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[54] ROOF TRUSSES

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[52] **U.S. Cl.** **52/694,** 52/693, 85/13, 287/20.92

[51] **Int. Cl.**.....**E04c 3/12**

[58] **Field of Search**.....52/693–694, 364, 52/368, 376; 287/20.92 L; 85/13

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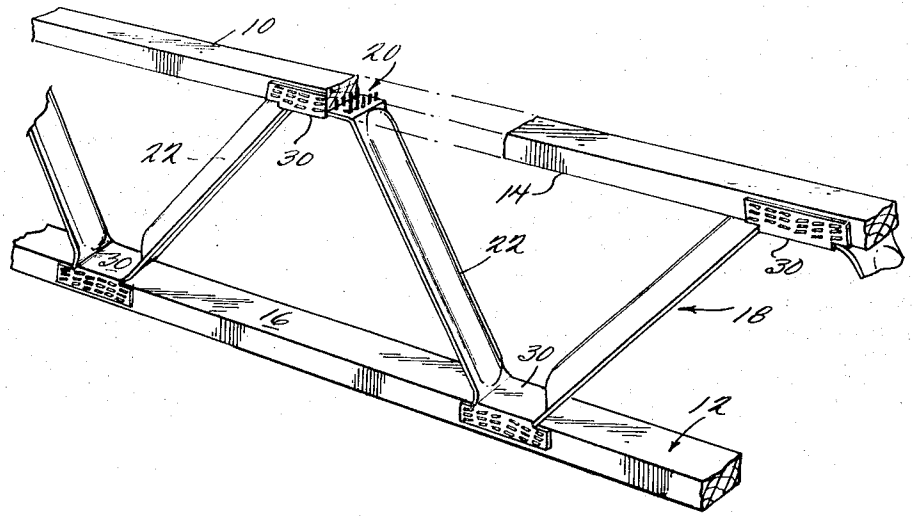
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[57] **ABSTRACT**

A truss structure having wooden chord members with a metallic web or strut member therebetween, attachment portions on said web member contacting two facing surfaces on said chord members, a plurality of pointed fastening elements struck and projecting from each of said attachment portions and embedded in said chord members to attach said web member to said chord members, truss connector members for bracing the attachment of said web members to said chord members, said truss connector members fitting over the attachment portions of said web member and around the edges of said chord members so that a plurality of pointed fastening elements struck out of and projecting from each of said truss connectors are embedded in the sides of said chord member.

