Jan. 8, 1957 C. H. WOODWORTH 2,776,457

ARCH HAUNCH CONSTRUCTION

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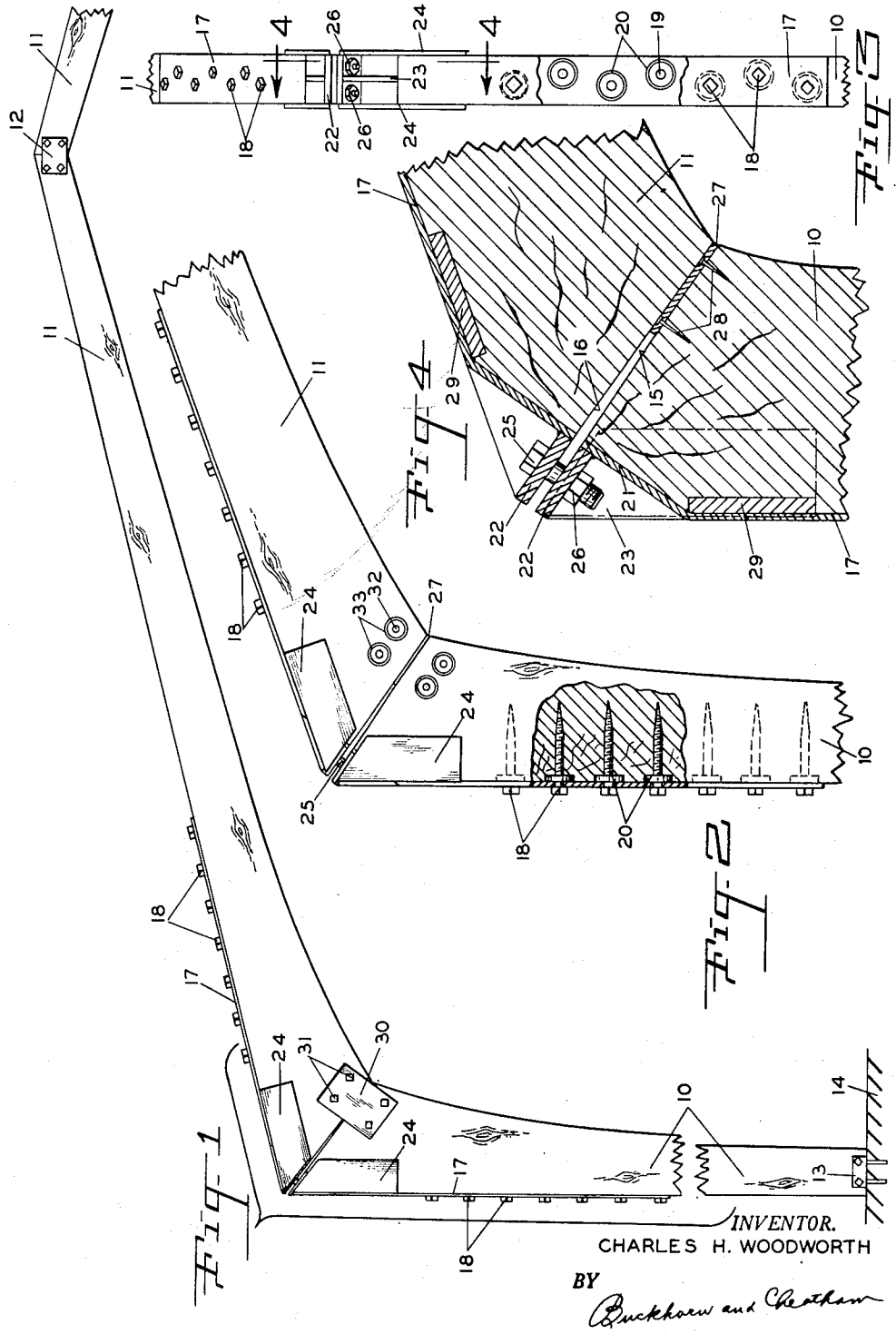

