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EUROPEAN PATENT APPLICATION

21 Application number: **81104254.8**

51 Int. Cl.³: **E 04 C 3/17, E 04 C 3/18**

22 Date of filing: **03.06.81**

30 Priority: **12.06.80 SE 8004373**

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43 Date of publication of application: **23.12.81**
Bulletin 81/51

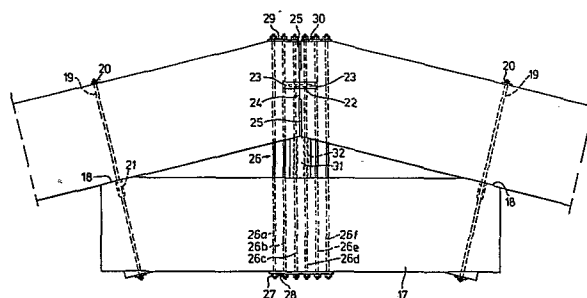
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84 Designated Contracting States: **BE CH DE FR GB LI NL**

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54 **Roof-truss comprising a tension member.**

57 A roof-truss having a tension member (4) between the two rafters (2, 3) of the roof-truss, characterised by a joint in the ridge portion between the two rafters (2, 3) and by a ridge joining (5) consisting essentially of a ridge beam (17) and a substantially vertical tie (26) between the ridge and the ridge beam.



ROOF-TRUSS COMPRISING A TENSION MEMBER

TECHNICAL FIELD

The present invention relates to the construction art. More particularly, the invention relates to a roof-truss with a tension member between the two rafters of the roof-truss.

5

BACKGROUND ART

In the construction art, in order to roof large spans, a construction is often used formed as a three-joint frame or arch, where the horizontal component of the bearing reaction is taken up by one or more tension members. This construction is usual with frame members both of steel and of glued laminated timber but in its original form it cannot take up upwardly directed loads.

A more economical construction from the material point of view can be obtained if the ridge joint is omitted and instead a two-joint frame or arch with a tension member is used. Joints in this context means that for the purpose of elementary stress analysis, the members are considered to be connected at the joints by frictionless pins. In addition, this construction affords the advantage that it can take up upwardly directed loads and is used when a moment-rigid junction is relatively simple to make at the building site. It is also used with smaller glued laminated timber arches. Transport problems, however, make its use more difficult or impossible with larger roof-trusses of glued laminated timber, because a practically applicable method has been lacking of being able to join large frames and arches of glued laminated timber and other non-weldable material, in a moment-rigid manner, at the building site.

DISCLOSURE OF INVENTION

The object of the invention is to offer a ridge joining which permits moment-rigid junction at the building site. According to the invention, the ridge joining bridges the ridge joint between the two rafters by a ridge beam which is connected to the ridge by a substantially

vertical tie.

The ridge beam, which may appropriately have a length of up to 5-20%, preferably 10-15% of the span of the roof-truss, normally abut against
5 the rafters without a statically effective connection in the unloaded state. As a result, the ridge joining gives the roof-truss substantially a rigidity corresponding to that which would have been obtained with a continuous frame construction. With downwardly directed roof loading, which, with a rigid ridge joining normally results in negative
10 moment in the ridge, according to the invention the moment forces are transferred in said case to the ridge beam. The joint function is thus eliminated in this case of loading. Negative moments are thus transferred to the ridge beam and from there, via the abutment of the ridge beam against the rafters, to the rafters, as a result of which
15 the positive field moment in the rafters is reduced. With upwardly directed forces, negative moments are also obtained in the ridge beam, according to the invention, that is to say the same effect as with downwardly directed loading. The favourable result of this feature is that, inter alia, there is only a minor horizontal component on the
20 wall columns and that compressive forces can be transferred into the roof-truss as a result of which the building can be stabilized as a result of the fact that only the columns at one side need to be braced.

It is also conceivable not to have full abutment between ridge beam
25 and rafter, a case which may be of interest when the stress from snow loading determines the dimensions of the ridge beam.

The opposite case is also conceivable, prestressed ridge joining, which is of interest primarily when upwardly directed wind forces
30 determine the dimensions of the construction and it is desired to use the ridge joining, which is over-strong for downwardly directed loads, to further reduce the dimensions or deformations of the rafters.