16 Claims, 12 Drawing Figures



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SHEET 1 OF 4

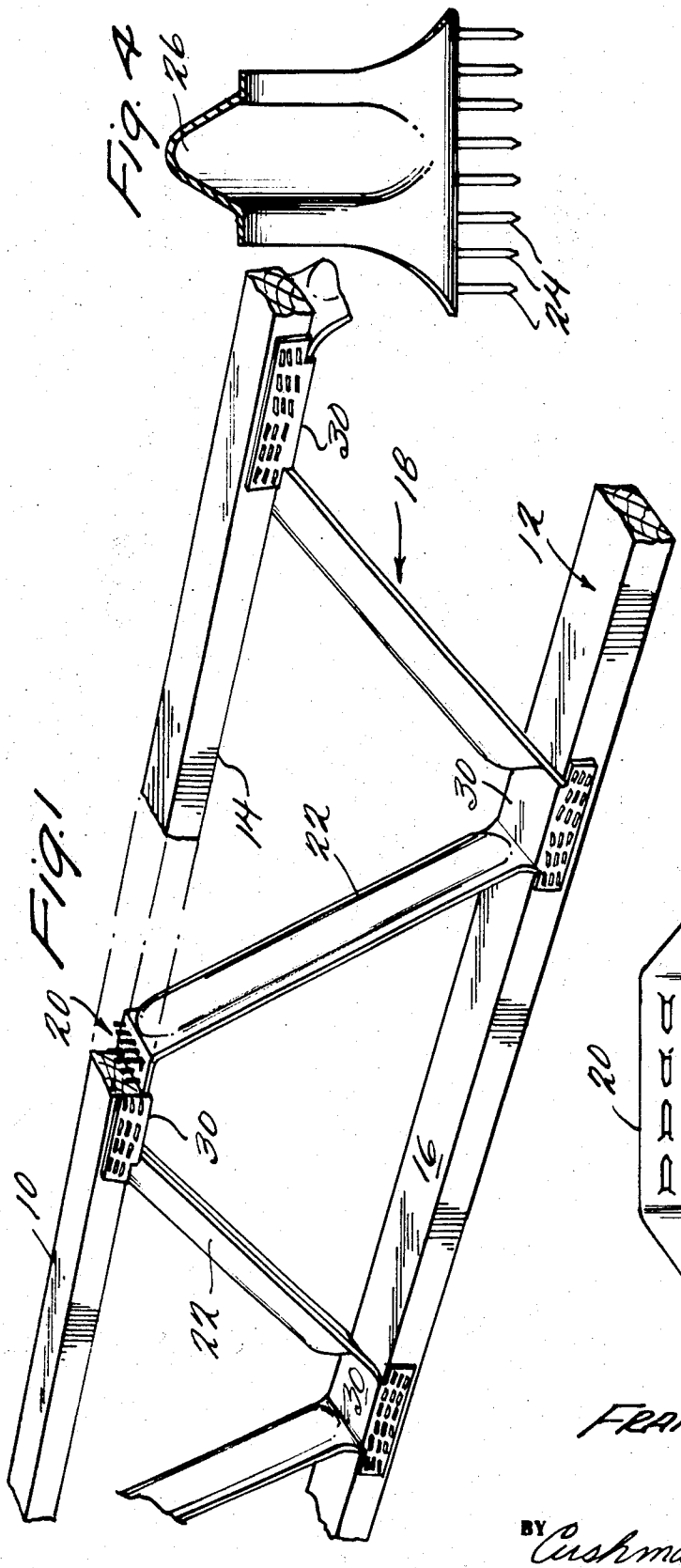


Fig. 1

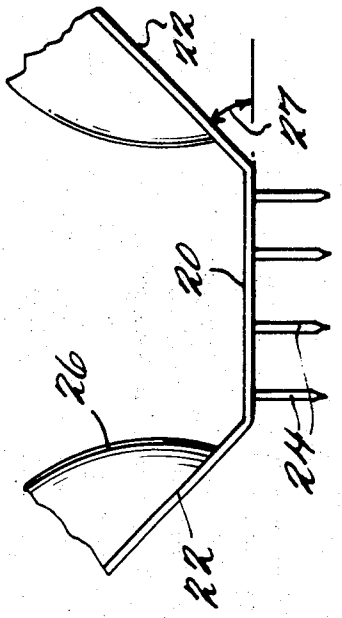


Fig. 3

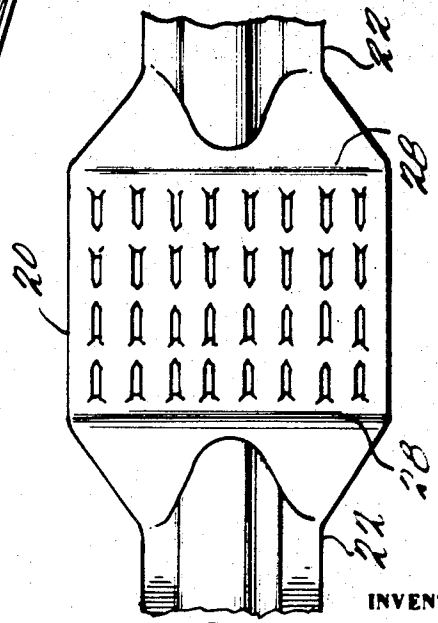


Fig. 2

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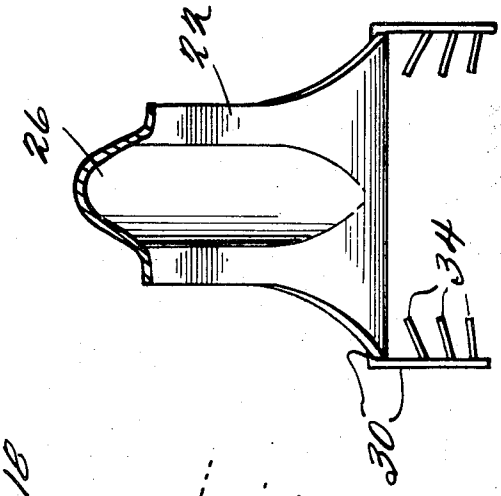