Fig. 1

Fig. 2

Fig. 3

Fig. 4

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Fig 5

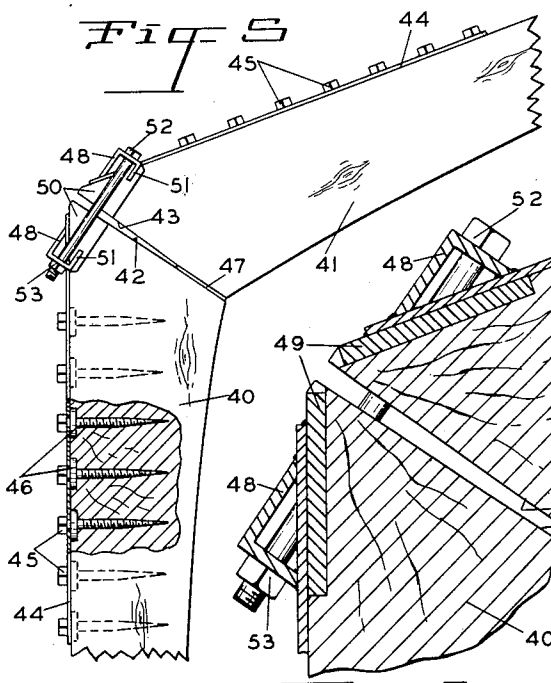





Fig 7

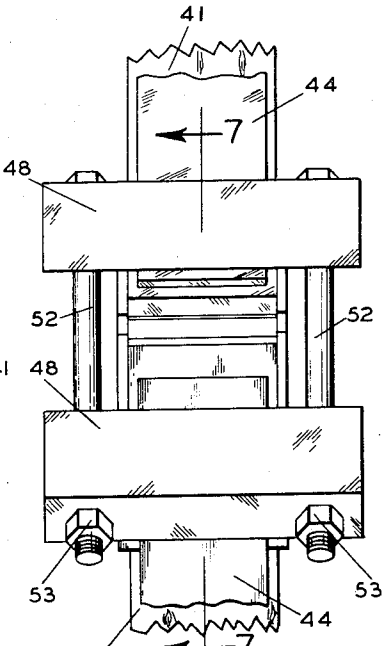


Fig 6

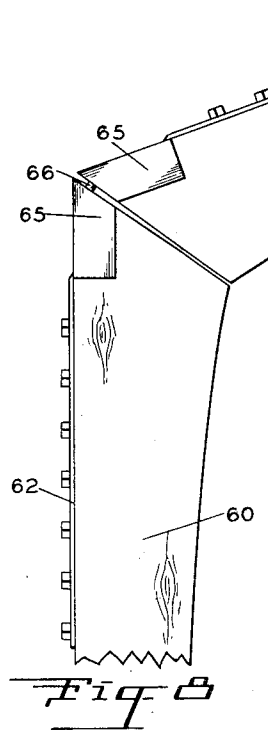


Fig 8

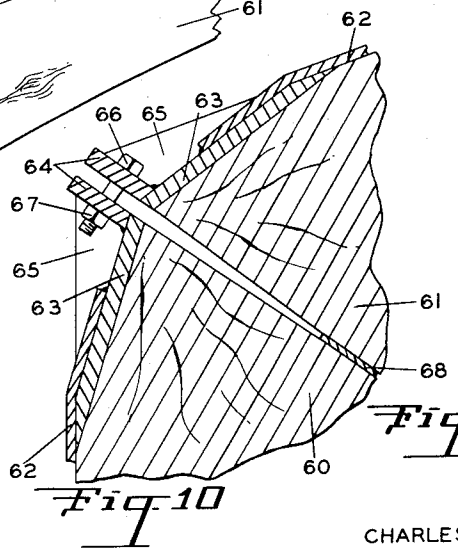


Fig 10

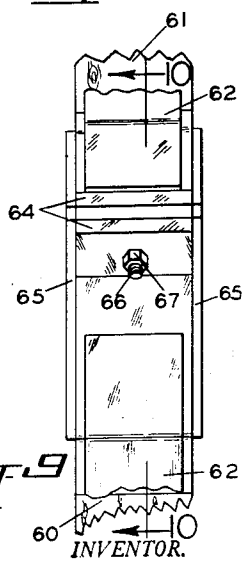


Fig 9

