Feb. 10, 1970 H. W. DICKINSON 3,494,089

BEAM CONSTRUCTION FOR BUILDINGS

Filed June 5, 1968 2 Sheets-Sheet 1

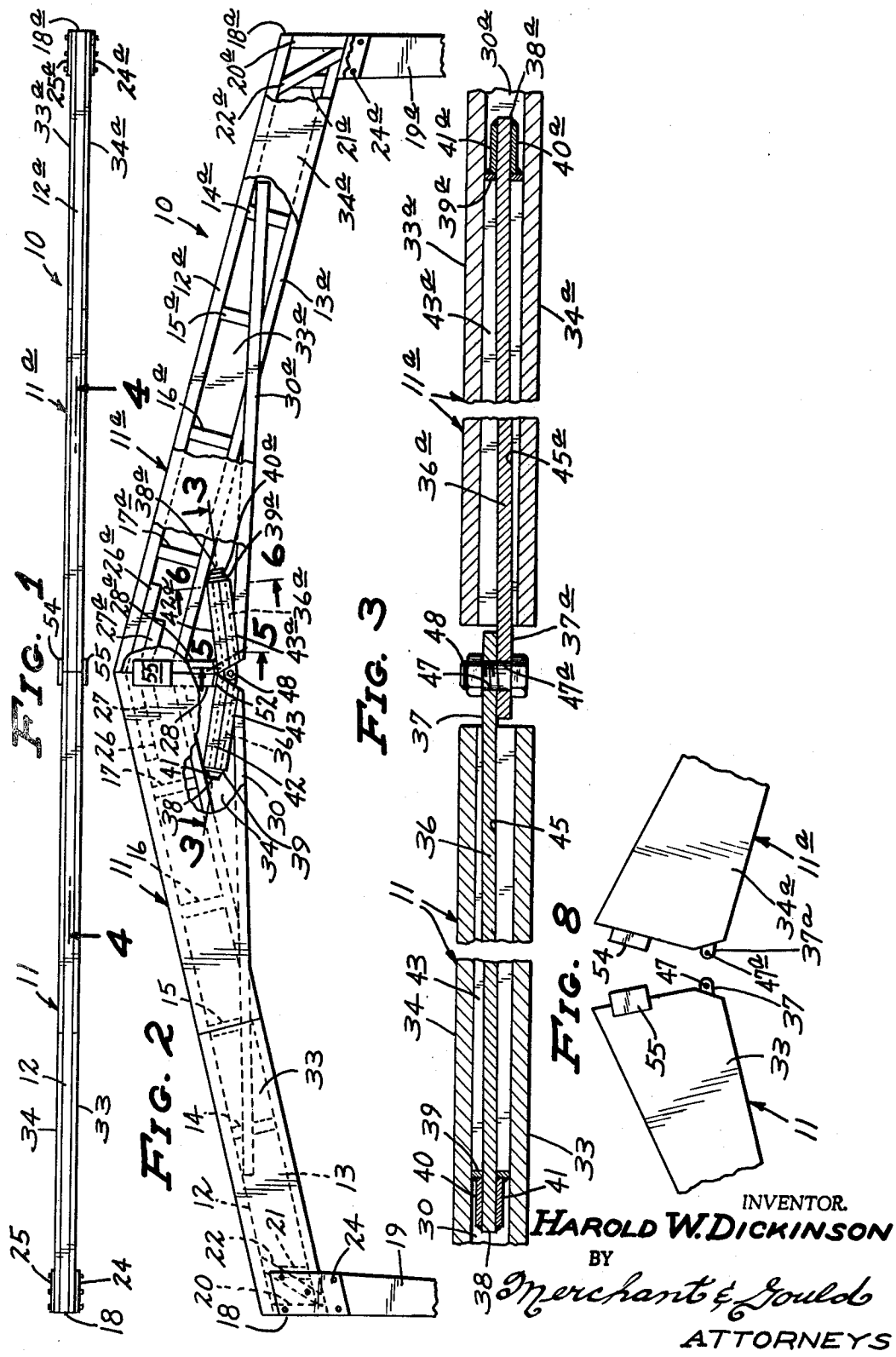