Fig. 7

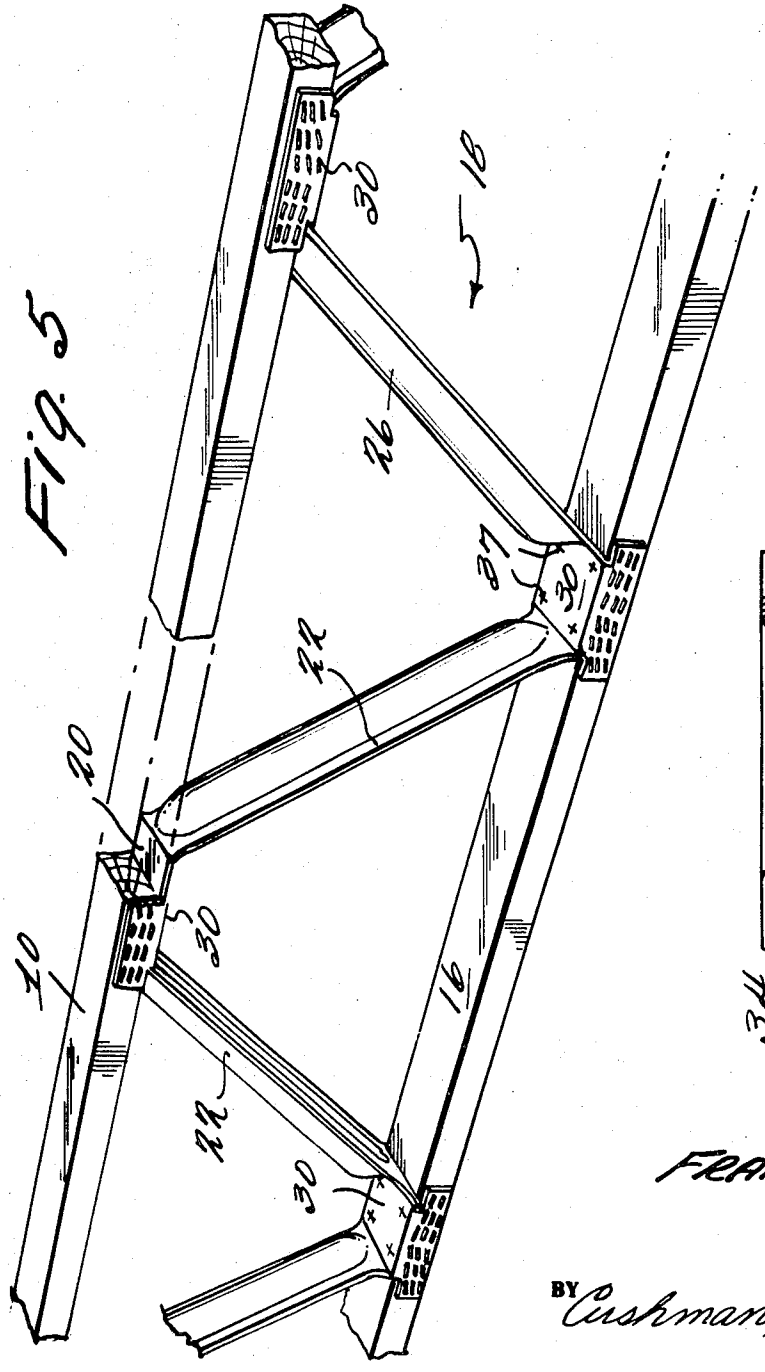


Fig. 5

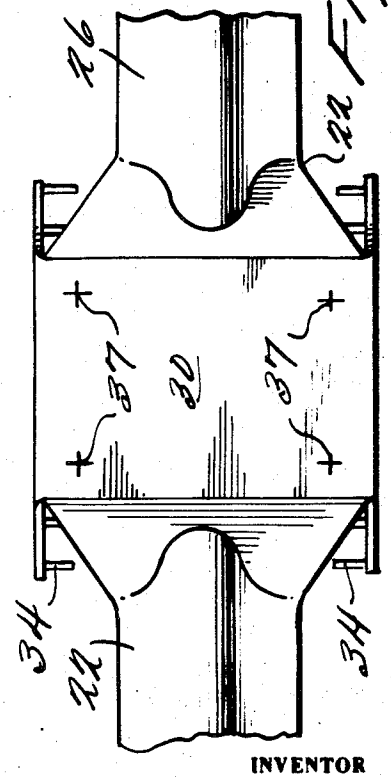


Fig. 6

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Fig. 8

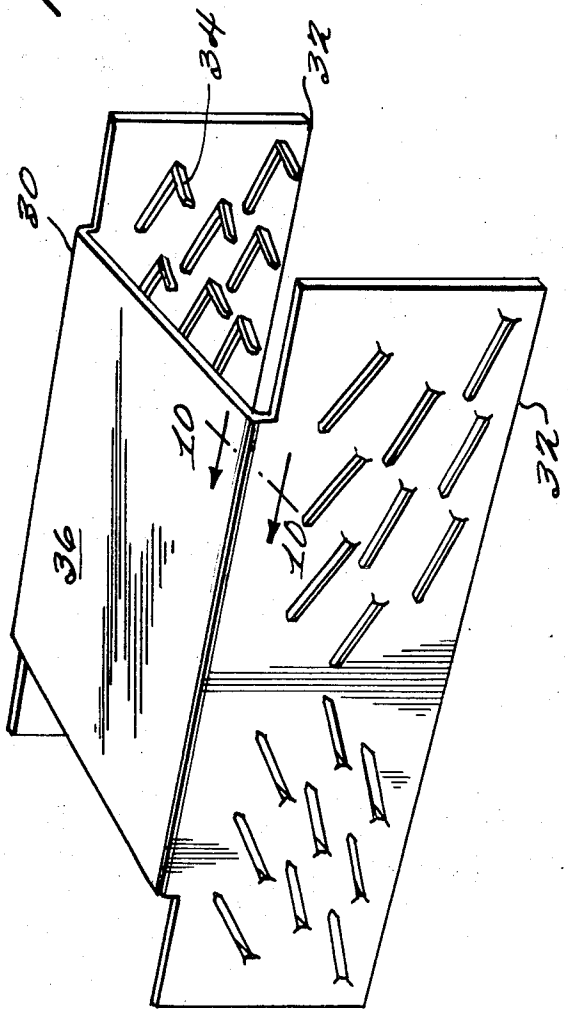


