Sept. 25, 1956

R. J. FINDLETON

APPARATUS FOR CONNECTING THE WEBS TO THE CHORDS IN TRUSSES

2,764,108

Filed March 3, 1952

2 Sheets-Sheet 1

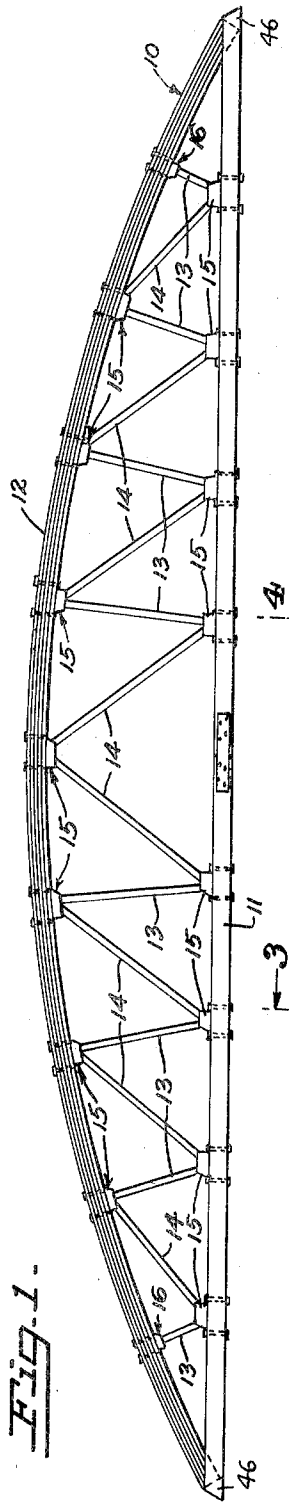


Fig. 1.

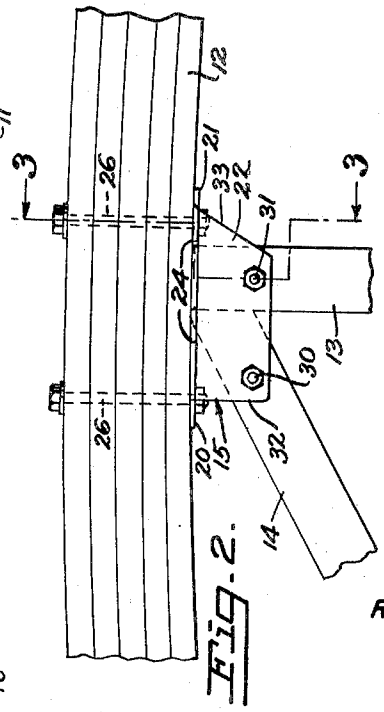


Fig. 2.

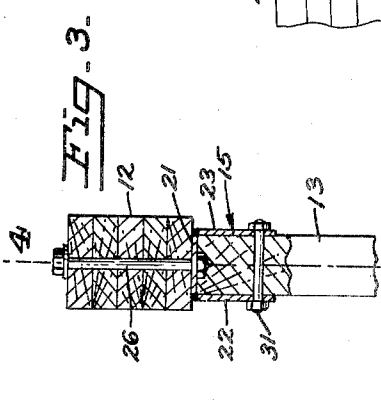


Fig. 3.

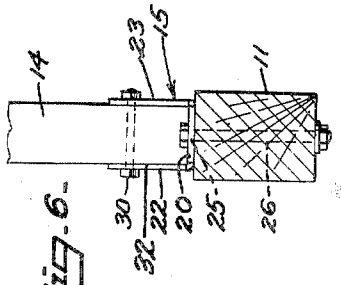


Fig. 6.

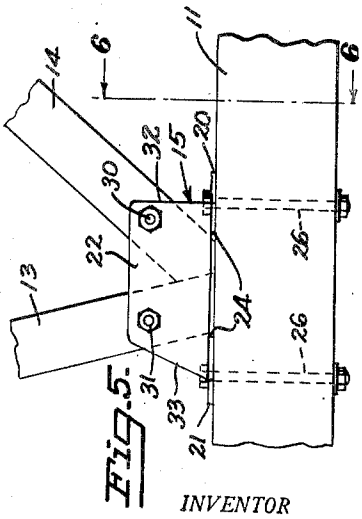


Fig. 5.