FIG. 1

FIG. 2

FIG. 3

FIG. 8

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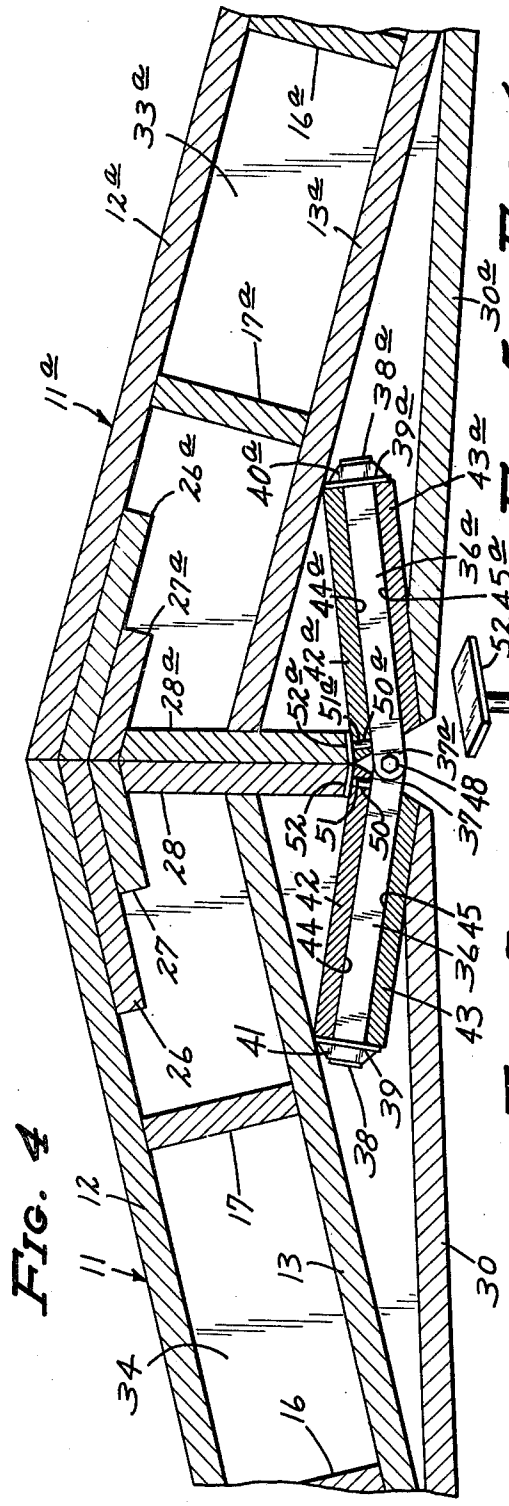