Further aspects and characteristics of and advantages with the invention
35 are apparent from the following description of a preferred form of embodiment.

BRIEF DESCRIPTION OF DRAWINGS

In the following description of a preferred form of embodiment, reference is made to the accompanying figures of the drawing, in which

5 Fig. 1 shows a cross-section through a hall building in which the roof-truss comprising a tension member according to the invention is utilized.

10 Fig. 2 shows, in more detail, a ridge joining included in a roof-truss of Fig. 1.

Fig. 3 constitutes a section on III-III in Fig. 1.

15 Fig. 4 shows, through a side view, the anchoring of one end of the tension member in the foot portion of one of the rafters of the roof-truss.

Fig. 5 constitutes a view on V-V in Fig. 4.

20 DESCRIPTION OF PREFERRED EMBODIMENT

The building section shown in Fig. 1 may, for example, consist of a section in a sports stadium, warehouse or industrial building or the like. Similar constructions may be considered, however, for smaller buildings and for other building work than house buildings. The roof-truss according to the invention is designated in general in Fig. 1
25 by the numeral 1. As can be seen from the Figure, it has a low profile. According to the form of embodiment, the incline of the roof is 14° . The main parts of the roof-truss 1 consist of a pair of rafters 2, 3 which form the frame or arch of the construction, a tension member 4,
30 and a ridge joining generally designated by 5. The rafters 2, 3 consist of glued laminated timber beams. The tension member 4 hangs from the rafters 2, 3 through wires 6. Transversely to the incline of the roof there are laid ridges 7 which, in conventional manner, connect the roof-trusses of the building while at the same time they
35 constitute a support for the roof covering 8. The feet of the rafters 2, 3 rest against wall columns 9, 10 and are secured against lifting

forces in the vertical direction and against horizontal forces in the lateral direction by plates 11, Fig. 5. A supporting beam 12 for a stand is shown in Fig. 1 to illustrate the use of the roof-truss for example for sports stadiums where the supporting beam 12 stabilizes the whole building via the column 9 and roof-truss 1. The ground level is designated by 13.

The tension member 4 consists of four steel bars 4a-d arranged as the corners in a rectangle, Fig. 3. The bars 4a-d are surrounded by a flat iron, the ends of which are united to the supporting wire 6. A bolt to support the upper steel bars passes through the flat iron. The tension bars 4a-d extend, at the ends, past the foot portions of the two rafters 2, 3 and through an end plate 15 which is disposed at each end and which bears against the short end of the respective rafter 2, 3. The ends of the tension bars 4a-d are threaded and nuts 16 complete the bolting.

The ridge joining 5 shown in detail in Fig. 2 comprises a horizontal ridge beam 17 which is very short in comparison with the span of the roof-truss 1. According to the form of embodiment, the length of the ridge beam 17 is only 12% of the span of the roof-truss 1. The two upper edges of the ridge beam 17 are bevelled so that contact surfaces 18 are obtained which abut against the under side of the rafters 2, 3. In order to facilitate the assembly of the roof-truss 1, mounting aids are provided in form of long bolts 19 which extend through each end portion of the ridge beam 17 at right angles to the contact surfaces 18 and up through the rafters 2 or 3 respectively. The parts can be screwed together by means of nuts 20. In order that the bolts 19 and laminated members 2, 3 and 17 may not be damaged if the rafters move slightly in relation to the ridge beam 17, the through holes through the ridge beam for the rods 19 are widened out close to the contact surfaces 18. This is indicated by the numeral 21. A loose steel pin 22 in the ridge portion also has a temporary purpose in connection with the assembly. The pin 22 is disposed loosely in horizontal holes 23 which extend into each rafter in the region in front of the contact surface 24 of the

rafter in the ridge. The end surface of one rafter 3 is recessed at 25 below and above the contact surface 24.