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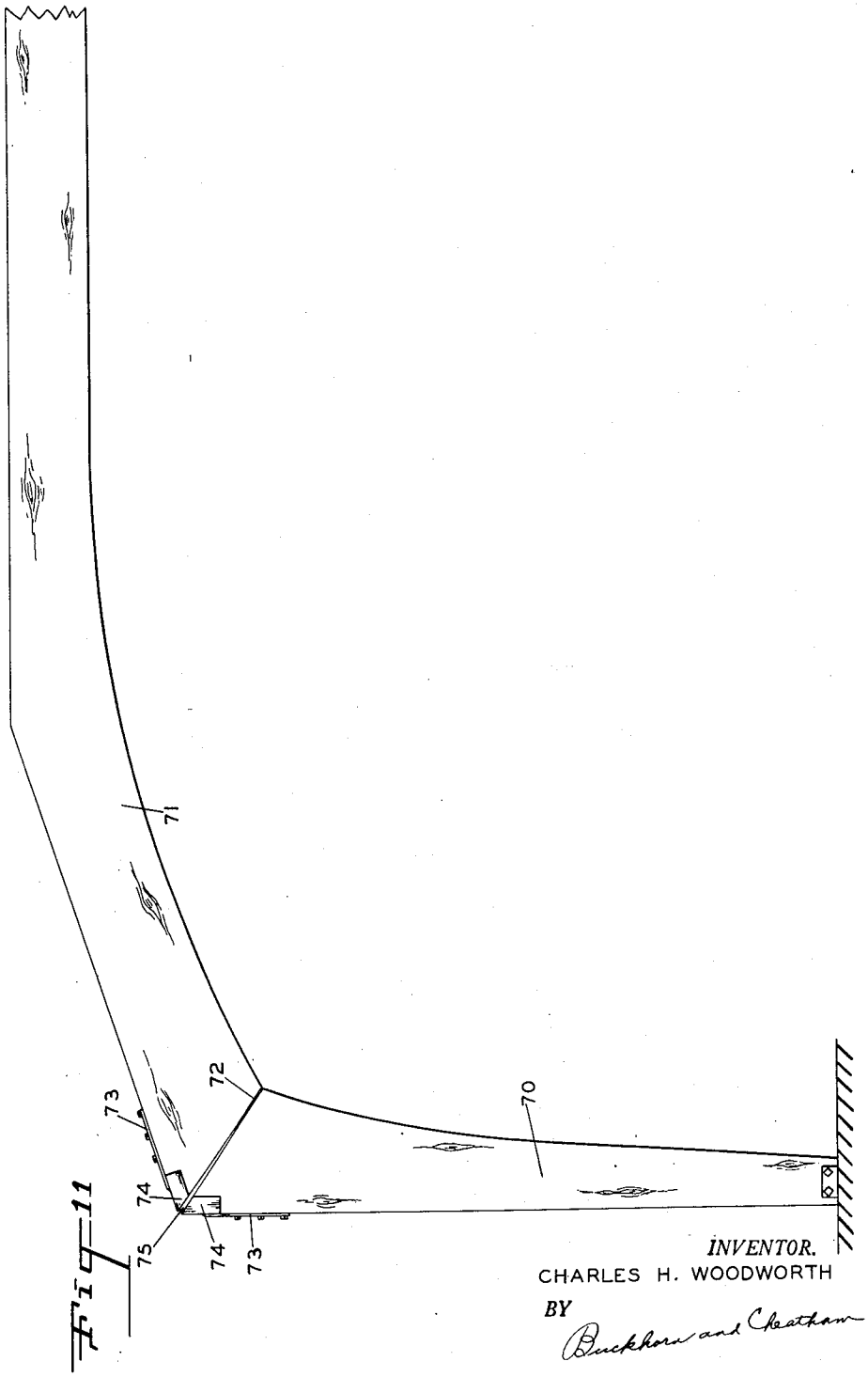


Fig. 11

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2,776,457

# ARCH HAUNCH CONSTRUCTION

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6 Claims. (Cl. 20—0.5)

The present invention relates to timber arches, having particular relation to the haunch portion of such an arch.