FIG. 4

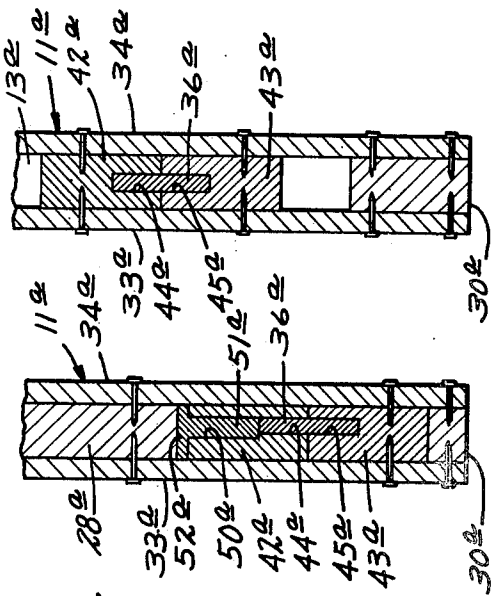


FIG. 5

FIG. 6

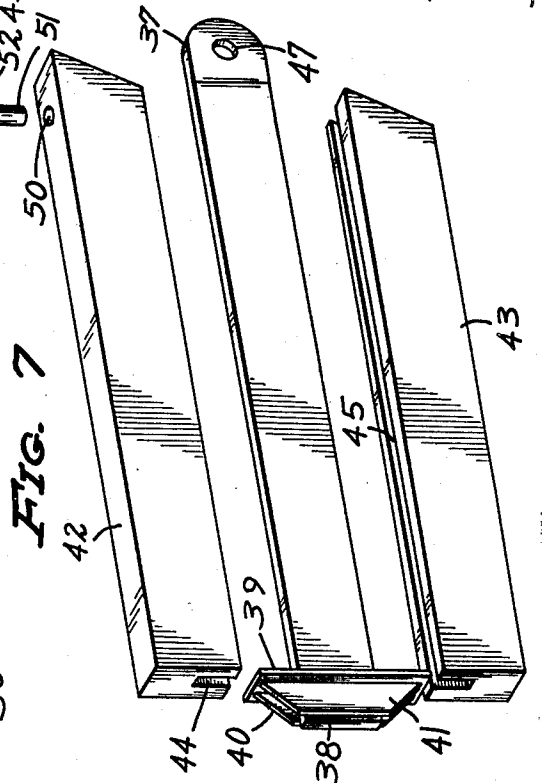


FIG. 7

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BEAM CONSTRUCTION FOR BUILDINGS

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Int. Cl. E04c 3/42; E04b 7/08
U.S. Cl. 52—639 9 Claims

ABSTRACT OF THE DISCLOSURE

A pair of identical beam sections each having an end formed at an angle with respect to the associated beam section such that the beam sections fit together in an angularly displaced downwardly diverging relationship to form a roof supporting beam. Each beam section is provided with a flat, metal connector member adjacent a bottom edge thereof that extends from the end of the beam section for attachment to the connector member on the other beam section. The connector member is skewed with respect to the beam section so that the end portions of the two connector members overlap when the two beam sections are fitted together.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to structural units for buildings and more particularly relates to prefabricated beams, rafters and the like.

Description of the prior art

Prior art structural units formed a background for the development of the present invention are disclosed in my two previous United States Patents Nos. 3,263,381 and 3,352,082. U.S. Patent No. 3,263,381 disclosed a prefabricated plywood arch which could be initially formed in sections and the clamped together in operative relationship at the job site. In that patent, a novel means was provided for forming an interconnecting joint between the roof supporting member and a detachable supporting leg member, which substantially eliminated the tendency of the roof supporting member to rock or pivot about the upper limits of the supporting leg under load.

Patent No. 3,352,082 discloses another structural unit in which a pair of stringers are held in a spaced, generally parallel relationship by means including a unique metal truss structure. The beam or rafter structure of this patent is light in weight and possesses great rigidity and load carrying ability. However, when utilizing the invention of this patent, it was necessary to fabricate the entire rafter structure at the factory and then ship the unit as a whole. The rafter structure could not be disassembled at the central peak for ease of handling and shipping.

SUMMARY OF THE INVENTION

The present invention provides an improved roof supporting or rafter structure which is strong, light in weight, very rigid and which can be easily fabricated primarily from wood. A pair of identical beam sections are provided that can be fitted together in an end-to-end relationship to provide a suitable beam or rafter structure. A first end of each beam section is adapted to be supported by a vertical ground-engaging leg member while the second end of each beam section is adapted to be secured to the second end of the other beam section to form the complete rafter structure. The second end of each beam structure is cut at an angle with respect to the upper and lower surfaces thereof so that when the two beam sections are connected together, a complete roof supporting beam having the proper pitch on each side of the peak, is formed.

Each beam section is provided with a flat, metal connector member that extends outwardly a short distance from the second end of the beam section adjacent its bottom surface or edge. The flat connector members are positioned in a plane that is skewed with respect to the plane of the beam section itself. Thus, when two identical beam sections are fitted together, the exposed end portions of the connector members will overlap each other a short distance. The exposed end portion of each connector member is provided with a hole through which a suitable bolt can be inserted to tie the two connector members together. Each connector member is rigidly attached to its associated beam section so that it cannot move in a direction toward the second end of the beam section. The two opposing connector members, when connected together, thus prevent the complete beam from collapsing downwardly at its center.