The ridge joining 5 is further held together mainly by a vertical tie 26 close to the ridge line of the roof-truss. More specifically, the tie 26 consists, according to the form of embodiment, of a bolt connection consisting of six ridge bolts 26a-f with associated nuts 27 as well as one lower 28 and two upper horizontal washer plates 29, 30. The last two ones are associated with the rafters 2 and 3 respectively and can be displaced in relation to one another. The ridge bolts 26a-f extend through vertical holes through the ridge beam 17 disposed symmetrically in relation to a vertical plane through the ridge line. The left-hand ridge bolts 26a-c extend further through vertical through holes in the left-hand rafter 2 adjacent to the end surface of said left rafter 2 facing the end surface of the right-hand rafter 3 and further through the left-hand upper washer plate 29. The three right-hand ridge bolts 26d-f extend in a corresponding manner through the right-hand rafter 3 and the right-hand washer plate 30.

According to the form of embodiment, a ridge support 31 is also provided as a spacing element between the under side of the roof ridge and the ridge bolt 17. The ridge support 31 has the form of a symmetrical prism with a plane underside and a saddle-shaped upper side with angles of inclination coinciding with the incline of the roof. The two centre ridge bolts 26c-d extend through vertical holes in the ridge support 31. The holes 32 are so wide that they permit movements of the ridge bolts 26c, 26d as a result of minor angular movements in the ridge members.

Briefly, the roof-truss 1 thus described works in the following manner. The rafters 2, 3 abut without any statically effective connection against the ends of the ridge beam 17 which is held firmly by the ridge bolts 26a-f secured to the ridge. In the case of downwardly directed loading through the weight of the roof itself and for example through possible snow loading, the moment forces are taken up by the

ridge beam 17 via the vertical ridge bolts 26a-f and the contact surfaces 18. This eliminates the joint function in the ridge. As a result of the fact that negative moments are introduced into the ridge beam 17, which moments are transferred to the rafters 2, 3, the positive field moments in the rafters are reduced, which renders possible a more slender construction.

With upwardly directed wind forces, the tension member 4 can be ignored, as it does not cooperate in the system in this case. On the other hand, the ridge joining 5 again acts so that negative moments are introduced into the ridge beam 17. Thus a load condition is achieved similar to the one with a freely mounted boomerang beam with upwardly directed loading, which means, inter alia, that the horizontal component of force on the lateral uprights 9, 10 is very small.

With an asymmetrical loading condition, which may often occur as a result of wind forces and with uneven snow loading, the ridge support 31 serves the purpose of transmitting transverse forces into the system. It thus replaces the ridge securing means previously necessary to take up transverse forces.

The roof-truss comprising a tension member according to the invention can be varied within the scope of the idea of the invention as defined in the following claims. Thus the ridge joining 5 need not necessarily consist of a horizontal ridge beam of glued laminated timber in combination with vertical ridge bolts through the ridge which press the ridge beam against the rafters, and a spacing element in between forming the ridge support. Thus it is easily conceivable that these parts may be replaced, for example, by a welded construction in which the bolts, if desired, may remain as in the illustrated form of embodiment or, for example, be replaced by rod- or plate-members embracing the rafters at each side of the ridge line or are secured by other means, for example by transverse horizontal bolts through the rafters near the end surfaces in the region of the ridge starting from vertical iron members between the ridge beam and the ridge at the outside of

the ridge beam and rafters. In a simple form of embodiment, it is also conceivable to replace the ridge bolts by vertical plank members or the like which are screwed or nailed firmly into the outsides of the ridge beam and rafters at each side of the vertical plane through the ridge line. Thus the possible variations within the scope of the idea of the invention are very numerous. Naturally, the invention is not restricted either to the proposed form of tension member, or to the selection of simple, completely straight-glued laminated timber beams for the rafters. Thus arched rafters are in principle conceivable to use with the construction according to the invention. In the description of the invention, the modification has also been mentioned that the ridge beam, in the unloaded state, does not abut entirely against the rafters, as well as the modification that the ridge joining is prestressed.

In the form of embodiment shown, the frame and the roof-truss 1 are symmetrical. It is also conceivable that one rafter may be longer than the other. In this case, the ridge beam can be disposed inclined whereas in the symmetrical case it may appropriately be horizontal.

