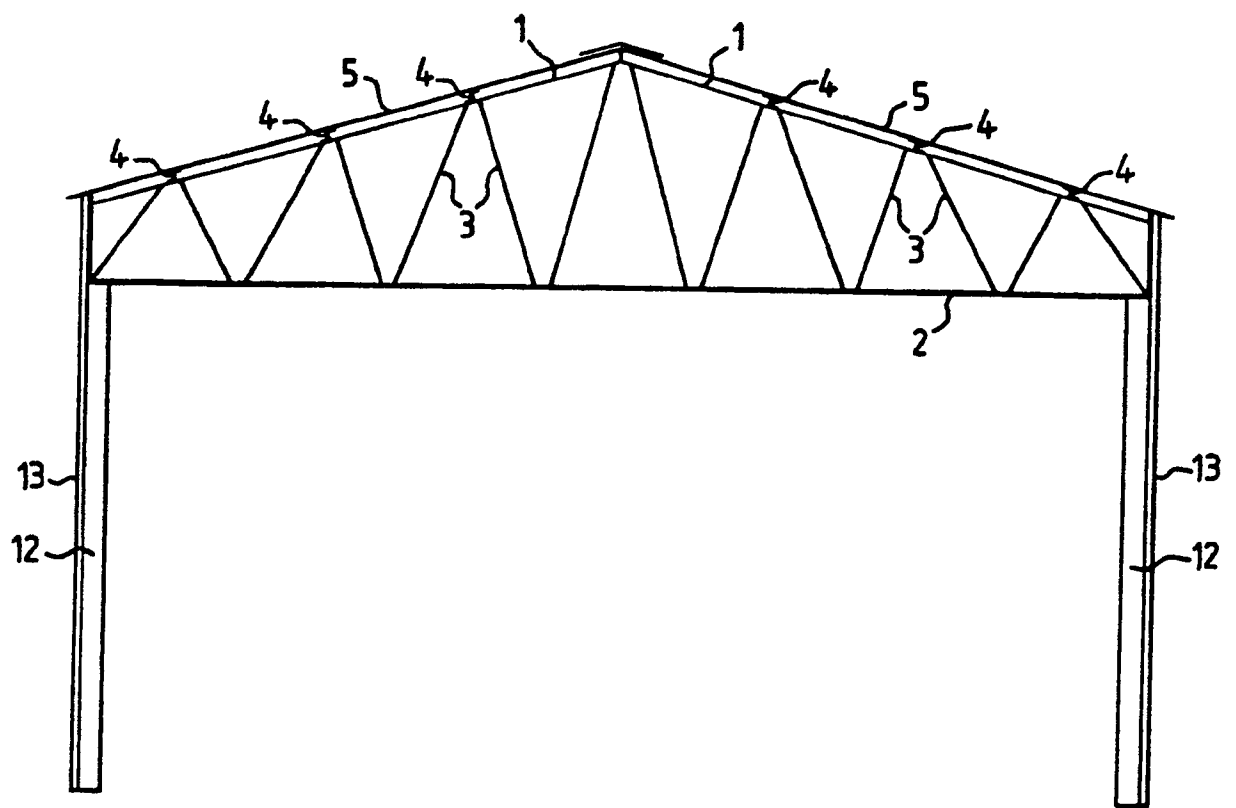


FIG. 5