In addition to the previously mentioned advantages of the present invention, the beam sections can be fabricated at a factory and shipped to a job site before being attached together to form the complete rafter. Since all of the beam sections are identical in construction, they can be quickly and easily fabricated and can be quickly shipped to a job site with a minimum of difficulty and expense. Further, joining the two beam sections together at the job site is a simple task requiring a minimum of skill and experience.

BRIEF DESRIPTION OF THE DRAWINGS

FIGURE 1 is a view in top plan of a structural unit produced in accordance with this invention;

FIGURE 2 is a view in side elevation, parts thereof being broken away;

FIGURE 3 is an enlarged fragmentary longitiudinal section taken substantially on line **3—3** of FIGURE 2;

FIGURE 4 is an enlarged fragmentary longitudinal section taken substantially on line **4—4** of FIGURE 1;

FIGURE 5 is an enlarged transverse section taken substantially along line **5—5** of FIGURE 2;

FIGURE 6 is an enlarged transverse section taken substantially along line **6—6** of FIGURE 2;

FIGURE 7 is an exploded perspective view of a connector member, its associated thrust blocks, including a base plate and pin; and

FIGURE 8 is a fragmentary view in side elevation of the adjoining second ends of the beam sections, shown in the disassembled condition.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like numerals are used throughout the several views to indicate like elements of the invention, there is disclosed a structural unit in the nature of an arched beam or the like, indicated in its entirety by the numeral **10**. Beam **10** comprises a pair of identical beam sections **11** and **11***a*. Since beam sections **11** and **11***a* are of identical construction, beam section **11** will be described in detail and the identical elements of beam section **11***a* will be designated with the same numeral together with the letter *a*.

Beam section **11** includes upper and lower elongated wooden stringers **12** and **13** that are disposed in a predetermined spaced apart relationship. In the preferred embodiment of my invention, stringers **12** and **13** are held in a parallel relationship by a plurality of spaced struts **14, 15, 16** and **17**. Struts **14–17** extend between stringers **12** and **13** and are generally perpendicular thereto and coplanar therewith.

Beam section **11** has a first end **18** adapted to be supported by a vertical ground-engaging leg member **19**. First end **18** is provided with an end plate **20** and a pair of brace members **21** and **22**, all of which extend between

stringers 12 and 13 to provide support thereto. First end 18*a* of beam section 11*a* is provided with similar structure and is adapted to be supported by leg member 19*a*. When the structural unit 10 of my invention is placed in position on the upright legs 19 and 19*a* as shown in FIG. 2, first end 18 of beam section 11 is secured to leg member 19 by means of a flat metal plate 24 and a similar metal plate 25 attached to the opposite side thereof.

Beam section 11 has a second end opposite first end 18 that is adapted to be secured to the second end of identical beam section 11*a*. Secured to the underside of stringer 12 adjacent its second end are a pair of wooden blocks 26 and 27 that are of the same width as stringer 12 so that their opposite edges are coplanar with the opposite edges of stringer 12. In the preferred embodiment of my invention, block 26 is somewhat longer than block 27 but these lengths are not critical. Extending downwardly from block 27 at the second end of beam section 11 is a wooden face plate 28 that abuts the end of stringer 13 and extends below stringer 13 a predetermined distance. Thus, it can be seen that the ends of stringer 12 and blocks 26 and 27, and the outer face of face plate 28 define the second end of beam section 11. This second end of beam section 11 lies in a plane that forms an acute angle with the bottom surfaces of both stringer 12 and stringer 13. This angle is such that when the two adjoining beam sections 11 and 11*a* are connected together, the resulting roof supporting beam or rafter 10 will have the proper arch or pitch on each side of its peak.

Beam section 11 also includes a truss member 30 having one end extending through and connected to lower stringer 13, and struts 14 and 15. This end of truss member 30, which extends toward first end 18 of beam section 11, terminates adjacent stringer 12. The other end of truss member 30 terminates generally adjacent the second end of beam section 11 beneath and spaced from the bottom end of face plate 28. Truss member 30 is thus also spaced from stringer 13 adjacent its second end to form an acute angle therewith. In normal practice, this acute angle is such that when beam 10 is erected in position as shown in FIG. 2, truss member 30 will be generally horizontally positioned.