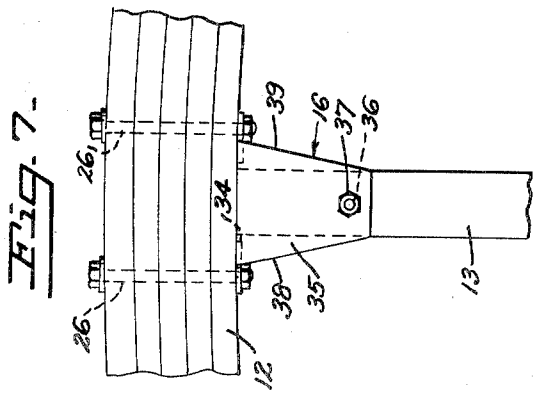


Fig. 7.

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APPARATUS FOR CONNECTING THE WEBS TO THE CHORDS IN TRUSSES

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2 Sheets-Sheet 2

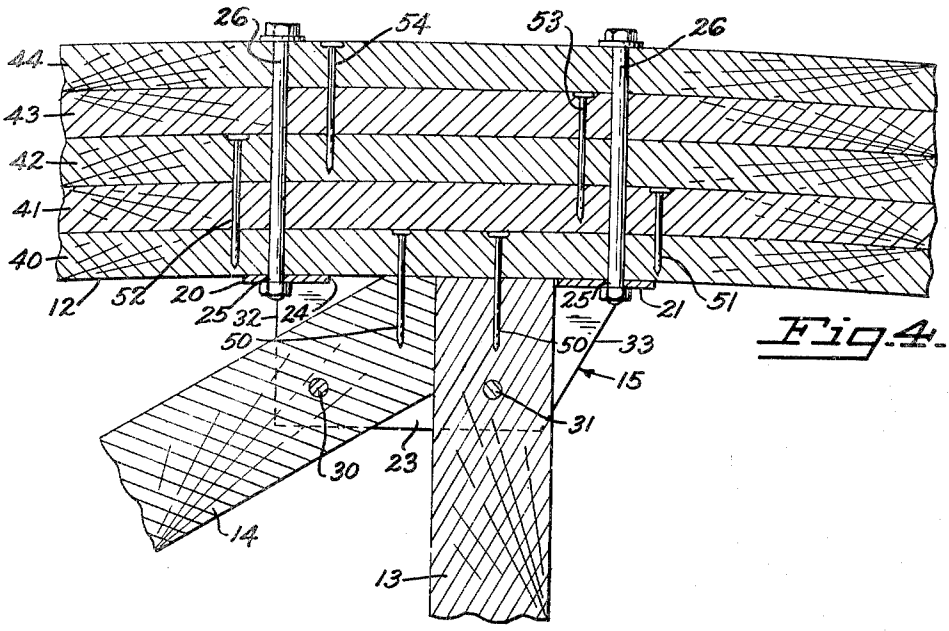


Fig. 4.

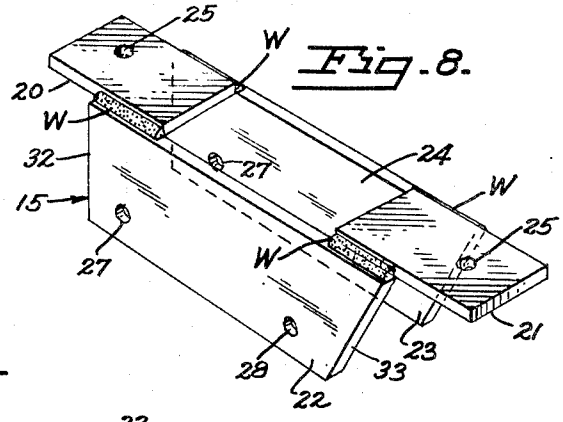
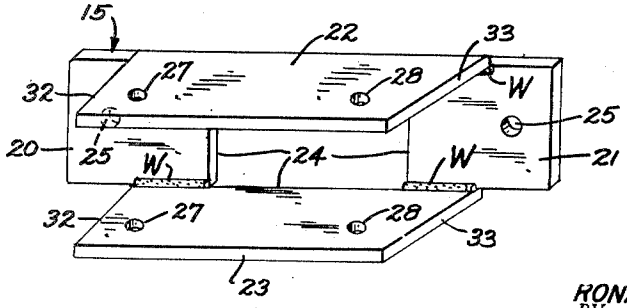


Fig. 8.