Fig. 10

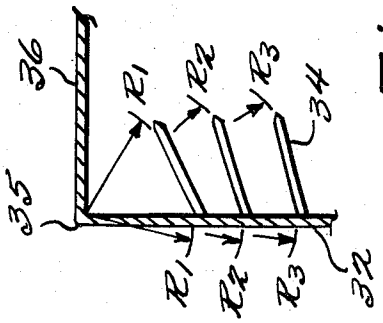
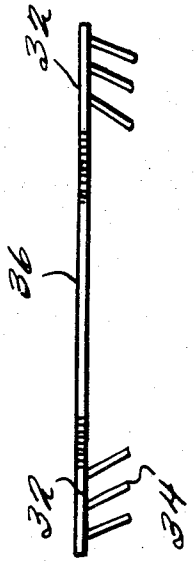


Fig. 9



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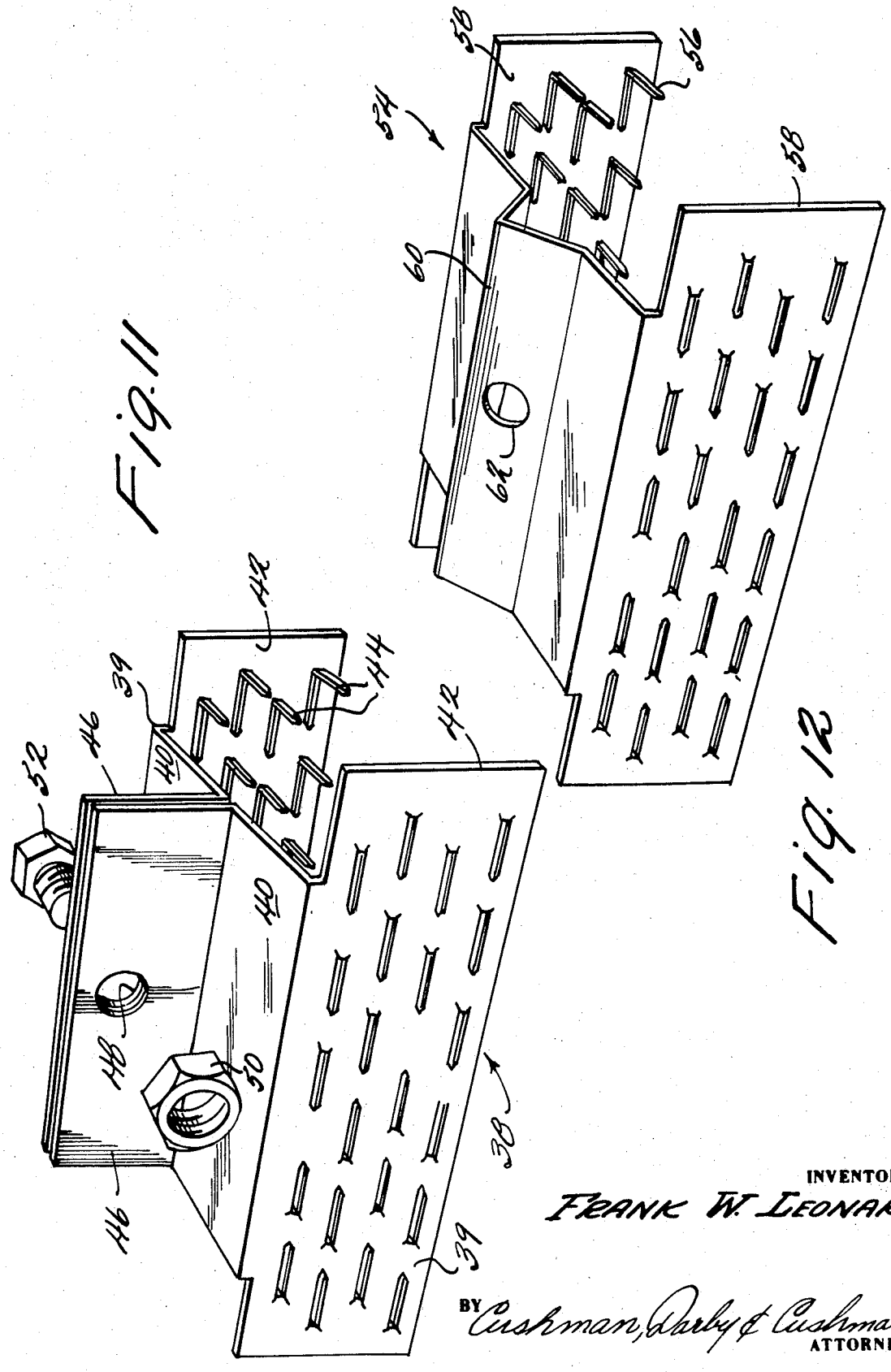