A pair of plate-like cover elements 33 and 34 are disposed on opposite sides of beam section 11 and are rigidly atttached to stringers 12 and 13, struts 14–17, end plate 20, brace members 21 and 22, blocks 26 and 27, face plate 28 and truss member 30. Cover elements 33 and 34 are normally cut from laminated stock such as plywood to conform to the outlines of beam section 11.

Positioned in the space between lower stringer 13 and truss member 30 adjacent the second end is a flat, metal connector member 36. Connector member 36 has a connector end portion 37 extending from the second end of beam section 11 generally between the bottom end of face plate 28 and the end of truss member 30. Connector end portion 37 actually extends beyond the plane in which the outer surface of face plate 28 lies for reasons hereafter to be described. Connector end portion 37 lies approximately in line with the upper surface of truss member 30. An opposite end 38 of connector member 36 is positioned a short distance above the upper surface of truss member 30 closer to the bottom surface of stringer 13. Therefore, when the beam 10 is assembled together, connector member 36 slopes downwardly from its outer end 38 towards its connector end portion 37.

Welded or otherwise attached to the outer end 38 of connector member 36 is a plate member 39 having a center opening through which connector member 36 extends. Plate member 39 is a flat rectangular piece of metal that is held in position at right angles to connector member 36. A pair of truncated triangular support members 40 and 41 are disposed on opposite sides of connector member 36 behind plate member 39 to securely hold plate member 39 in position. Connector member 36 is securely attached to beam section 11 by means of a pair of thrust blocks 42 and 43. Thrust blocks 42 and 43 are each provided with longitudinal grooves 44 and 45 respectively formed in one side thereof. Grooves 44 and 45 extend from the center of one end of each of the thrust blocks 42 and 43 to a point offset from the center of the opposite end of each of the thrust blocks. Thrust block 42 is positioned over connector member 36 with the top edge of connector member 36 lying within groove 44. Thrust block 43 is positioned beneath connector member 36 with the bottom edge of connector member 36 lying in groove 45. The depth of each groove 44 and 45 is equal to one-half the width of connector member 36 so that the bottom surface of thrust block 42 lies against the top surface of thrust block 43 when the unit is assembled. When the unit is assembled, the outer end of each of thrust blocks 42 and 43 abuts firmly against plate member 39, and the opposite ends of the thrust blocks terminate short of connector end portion 37.

Since each of the thrust blocks 42 and 43 are of the same thickness as stringers 12 and 13 and truss member 30, the opposite side faces of each of the thrust blocks lies closely adjacent the two cover members 33 and 34, as best shown in FIGS. 5 and 6. Thrust blocks 42 and 43 can therefore be nailed and glued securely to cover members 33 and 34 to hold them securely in the position shown. When the two thrust blocks are securely attached in the position shown, connector member 36 cannot move towards the second end of beam section 11 since plate member 39 prevents such movement. Further, connector member 36 cannot move laterally with respect to the thrust blocks or beam section since it is firmly positioned within the two grooves 44 and 45.

As previously mentioned, grooves 44 and 45 are formed somewhat diagonally with respect to thrust blocks 42 and 43 since their outer ends are positioned near the center of the thrust blocks while the inner ends are offset from the center. In the embodiment shown, the inner ends of grooves 44 and 45 lie closer to cover member 34 than to cover member 33. Therefore, metal connector member 36 lies in a plane that is skewed with respect to the plane of stringers 12 and 13 and truss member 30. The reason for thus positioning connector member 36 is perhaps best shown in FIG. 3. As previously mentioned, beam sections 11 and 11*a* are constructed in an identical fashion so that two beam sections can be placed in an end-to-end relationship to form a complete beam 10. When placed in this end-to-end relationship, the connector members 36 and 36*a*, since they are both skewed with respect to the plane of the beam as a whole, will overlap each other as shown in FIG. 3. Connector end portions 37 and 37*a* thus lie closely adjacent each other in a side-by-side relationship. Each connector end portion 37 and 37*a* is provided with a hole 47, 47*a*, which holes are aligned when the beam 10 is formed by placing the two beam sections in an end-to-end relationship. A bolt 48 having a suitably threaded nut thereon is inserted through holes 47 and 47*a* to lock the two connector members together.