Fig. 9.



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2,764,108

APPARATUS FOR CONNECTING THE WEBS TO THE CHORDS IN TRUSSES

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Application March 3, 1952, Serial No. 274,613

10 Claims. (Cl. 108—23)

This invention relates to an improved apparatus for connecting the webs to the chords in trusses.

Although the invention is applicable to trusses of any shape and design, it is particularly useful in the construction of bowstring trusses, that is, the type of truss in which there is a horizontal lower chord and a curved upper chord with supporting web members running between the two chords. For that reason the invention will be discussed in connection with a bowstring truss, and particularly in connection with a type of bowstring truss in which the upper chord is constructed from a plurality of laminations.

The invention solves several problems that have arisen in connecting the web members to the chords of bowstring trusses and other types of trusses. Previous connecting members were unable to solve these problems.

For example, webs have been attached to trusses by gusset plates, that is, metal plates which were bolted on opposite sides of the chord, extended down beyond the chord, and were secured on opposite sides of the web members by several bolts. Gusset plates were satisfactory for metal trusses where the web stress is high, but in trusses made from timber and especially in bowstring trusses, they were objectionable. Unless the lumber were dry and thoroughly seasoned, shrinkage produced stresses near the bolts and caused splitting. Also the bolts through the laminated upper chord caused trouble and weakness, because the direction of the bolts was parallel with the laminations. Also gusset plates required a great deal of metal, and their attachment was expensive and consumed much time.

The same objections apply to the type of connection known as the "strap and pin design," which was somewhat similar to the gusset plate construction, except that a strap was used instead of a wide plate. In addition to the disadvantages recounted above, the strap and pin connection tended to buckle a chord made from timber, unless the connection was very carefully designed.

In another type of prior art connection, rods were passed vertically through the chords, and the web members were adapted into the chords and secured by these rods. This method of attachment was expensive, because of the work of notching the chord where it received the web. The notches tended to weaken the chord, so that a thicker chord had to be used, thereby adding further to the expense. Moreover, it was quite difficult to erect a truss using this type of construction.

The prior art also has used split upper and lower chords with webs in between. Although many good bowstring trusses have been made in this manner, the allowable value for the bolts was low because of the angle of the bolt to the grain of the wood and because of the wood-to-wood connection. Furthermore, the use of double chords meant that there was twice as much work, for all chords had to be duplicated whether or not the structural requirements would otherwise call for duplication. Also, this method involved a relatively large amount of labor and materials.

Still another construction method was to bolt the webs to the outside of the chords. This method again made for low allowable values of bolt strength and it was difficult to construct laminated chords on trusses when using this method of construction.

All these problems have been solved and several additional unexpected advantages achieved by the present invention, which employs a new type of connecting member which we call a "bucket." It is secured to the inner faces of the chords instead of to their sides, by a pair of spaced-apart face plates. Lamination bolts may then be passed through these plates and through all the laminations of the chords. The bucket has side plates at right angles to these face plates and these side plates are used for securing the webs, a single bolt being passed through each web. An open space between the face plates and between the side plates makes it possible for the webs to abut directly on the chord, so that the webs may be spiked to the chord during the construction of the truss. The geratest allowable values for bolts are obtained, since the bolts pass through steel side plates. At the same time, the lamination bolts through the upper chord strengthen it, the greatest possible values being obtained in that direction also. In addition, the open space enables the employment of a greatly superior method of truss construction which speeds up the time of construction and also saves labor and materials.

Other objects and advantages of the invention will appear from the following description of the bucket connecting member and of a bowstring truss in which the bucket is employed. In compliance with United States revised statutes, section 4888, a specific truss and a specific bucket is shown and described; however, it is not intended to limit the invention narrowly to the specific details herein.