Fig. 11

Fig. 12

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ROOF TRUSSES

BACKGROUND OF THE INVENTION

The present invention relates to trusses and more particularly to trusses constructed from a combination of wooden and metallic members. Specifically, the present invention relates to a novel improved metallic web member for use in forming a truss with wooded chord members and to a novel means for fastening the web member to the wooden chord members.

In the building industry there are many applications in which a load bearing member is required which is light weight and has the ability to support large loads over long, clear spans. Although trusses satisfy these requirements and are being widely used in the building industry, they have the disadvantage of being relatively expensive due to the substantial amount of labor required in their assembly.

Due to substantial increases in labor costs, the assembly costs have risen to such a value that the use of trusses has become uneconomical in many situations. To counteract these rising labor costs, attempts have been made to develop trusses which can be supplied at the building site in either a pre-assembled form or which can be easily assembled from prefabricated parts without requiring substantial amounts of labor.

In an attempt to lower cost, trusses have been developed which are constructed from two wooden chord members held in a spaced relationship by metallic bracing elements. In the usual configuration of these trusses a plurality of these metallic braces are attached to the sides of the wooden chords by nails, bolts or truss connector plates driven through the braces into the chords or the braces have nail-like members struck from the end flanges which penetrate the chords.

Although the above-described configuration of metallic and wooden trusses are somewhat cheaper to assemble, they have distinct disadvantages. One disadvantage lies in the fact that the strength of this type of truss is limited to the strength of the means of attaching the braces to the sides of the chord members. Because web members are attached to the sides of the chord members, they are subject to both shear and bending stresses so that when a force is transmitted by a web attached to the chord be either nailing or teeth struck from the brace, there is a tendency for these attachment member to either shear off or bend and become dislodged from the wooden chord. Due to this failure of the attachments members, this configuration tends to limit the use of the truss member to situations where high strength is not required.

Another disadvantage is also due to the fact that these braces are attached to the sides of the chord. When the chords are loaded with the braces attached to the sides, an eccentric load is applied to the chord due to the fact that the points of attachment of the braces are offset from the center of the chord members. This loading tends to rotate the chords and produce failures.

A further disadvantage of this type of configuration is due to the large amount of labor required to individually attach the braces to the chord. Thus this configuration is relatively expensive to assemble.

Another disadvantage is caused by the twisting or rotation of the connections between the chords and web members due to the distortion of the web member as the truss is loaded. This rotation produces a variance in loading of the fastening elements due to their position relative to the center of rotation of the connection. This non-uniform loading of the fastening elements tends to limit or lower the ultimate loads which the truss can support.