CLAIMS

1. A roof-truss having a tension member between the two rafters of the roof-truss, c h a r a c t e r i s e d by a joint in the ridge portion between the two rafters (2, 3), by a ridge joining (5) consisting
5 essentially of a ridge beam (17) and a substantially vertical tie (26) between the ridge and the ridge beam, and that the ridge beam has a length amounting to 5-20%, preferably 10-15%, of the span of the roof-truss.
- 10 2. A roof-truss as claimed in Claim 1, c h a r a c t e r i s e d in that the rafters abut against the ends of the ridge beam without a statically effective connection in the unloaded state, as a result of which the ridge joining gives the roof-truss a rigidity substantially corresponding to that which would have been achieved with a continuous frame
15 construction.
3. A roof-truss as claimed in Claim 1, c h a r a c t e r i s e d by a certain spacing between the rafters and the ends of the ridge beam in the unloaded state, so that the rafter members will not abut against the
20 ridge beam until after a minor alteration of the angle in the joint caused by a downwardly directed loading on the roof-truss, and that the joining in the ridge, not before said angle alteration, is subjected to elastic deformation as a result of said loading.
- 25 4. A roof-truss as claimed in Claim 1, c h a r a c t e r i s e d in that the ridge beam is secured to the rafters by means of said vertical tie which is prestressed.
- 30 5. A roof-truss as claimed in one of the Claims 1-4, c h a r a c t e r i s e d in that the vertical tie (26) comprises separate members (26a-c and 26d-f respectively) which individually or in groups tie the ridge beam to the ridge at each side of a vertical plane through the ridge line so that said tie does not hinder angular movements in the ridge joint.

6. A roof-truss as claimed in one of the Claims 1-5, c h a r a c -
t e r i s e d by a ridge support (31) in the form of a spacing
member between the ridge beam and the rafters in the ridge line.
- 5 7. A roof-truss, as claimed in one of the Claims 1-6, c h a r a c -
t e r i s e d in that the roof-truss has an inclination corresponding
to an incline of the roof between 10° and 20° .

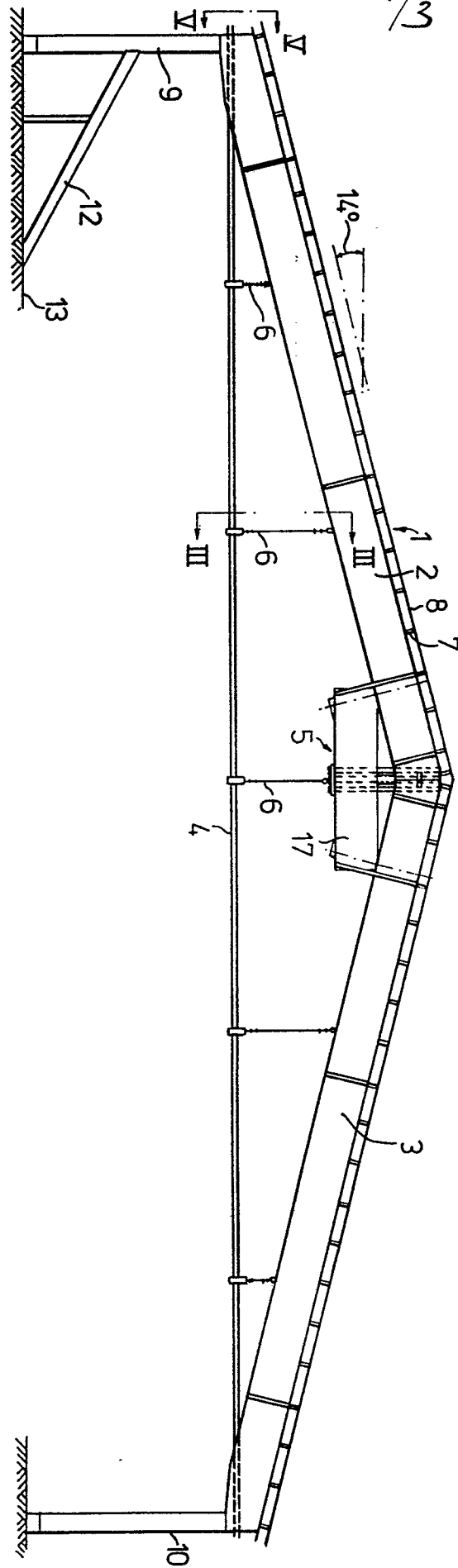


Fig. 1.