The principal object of the present invention is to provide means whereby large timber arches, which may be formed of natural or laminated pieces of lumber, may be built at a central factory provided with equipment to fabricate and otherwise handle such large pieces of lumber, and shipped in disassembled condition to the place of usage. A large arch of this nature may comprise posts twenty to forty feet long and weighing several tons, and a unitary or jointed beam connecting the upper ends of the posts and which may be, for example, one hundred feet long and weighing many tons. If it were necessary, in order to provide prefabricated arches, to permanently unite the post and the beam, the resulting construction in many cases could not be transported on any type of road or railroad vehicle no matter how it were positioned with respect to the vehicle, and, furthermore, the resulting construction would in many cases be too heavy for building constructors to handle. The present invention permits the prefabrication of an arch comprising a pair of posts and a connecting beam, the various parts of which may be disassembled and shipped by road or rail to its place of usage.

A further object of the present invention is to provide an arch haunch construction including adjustable means whereby the angular relation of the post and the beam may be adjusted in order to permit prestressing of the arch and to facilitate erection thereof. For example, in erecting a three-hinge arch comprising a pair of posts, and a pair of beams meeting at the center of the span, the posts may be erected, then the beams mounted on the ends of the posts with their adjacent ends in approximate relation to each other, then the haunch joints adjusted to bring the adjacent ends of the beams into exact relation to each other and to other elements of the structure of which the arch is a part.

The foregoing and other objects and advantages of the present invention are achieved by providing a timber arch comprising an upright post having a plane, mitered upper end surface, and a lateral beam having a plane, mitered end surface in substantially parallel, spaced relation to the mitered end surface of the post, a compression plate lying between and spacing the inner portions of the adjacent end surfaces, and tension means including an adjustable tension member, such as a bolt, spanning the space between the outer portions of the end surfaces whereby prestressing and adjustment of the angular relation of the beam to the post may be accomplished.

A further object and advantage of the present invention is that the compression plate lying between and spacing the inner portions of the adjacent end surfaces of the beam and post greatly reduces or eliminates the need for precise fabrication and tight jointing along the entire length of the diagonal joint. Precision fabrication may be limited to the critical areas which the compression plate contacts, and the precision fabrication of these small areas may be achieved much more readily and with less expense and more assurance of accuracy than would be required for precision manufacture of the entire joint.

Other advantages inherent in the foregoing construction are that crushing of the inner portions of the adjacent ends of the beam and post, with resulting deformation of the structure and disruption of the stress-strain



relationship of the structure, may be avoided. Another advantage flowing from the construction is that the necessity for routing, sawing, or otherwise shaping very large structural timbers in the formation of arches at the place of usage is avoided.

The foregoing and other objects and advantages of the present invention will be more apparent from inspection of the following specification taken in connection with the accompanying drawings wherein like numerals refer to like parts throughout.

In the drawings,

Fig. 1 is a side elevation of a portion of a three-hinge arch manufactured in accordance with the present invention;

Fig. 2 is a side elevation of the haunch portion of the arch disclosed in Fig. 1, taken on an enlarged scale, with parts broken away;

Fig. 3 is a front elevation of Fig. 2;

Fig. 4 is a vertical section taken substantially along line 4—4 of Fig. 3 and on a further enlarged scale;

Fig. 5 is a view corresponding to Fig. 2 illustrating a modified form of the invention;

Fig. 6 is a front elevation, on an enlarged scale, of the haunch portion of Fig. 5;

Fig. 7 is a vertical section taken substantially along line 7—7 of Fig. 6;

Fig. 8 is a view corresponding to Fig. 2 showing a further modification of the haunch construction;

Fig. 9 is a front elevation, on an enlarged scale, of a portion of Fig. 8;

Fig. 10 is a vertical section taken substantially along line 10—10 of Fig. 9; and

Fig. 11 is a side elevation of a two-hinge arch having a form of the present invention incorporated therein.