SUMMARY OF THE INVENTION

The principal object of this invention is to provide a combined metallic and wooden truss that eliminates the above disadvantages and is inexpensive to manufacture. This and other objects are accomplished by providing a truss having spaced wooden chord members with a metallic web member extending between the chord members and contacting them on their interior facing surfaces. The contact areas of the metallic web members are provided in one embodiment with pointed fastening elements which are struck out therefrom for penetrating the interior facing surfaces of the chord members to attach the web to the chord members. There are also provided web clamping elements which fit over the attachment surfaces and around the side of the chords and are provided with a plurality of pointed fastening elements struck out of said elements, with said pointed fastening elements penetrating the sides of the chord and thus reinforcing the attachment of the web portions to the wooden chords.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawings in which:

FIG. 1 is a perspective view of two wooden chord members assembled to form a truss incorporating the use of a continuous web member and truss connector clamps;

FIG. 2 is a partial plan view of the web member showing the attachment portion with the fastening elements struck therefrom;

FIG. 3 is a partial side elevation view of the web member showing the attachment portion with the fastening elements struck therefrom;

FIG. 4 is a partial end elevation of the web member showing the fastening elements struck therefrom;

FIG. 5 is a perspective view as in FIG. 1 of another arrangement of the web and truss connector clamps;

FIG. 6 is a partial plan view of the web member and clamp of FIG. 5;

FIG. 7 is a partial end view in elevation of the arrangement of FIG. 5;

FIG. 8 is a perspective view of an embodiment of the truss connector clamp of the present invention;

FIG. 9 is an end view of the clamp of FIG. 8 shown in an open position;

FIG. 10 is a section view taken along the lines 10—10 of FIG. 8; and

FIGS. 11 and 12 are perspective views of alternate embodiments of the truss connector clamp.

DETAILED DESCRIPTION

Referring more particularly to the drawings wherein like reference characters designate like or correspond-

ing parts throughout the several views, the combination truss according to the present invention is shown in FIG. 1 as having an upper chord member 10 and a lower chord member 12 constructed from wooden beams having rectangular cross sections. These two rectangular chords are oriented so that the contact surface 14 on chord 10 and the contact surface 16 on chord 12 are facing in a direction toward each other.

A web member 18 is shown as being constructed from a continuous length of metallic material with alternate attachment portions 20 and spanning portions 22 formed therein. In FIG. 1 the web member is shown as being positioned between the two chord members with the attachment portions 20 contacting the contact surfaces 14 and 16 of the two chord members and with the spanning portions 22 extending diagonally between the two chord members.

It will be understood, of course, that chord members 10 and 12 need not be parallel since the respective dimensions of spanning portions 22 need not be equal but may be formed to accommodate non-parallel configurations of the chord members. Moreover, in particular circumstances the web member 18 need not be continuous over the entire length of the chord members but may consist of spaced sets of members having the lower attachment portion, the first spanner portion, an upper attachment portion, the second spanner portion and a second lower attachment portion.

Referring now to FIGS. 2, 3 and 4, the web member 18 is shown as having elongated fastening elements 24 struck from the surface of attachment portion 20 and projecting from said attachment portion. As illustrated, each fastener element has a width approximately equal to or slightly greater than its thickness.

In FIG. 3, the spanning portion 22 is shown as being deformed at 26 to increase the stiffness of the web member and increase its capacity to carry compressional forces transmitted therethrough. The spanning portions, of course, may be of an cross-sectional configuration appropriate to withstand the compressive forces to which the truss will be subjected. The spanning portion 22 is shown, in FIG. 3, as being bent at an angle of inclination 27 with the plane of the attachment portion 20. This angle 27 can be varied by bending of the spanning portion 22 with respect to the attachment portion 20 along the line shown as 28 in FIG. 2. It can be seen also that trusses with different chord spacing can be constructed using the same web member by bending the spanning portion to different angles of inclination with respect to the contact surfaces.

In FIG. 1, one embodiment of the truss connector clamp member 30 is shown as fitting over the attachment portion 20 and down along the sides of the chord members. A more detailed illustration of this embodiment is shown in FIGS. 8, 9 and 10 as having a flat plate like main portion 36 and two flanges 32. Pointed fastening elements, one of which is indicated at 34, are struck from these flanges and extend away from said flanges at an angle as shown in FIG. 10 to facilitate penetration of the chord members. It should be noted that the angle increases with the distance from the bend axis 35. The main portion 36 is of a size which will fit over the attachment portion 20, so that the two flanges can be bent down against the sides of the chord members with the fastening members 34 penetrating the chord members. By attaching the clamp members to the chords in the above manner, the attachment portions 20 are held in contact with the chord members when tension forces are transmitted through the truss.

In the alternative arrangements illustrated in FIGS. 5, 6 and 7, the fastener elements 24 on attachment portions 20 are eliminated and truss connector clamp 30 is welded, for example at 37 directly to portion 20 of the member 18. It should be understood, of course, that to facilitate assembly the welding operation would be carried out with the truss connector clamp 30 in the open position of FIG. 9. Subsequent to the welding attachment, when it is desired to fix the chord members to the truss connector clamp 30, the flanges 32 are rotated about bend axis 35 where upon the fastener elements 34 become embedded into the sides of the chord members.