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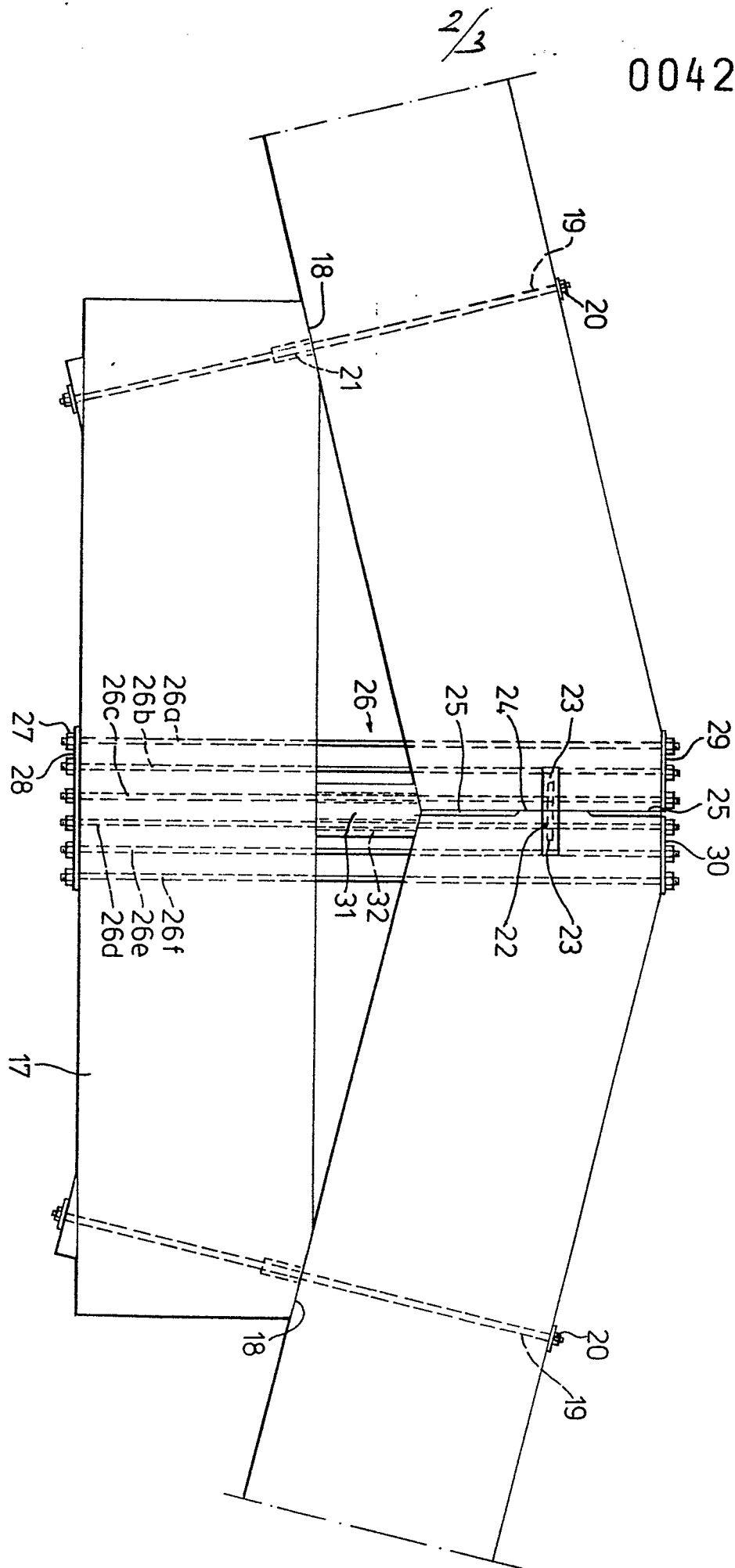


Fig. 2.

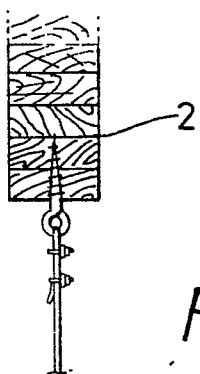


Fig. 3.