Referring to Figs. 1 to 4 inclusive, a form of the present invention is illustrated incorporated in a three-hinge arch, a portion only of the arch being illustrated. The arch comprises a pair of upright posts **10**, of which only one is shown, and a pair of laterally extending beams **11** extending from the tops of the posts and having their abutted ends connected by suitable means such as illustrated at **12**. The bottoms of the posts are preferably fixed in position as by means of brackets **13** fixed to a concrete foundation **14**. Each of the posts and beams comprises an elongated timber member, which may be shaped from a single piece of wood or may be built up of a plurality of laminations. The abutted ends of each post and beam are provided with mitered end surfaces indicated at **15** and **16**, the end surfaces being substantially parallel to each other and to a plane substantially bisecting the angle between the post and the beam.

In accordance with the present invention, the post and beam are connected together by separable means whereby the elongated members may be shipped to the place of usage from a central fabricating plant. The connecting means comprises a pair of substantially identical tension connectors, each including an elongated metal element such as strap **17** lying flush against the outer surface of the associated member and extending in the longitudinal direction thereof from its mitered end. The strap **17** is connected to the member by a plurality of fastening means such as lag screws **18** extending through suitable holes in the strap into the member, the member preferably being provided with openings **19** for reception of the screws, and the construction being reinforced by inserted metal rings **20**. The outer corners of the abutted ends of the members are recessed and a portion of the adjacent end of the strap **17** is bent inwardly to lie along the recessed surface substantially at right angles to the end of the member, as indicated at **21**. A bracket comprising an end wall **22**

is fixed to the portion 21 of the strap, the wall 22 extending substantially in line with the end surface of the member, the bracket also comprising a fillet 23 in a central location and side plates 24 adapted to embrace the sides of the associated timber member. The brackets provide means to retain a pair of adjustable, threaded members, such as bolts 25, extending normally to the end surfaces of the members and having heads bearing against one end wall 22. The opposite ends of the bolts 25 are threadedly engaged with nuts 26 bearing against the outer surface of the opposed wall 22. The brackets and the tension bolts 25 lie wholly within the angle formed by the outer surfaces of the post and beam so as not to interfere with applied surfacing members. A compression plate 27 is positioned between inner portions of the end surfaces 15 and 16 adjacent the angle formed by the inner surfaces of the post and the beam, the plate being retained on one of the members such as by nails indicated at 28. The compression plate not only provides means to spread the highest compressive forces, which are immediately adjacent the inner edges of the end surfaces 15 and 16, so as to prevent crushing of the fibers of the wood adjacent the inner angle, but provide means to space the end surfaces 15 and 16 to a slight extent. The bolts 25 and nuts 26 may be relatively rotated to adjust the anguler relation of the end surfaces 15 and 16. By reason of this construction the arch may be prestressed and erection thereof and alignment with other arches facilitated. Pads 29 are preferably welded to the inner surfaces of the longitudinally extending portions of the strap 17 so as to distribute certain stresses. In order to prevent sideslipping of the beam with respect to the post adjacent the inner corners thereof, the joint may be reinforced by plates 30 held in position by lag screws 31 extending into openings 32 surrounded by imbedded rings 33. It is to be appreciated that the plates 30 may be omitted or any other conventional reinforcing member substituted therefor, the present invention being concerned with the tension connectors and the compression plate.