An alternate configuration of the truss connector clamp member is shown in FIG. 11. This clamp 38 comprises two pieces of flat sheet material each of which is bent to form angle-shaped clamp portions 39 having two flanges 40 and 42 extending at right angles to each other. The attachment flange 42 has pointed fastening members 44 struck therefrom and extending in a direction perpendicular to the surface of this flange and parallel to a top flange 40. Joining flanges 46 extend at a right angle to the top of flanges 40 and have suitable bores 48 through which a nut 50 and bolt 52 may be assembled to hold the two angle-shaped portions 39 together. This configuration of clamp member 30 is used in the same manner as the one described in the preferred embodiment, with the top flanges 40 fitting over the attached portion 20 with the fastening members 44 penetrating the sides of the chord members and portions 39 being held together by the bolt 50 and nut 52.

FIG. 12 illustrates another embodiment of the clamp member of the present invention. This clamp 54 is constructed from a single piece of sheet material which is bent into the shape shown in FIG. 12. This single piece construction allows the clamp to be easily positioned on the chord. The clamp has fastening elements 56 struck from two side flanges 58 and a folding section 60 provided in its upper portion. The folding section 60 is provided with two bores 62 which are located so that they are axially aligned when the folding section is collapsed. These bores 62 are of a size to allow the insertion of a nut and bolt assembly (not shown) therethrough to hold the section in its collapsed position when in use. This configuration of the clamp member is used in the same manner as the preceding two configurations with the fastening members 56 penetrating the chord members and the folding section 60 being held together by a bolt and nut.

To assemble the truss assembly of the present invention, two chord members 10 and 12 are placed with their contact surfaces 14 and 16 generally facing each other, and a web member 18 is placed between the two chord members. When the web member is provided with fastening elements 24 in the attachment portions 20 as used in the arrangements of FIG. 1, these elements are driven into the contact surfaces of the chord members to fasten the web member to the chord members. The clamp members of the embodiments of FIGS.

8, 11 and 12 are attached as described above over the web member to complete the assembly of the truss.

It should be apparent from the above description of the described embodiments of this invention that other configurations of the foregoing arrangements, particularly with respect to the shape of the fastening elements are within the scope of the present invention.

As can be seen from the above description, the loads transmitted by the web members 18 are centrally located on the chords 10 so that no eccentric loading is produced on the chords.

It can also be seen that in the present invention the pointed fastening elements in the web member are prevented from being withdrawn from the wood by the truss connector clamps which clamp or hold the web member 18 against the contact surfaces 14 and 16 on the chord members 10 and 12.

Also as the trusses of the present invention are loaded, the horizontal components of forces transmitted by the web 18 to the wooden chords is transmitted entirely through the attachment portions 20 of the web member. The vertical components of forces are transmitted by the fastening elements in the clamp members while the horizontal components are transmitted by the fastening elements in the web member itself. Thus it can be seen that each fastening element is loaded uniformly in shear.

Moreover, since the side flanges of each of the clamp members extend beyond the attachment portion 20 of the web member, the forces transmitted by the web member to the clamp can be distributed over a greater number of fastening elements.

It is though that the invention and many of its attendant advantages will be clearly understood from the foregoing description, and it is obvious that various changes may be made in the construction and arrangement of the elements without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A truss structure having metallic and wooden members,

first and second spaced wooden chord members having side surfaces and first and second contact surfaces respectively,

metallic means for supporting said chord members in a spaced relationship comprising,

a one-piece zig-zag shaped web member extending between said first and second chord members,

said web member having spaced chord engaging portions with alternate chord engaging portions contacting said first contact surface and said other chord engaging portions contacting said second contact surface, the portion of said web member between said contact portions being angularly disposed from said chord engaging portions and extending between said chord members, a plurality of metallic clamp members for attaching said chord engaging portions of said web member to said respective chords, each of said clamp members having a flat metallic sheet having a central portion of two flange portions on opposite sides of said central portion and

a plurality of pointed fastening members being struck out and projecting from each of said flange portions

said central portion of each clamp member being shaped to fit over said chord engaging portions with said flange portions directed towards said chords so that said pointed fastening members are embedded in the said surfaces of said chords.

2. A truss as described in claim 1 wherein said chord engaging portions of said web member are formed with a plurality of pointed fastening elements struck out and projecting from each of said chord engaging portions, said fastening elements in said adjacent chord engaging portions being pointed in opposite directions so that all of said fastening elements in one chord engaging portion are pointed in a direction toward and embedded in said first chord member and said fastening elements in adjacent chord engaging portions are pointed in a direction toward and embedded in said second chord member.