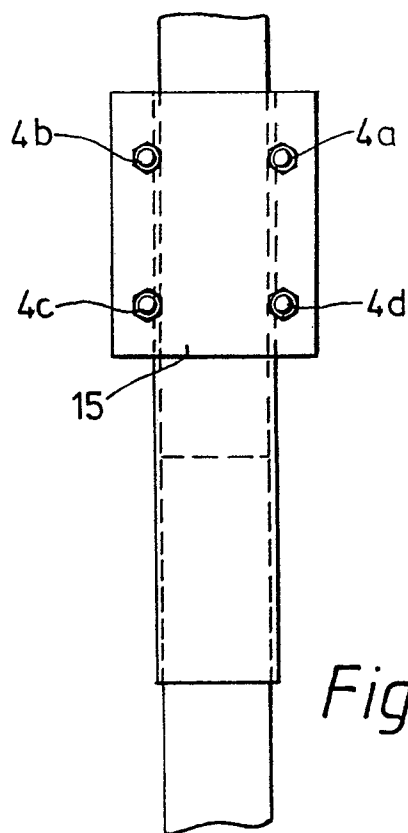
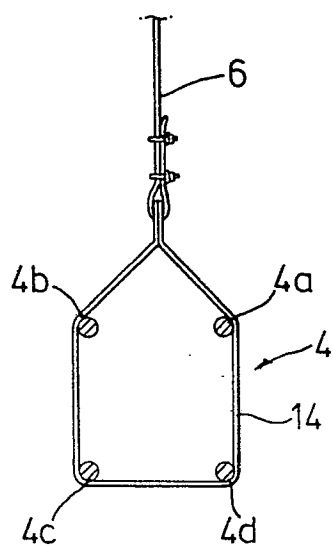


Fig. 5.

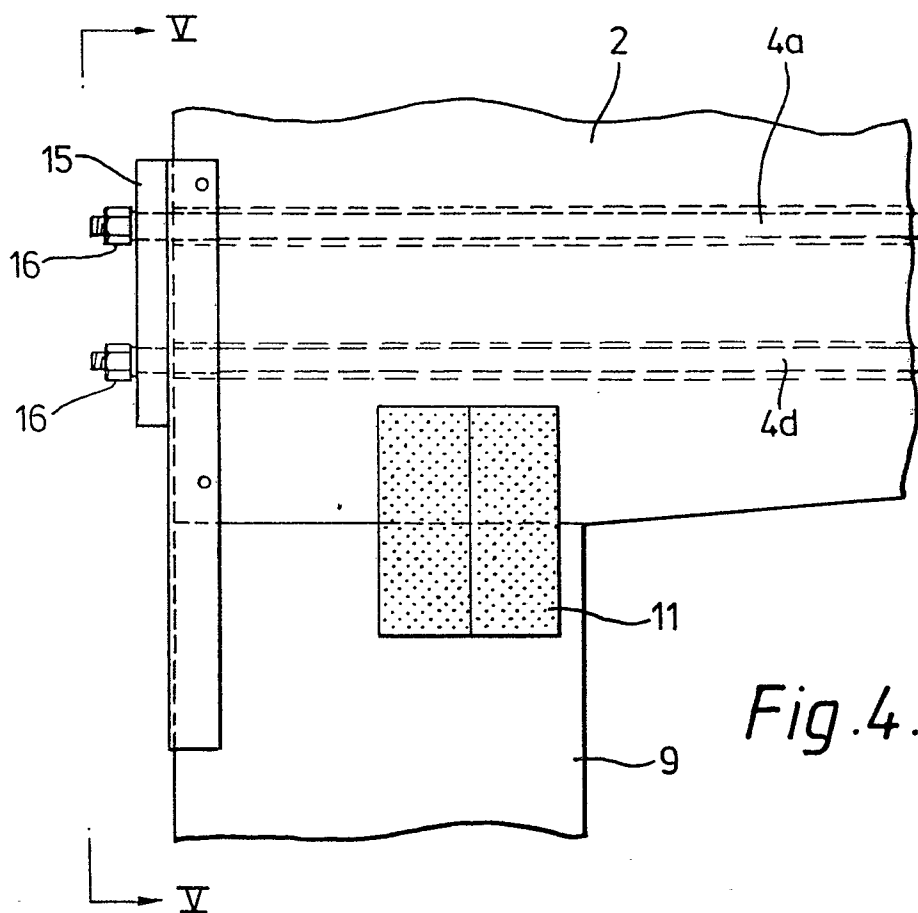


Fig. 4.