Formed in the end of thrust block 42 adjacent connector end portion 37 is an opening 50 that extends between groove 44 and the upper surface of thrust block 42. A pin 51 is mounted in hole 50 and has a rectangular metal base plate 52 secured to the upper end thereof. The bottom end of pin 51 rests against the top edge of connector member 36. Base plate 52 is mounted directly between the upper surface of thrust block 42 and the lower end of wooden face plate 28. Base plate 52 thus provides a firm surface on which the vertical face plate 28 can rest.

To assemble beam section 11 at the factory, a cover element such as 34 is first cut in the proper shape and placed in a suitable jig. Cover element 34 is constructed from a laminated material such as plywood and may be formed from two or more sheets of plywood. Stringers 12 and 13 and truss member 30 are placed in position on cover element 34 and are glued in place. All of the other structural elements are also placed in their proper position and glued to cover element 34. Cover element 33,

cut to the proper shape, is then disposed over the beam section and attached thereto. Although the elements are primarily secured together by means of glue, some nails are also utilized to add additional strength to the structure. Since the stringers and all of the other skeletal members of the beam section are of the same thickness, they are all securely glued or otherwise fastened to both of the cover elements **33** and **34**. A rigid, strong unitary structure thus results.

The beam sections are then shipped to the job site and are connected together to form the entire beam **10** only after arriving at the job site. Connecting together beam sections **11** and **11***a* is a relatively simple task since it requires only the insertion of bolt **48** through the two overlapping connector end portions **37** and **37***a* and the attachment of two wooden plates **54** and **55** on opposite sides of beam **10** at its peak. Wooden plates **54** and **55** prevent beam sections **11** and **11***a* from moving out of their proper coplanar relationship. The resulting beam **10** is very strong and can be hoisted into place on legs **19** and **19***a* for attachment thereto. Because beam **10** is extremely rigid, it exerts only a downward force on legs **19** and **19***a*.

The weight of beam **10** together with the roof supported thereby tends to cause a downwardly exerted pressure to exist at the center of beam **10**. The two connector members **36** and **36***a* thus tend to pull apart placing a good deal of pressure on thrust blocks **42**, **43**, **42***a* and **43***a*. This pressure is of course distributed to the beam section by means of the cover elements and truss members. Bolt **48** also acts as a pivot point such that the adjoining second ends of beam sections **11** and **11***a* are forced tightly together above bolt **48**. The two face plates **28** and **28***a* absorb much of this inwardly directed pressure as do the ends of the stringers and the wooden blocks **26**, **27**, **26***a* and **27***a*. These blocks and face plates provide a large and well supported surface area against which this pressure is directed. The inwardly directed pressure is thus distributed over the entire beam section rather than a small portion thereof.

While I have shown and described a preferred embodiment of my invention, I wish it to be understood that the invention is capable of modification by those skilled in the art.

What is claimed is:

1. A beam section comprising:

(a) upper and lower elongated wooden stringers disposed in a predetermined spaced apart relationship;

(b) a plurality of spaced struts extending between said stringers;

(c) said beam section having a first end adapted to be supported by a vertical ground-engaging leg member, and a second end adapted to be secured to the second end of an identical beam section in an end-to-end relationship;

(d) a truss member having one end connected to at least said lower stringer betwen said first and second ends, the other end of said truss member terminating adjacent said second end and being spaced from said lower stringer at said second end to form an acute angle therewith;

(e) means for rigidly connecting together said stringers, said struts, and said truss member, including a pair of cover elements disposed on opposite sides thereof and rigidly attached thereto;

(f) a metal connector member positioned in the space between said lower stringer and said truss member and having a connector end portion extending from said second end;

(g) means for securely attaching said metal connector member to at least said cover elements to prevent movement thereof toward said second end; and

(h) said metal connector member lying in a plane that is skewed with respect to the plane of the stringers and truss member whereby the connector end portions of a pair of identical beam sections placed in an end-to-end relationship will overlap each other.