In the drawings:

Fig. 1 is a view in side elevation of a bowstring truss showing between its chords and its webs, a plurality of bucket connections embodying the principles of the invention.

Fig. 2 is an enlarged view in side elevation of the connection of one pair of webs to the laminated upper chords of Fig. 1.

Fig. 3 is a view in section taken along the line 3—3 in Fig. 2.

Fig. 4 is a greatly enlarged view in section taken along the line 4—4 in Fig. 3.

Fig. 5 is a view in elevation showing the connection of a pair of webs to the lower chord.

Fig. 6 is a view taken along the line 6—6 of Fig. 5.

Fig. 7 is a view in elevation showing the connection of the single end web to the upper chord.

Fig. 8 is an isometric view of the bucket used in Figs. 2–6.

Fig. 9 is an isometric view of the bucket of Fig. 8 looking at it from another direction.

The bowstring truss **10** shown in Fig. 1 is made up of a lower horizontal chord **11**, a curved upper chord **12**, and a plurality of radial webs **13** and diagonal webs **14**, secured to the chords **11** and **12** by a plurality of buckets **15** and **16**. The buckets **15** are used over most of the truss **10** where two webs **13**, **14** meet at the chord, and the bucket **16** is adapted for use near each end where there is only a single web **13**.

The bucket **15**, shown in the assembly in Figs. 2–6 and by itself in Figs. 8 and 9, comprises a pair of spaced-apart face plates **20**, **21** which are secured to the inner face of either chord **11** or **12**. A pair of side plates **22**, **23** is secured, preferably by welds W, to the plates **20**, **21**, leaving the opening **24** where the webs **13**, **14** abut the chord **11** or **12**.

Each base plate **20**, **21** has a single opening **25** to receive one of the lamination bolts **26**. Each side plate

22, 23 has a pair of openings 27, 28 to receive bolts 30, 31 one of which passes through each web 13 and 14. The openings 27, 27 of opposite plates 22, 23 are aligned as are the openings 28, 28.

In order to save metal, reduce weight, and make the bucket easier to put on, one end 32 of each side plate 22, 23 may be rectilinear and the other end 33 may be inclined. The rectilinear end 32 normally goes on the side of the diagonal web 14, which has a smaller angle of inclination, while the inclined edge 33 lies adjacent the radial web 13, which has a larger angle of inclination to the chord.

The bucket 16 (see Fig. 7) is similar to the bucket 15 except that its opening 34 receives only one web, and therefore is smaller. Also, the side plates 35 have only one bolt opening 36 and only one bolt 37. Since the web 13 is perpendicular to the chord 12, both the forward and rear edges 38, 39 of the side plates 35 may be inclined, as shown.

Considerable time and labor may be saved by using the buckets 15 and 16 in a novel method of building a bowstring truss 10, which is further described and is claimed in my co-pending application, Serial Number 372,262, filed August 4, 1953, where the truss as a whole (as contrasted with the connecting members 15, 16 claimed herein) is also claimed. The truss 10 is normally constructed on the ground with both chords 11 and 12 and the webs 13, 14 lying on the ground instead of placing the truss in the perpendicular position it will assume when the truss 10 is lifted into place and installed.

After choosing a location and laying the lower chord 11 on its side, the buckets 15 are secured by the bolts 26 to the lower chord 11 at the locations indicated by the engineer. Next, the web members 13, 14 are secured to the lower chord 11 and to the buckets 15, the ends of the webs having previously been cut off at the proper angles as indicated by the engineer. If desired the webs 13, 14 may be spiked into place temporarily on the lower chord 11 until the bolts 26 have been tightened firmly in place.

The next step is to bolt the buckets 15, 16 on the outer ends of the webs 13, 14. The construction of the upper chord 12 is then begun by securing the interiormost lamination 40 to the webs 13, 14 by the nails or spikes 50. After the first lamination 40 has been completed by nailing it to all the webs 13, 14, the second lamination 41 is placed over it and a nail 51 is used to spike it to the first lamination 40. Succeeding laminations 42, 43, 44 are then added until the upper chord 12 has been completed. The spikes 52, 53, 54 which hold these laminations may be longer than the spike 51, because they can pass all the way through two laminations and part way through a third lamination insteal of through one lamination and part way through a second. One reason that the present method saves time is that it is easy to bend the relatively thin laminations into place around the already positioned webs and to hold them there by spikes.