3. A truss structure as claimed in claim 1, wherein said chord members are paced in a parallel relationship.

4. A truss structure as claimed in claim 1, wherein said first and second contact surfaces are planar surfaces which are parallel to each other.

5. A truss structure as claimed in claim 1, wherein the portions of said web member between said contact portions are deformed to increase the stiffness and capacity of said web means to transmit compressional forces.

6. The truss structure as claimed in claim 1, wherein said central portion of each of said clamp members is welded to each of said chord engaging portions of said web member.

7. A truss structure as claimed in claim 1, wherein said central portion has an upstanding folding means movable to a closed position for maneuvering the width of said central portion to be equal to the width of said contact surfaces on said chord members, and wherein means are provided on said clamp for forcing said folding means to its closed position.

8. A truss structure as claimed in claim 1, wherein each of said clamp members comprises first and second clamp portions, a planar top flange portion on said clamp portions which contacts the upper surface of said chord engaging portions of said web member, an attachment flange on each of said clamp portions extending at an angle with respect to said top flange portion, said fastening members being formed on said attachment flange members,

means on each of said clamp members for joining said clamp portions and urging them in a direction to clamp siad chord members between said first and second clamp portions.

9. The combination with,

first and second spaced wooden chord members having side surfaces and first and second contact surfaces respectively, a metallic web member for supporting said chord members in a spaced relationship to form a truss structure, said web member being of a one-piece construction extending between said first and second chord members in a zig-zag shape,

said web member having spaced attachment portions contacting said first contact surface and said other attachment portions contacting said second contact surface,

the portion of said web member between said contact portions being angularly disposed from said attachment portion and extending between said chord members,

a plurality of pointed fastening elements struck out and projecting from each of said attachment portions and embedded in said chord members to attach said web member to said chord members,

a plurality of clamp members each having a flat metallic sheet having a central portion and two flange portions on either central portion,

a plurality of pointed fastening members struck out and projecting from each of said flange portions,

said flange portions extending at an angle with the plane of said central portion,

said central portion of each clamp member fitting over said attachment portions with said flange portions directed towards said chords so that said pointed fastening members are embedded in the side surfaces of said chords.

10. The combination claimed in claim **9**, wherein said fastening elements in said adjacent attached portions are pointed in opposite directions so that all of said fastening elements in one attachment portion are pointed in a direction toward said first chord member and said fastening elements in adjacent attachment portions are pointed in a direction toward said second chord member.

11. The combination claimed in claim **9**, wherein said chord members are spaced in parallel relationship.

12. The combination claimed in claim **9**, wherein said first and second contact surfaces are planar surfaces which are parallel to each other.

13. The combination claimed in claim **9**, wherein the portions of said web member between said contact portions are deformed to increase the stiffness and capacity of said web member to transmit compressional forces.

14. The combination claimed in claim **9**, wherein said clamp member comprises first and second clamp portions, a planar top flange portion on said clamp portion which contacts the upper surface of said attachment portion, an attachment flange on each of said clamp portions extending along at an angle less than 180° with respect to said top flange portion,

means on said clamp for joining said clamp portions and urging them in a direction to clamp said chord members between said first and second clamp portions.

15. The combination with,

first and second spaced wooden chord members having side surfaces and first and second contact surfaces respectively,

a metallic web member of a one-piece construction extending between said first and second chord members in a zig-zag shape and having spaced attachment portions with alternative attachment portions contacting said first contact surface and said other attachment portions contacting said second contact surface and,

the portion of said web member between said contact portions being angularly disposed from said attachment portion and extending between said chord members and,

a plurality of pointed fastening elements struck out and projecting from each other of said attachment portions and embedded in said chord members to attach said web member to said chord members to supporting said chord members in a spaced relationship,

wherein the improvement comprises,

clamp means for holding said web member against said chord members so that said combination will be held together, said clamp means including a flat metallic sheet having a central portion and two flange portions on either end of said central portion,

a plurality of pointed fastening members struck out and projecting from each of said flange portions,

said flange portion extending at an acute angle with the plane of said central portion,

said central portion of each clamp member fitting members are embedded in the side surfaces of said chords.

16. The combination claimed in claim **15**, wherein said clamp means comprises first and second clamp portions, a planar top flange portion on said clamp portion which contacts the upper surface of said attachment portion, an attachment flange on each of said clamp portions extending along at an angle less than 180° with respect to said top flange portion, fastening members for attaching said attachment flange members to the sides of said chords,

means on said clamp for joining said clamp portions and urging them in a direction to clamp said chord members between said first and second clamp portions.

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