2. The apparatus of claim **1** wherein said metal connector member is a relatively flat member having a plate member secured to the end thereof opposite said connector end portion, wherein a pair of wooden thrust blocks are provided each having a longitudinal groove formed in one side thereof, said thrust blocks being positioned over and under said metal connector member respectively, with the opposite side edges of said connector member lying in said grooves, one end of each of said thrust blocks firmly abutting said plate member and the opposite end of each terminating short of said connector end portion, said thrust blocks being secured to said stringers and truss member to prevent movement of said connector member toward said second end.

3. The apparatus of claim **2** wherein said grooves extend from the center of said one end of each of said thrust blocks to a point offset from the center of said opposite end of each of said thrust blocks so that said metal connector member lies in a plane that is skewed with respect to the plane of said stringers and truss member.

4. The apparatus of claim **2** wherein said beam section is provided with a wooden face plate at its second end, said face plate being secured to said upper and lower stringers and having its lower end abutting the side of one of said thrust blocks.

5. The apparatus of claim **4** including a metal base plate mounted between said lower end of said face plate and said one thrust block, and a metal pin extending through an opening in said one thrust block between said metal connector member and said base plate, said pin being rigidly secured to said base plate.

6. A roof supporting beam, comprising:

(a) a pair of identical beam sections each having a first end adapted to be supported by a vertical leg member, and a second end adapted to be secured to the second end of the other beam section in an end-to-end relationship, each of said second ends being formed at an angle with respect to said associated beam section such that said beam sections fit together in an angularly disposed downwardly diverging relationship;

(b) each of said beam sections including:

(1) upper and lower elongated wooden stringers disposed in a predetermined spaced apart relationship;

(2) a wooden face plate attached to said stringers at said second end and extending below said lower stringer a predetermined distance;

(3) a metal connector member positioned beneath said lower stringer, having a connector end portion extending from said second end below said face plate and having the end opposite said connector end portion positioned adjacent said lower stringer a predetermined distance from said second end of said beam section, said metal connector member lying in a plane that is skewed with respect to the plane of the stringers so that the connector end portions of said pair of beam sections will overlap;

(4) means for rigidly connecting together said stringers, said face plate and said connector member including a pair of cover elements disposed on opposite sides thereof and rigidly attached thereto; and

(c) means for connecting together said overlapping metal connector members extending from said oppositely disposed second ends of said beam sections to hold said beam sections in said angularly displaced downwardly diverging relationship.

7. In a beam section having a first end adapted to be supported by a vertical leg member, and a second end adapted to be secured to the second end of an identical

beam section in an end-to-end relationship, said second end being formed at an angle with respect to said beam section such that two of said beam sections can be fitted together in an angularly displaced downwardly diverging relationship to form a roof supporting beam, the improvement comprising:

(a) a relatively flat connector member having a connector end portion and having a plate member secured to the end thereof opposite said connector end portion;

(b) a pair of wooden thrust blocks positioned on opposite sides of said connector member, one end of each of said thrust blocks firmly abutting said plate member and the opposite end of each terminating short of said connector end portion, said connector end portion extending from said second end adjacent the bottom edge thereof;

(c) means for securing said thrust blocks to said beam section to prevent movement of said connector member toward said second end; and

(d) means for securing said connector member to said thrust blocks so as to prevent lateral movements thereof.

8. The apparatus of claim 7 wherein said means for securing said connector member to said thrust blocks so as to prevent lateral movements thereof includes a longitudinal groove formed in one side of each of said thrust blocks, said thrust blocks being positioned over said metal connector member with the opposite side edges thereof lying in said grooves, and wherein said grooves extend

from the center of one end of each of said thrust blocks to a point offset from the center of said opposite end of each of said thrust blocks so that said metal connector member lies in a plane that is skewed with respect to the plane of said beam section, whereby the connector end portions of a pair of identical beam sections placed in an end-to-end relationship will overlap each other.

9. The apparatus of claim 7 wherein said connector member is mounted in a plane that is skewed with respect to the plane of said beam section so that the connector end portions of a pair of identical beam sections placed in an end-to-end relationship will overlap each other.

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