In the form of the invention illustrated in Figs. 5, 6 and 7, the tie bolts are located outside of the surfaces of the post and beam, this form of connector being permissible where construction details will permit and having some advantage in elimination of fabricating steps. As illustrated, the haunch comprises a post 41 having mitered end surfaces 42 and 43 respectively, as previously described. A tension strap 44 is connected to the outer surface of each member by lag screws 45 extending through rings 46 as previously described, and the inner portions of the end surfaces are separated by a compression plate 47. In this form of the invention the tension straps 44 are straight and a bracket is mounted on the end thereof, the bracket comprising an angle bar section 48 welded transversely to the strap and having its ends projecting beyond the sides of the timber member. The construction is reinforced by pads 49 adapted to bear against the timber member, and side plates 50 adapted to embrace the timber member. The outer ends of the angle bars 49 are preferably braced by fillets 51. Tie bolts 52 extend through one bracket and across the joint alongside the outer surfaces of the plates 50, the bolts passing through nuts 53 bearing against the opposed bracket. The angular relation of the end surfaces 42, 43 may be adjusted as previously described.

A further form of the invention is illustrated in Figs. 8, 9 and 10 wherein it is seen that the outer corners of the post 60 and beam 61 may be inwardly recessed, and the ends of the tension straps 62 are bent inward and welded to pads 63. The ends of the pads have brackets welded thereto comprising end walls 64 lying wholly within the prolongations of the outer surfaces of the timber members, and side plates 65 not only adapted to embrace the sides of the member but to provide bracing fillets for the end members 64. A tie bolt 66 spans the members 64 and may be tightened by a nut 67. The inner portions of the adjacent end surfaces of the beam and post are separated by a compression pad 68 as previously described. This form of the invention has the advantages of the other forms and may be more suitable for certain constructions such as those involving relatively small timber members.



In Fig. 11 it is seen that the construction lends itself very readily to the fabrication of two-hinge arches, a portion of such an arch being illustrated as comprising a pair of posts 70, of which one is shown, and a connecting beam 71, the abutted ends of the post and beam being mitered as previously described and separated by a compression pad 72. A pair of tension connectors including tension straps 73 and side plates 74 are provided to mount a tie bolt 75. It is to be appreciated that Fig. 11 is illustrative of a type of arch and the tension connectors may be fabricated in accordance with any one of the previously described modifications thereof.

Having illustrated and described preferred embodiments of the present invention, it should be apparent to those skilled in the art that the invention permits of modification in arrangement and detail. I claim as my invention all such modifications as come within the true spirit and scope of the appended claims.

I claim:

1. A timber arch comprising a pair of elongated timber members having abutted, mitered end surfaces, one of said members comprising an upright post and the other comprising a lateral beam, a pair of tension connectors, each of said tension connectors comprising an elongated metal element lying flush against the outer surface of one of said members and extending in the longitudinal direction thereof from its mitered end, means fastening said element to its associated member, each of said tension connectors comprising a bracket mounted on the end of said element adjacent the mitered end of the member, and tension means comprising a bolt spanning the haunch joint substantially at right angles to said mitered end surfaces, and a nut engaged with said bolt, the head of said bolt bearing against the outer surface of one of said brackets and said nut bearing against the outer surface of the other of said brackets whereby the relative spacing of the outer edges of said mitered end surfaces may be adjusted.

2. The construction set forth in claim 1; in combination with a compression plate interposed between inner portions of said mitered end surfaces.

3. The construction set forth in claim 1; in combination with a compression plate interposed between inner portions of said mitered end surfaces, said compression plate slightly spacing the inner portions of said mitered end surfaces whereby said mitered end surfaces may be inclined toward each other.

4. The construction set forth in claim 1 wherein each of said bracket means lies wholly within the angle defined by the outer surface of the timber member and the mitered end surface of the timber member.

5. The construction set forth in claim 1 wherein each of said tension connectors comprises a pair of flanges adjacent the bracket thereon and respectively lying against the opposite lateral surfaces of the associated timber member.

6. The construction set forth in claim 1 wherein said element comprises a strap and said bracket comprises an angle bar having the edges of its legs welded to said strap and its ends extending beyond the sides of said timber members, and said tension means comprises a pair of bolts respectively associated with the ends of said brackets beyond the sides of said timber members.

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