After all the laminations are in place a few back-nails (not shown) may, if desired, be driven through from the opposite direction to the spikes 50, 51, 52, 53, and 54. Then holes 45 are bored to receive the bolts 26, and the bolts are installed. The bolts 26 then serve both to hold the laminations 40, 41, 42, 43, and 44 together firmly and to attach the bucket 20 rigidly into position. The truss 10 is then completed by attaching a pair of shoes 46 at each end, if this has not already been done.

It will be apparent that the method (claimed in Serial No. 372,262, filed August 4, 1953) is rapid and accurate, and that the bucket-type connections are rapidly installed. Because the bucket gives a metal-to-wood connection, the bolts are utilized to their maximum strength. The open areas 24, 34 make it possible to secure the webs 13, 14 directly to the chords 11, 12. The use of a single bolt through each web avoids the splitting action caused by using a plurality of bolts. The simplicity of the buckets 15, 16 make them easy and inexpensive to manufacture, and also conserves the metal in them so that the maximum effectiveness is attained with a relatively small amount of metal.

What is claimed is:

1. In a truss the combination with a chord and at least one web, of a bucket member joining said web and said chord, said bucket member having a pair of co-planar spaced-apart base plates lying along the inner surface of said chord, each said plate having a bolt opening therethrough, said bucket member also having a pair of side plates secured parallel to each other and perpendicular to said base plates along the collinear side edges of said base plates and having aligned bolt openings therethrough for securing them to said web, said web extending through the space between said base plates and into direct contact with said chord; at least one nail directly joining each said web and said chord at said space where they are in contact; and bolts through said bolt openings, securing said base plates to said chord and said side plates to said web.

2. In a bowstring truss, the combination with a cord and a plurality of webs, of a bucket member joining said webs to said chord, said bucket member having a pair of co-planar spaced-apart face plates lying against the inner surface of said chord, each said plate having a bolt opening therethrough, said bucket member also having a pair of side plates secured parallel to each other and perpendicular to said face plates along the collinear side edges thereof and having aligned bolt openings therethrough for securing them to said web, each side plate having one bolt opening per web, said webs extending through the space between said face plates and into direct contact with said chord; at least one nail joining each said web to said chord at said space where they are in contact; and bolts through said bolt openings, securing said face plates to said chord and said side plates to said webs.

3. The truss of claim 2, in which at least one side edge of said side plates is inclined so that the edges of said side plates secured to said face plate are longer than the edges parallel thereto.

4. A connection joining the webs to the chords in trusses, including in combination a connecting member having two parallel side plates, each with at least one substantially straight edge, and with aligned bolt openings, and a pair of spaced-apart co-planar face plates welded to the straight edges of said side plates and bridging between them, each face plate having a bolt opening therethrough, the end of the web projecting through the space between said face plates and said side plates and bearing directly against the inner surface of said chord, nails joining a portion of said chord and said web together where they bear directly against each other; bolts joining said web and said side plates through the openings therethrough; and bolts joining said chord to said face plate and extending through its openings.

5. In a wooden truss, a connection joining a web to a laminated chord comprising a unitary channel-shaped connecting member with a face plate adapted to bear against the inner face of said chord and a pair of parallel side plates, one at each side of said face plate, said face plate having an opening therethrough of substantial size and at least as large as the cross sectional area of said web, said connecting member being bolted to said web, said web extending through said opening and substantially co-planar with said face plate; at least one nail joining the inner lamination of said laminated chord to said web where they are in direct contact, through said opening, and bolts joining said chord to said face plate on each side of said opening.

6. A connecting member for trusses enabling the spiking of a web to a chord, comprising a channel member with the channel unobstructed for its entire length, said channel member comprising a pair of side members and a bed member, and having an opening substantially the

width of said channel end of sufficient length to receive the web therethrough extending through said bed member, bolt openings through said bed member on both sides of said opening, and bolt openings through said side members.

7. The connecting member of claim 6 in which each bolt opening through one said side member is aligned with a bolt opening through the other side member.

8. A connecting member for trusses enabling the spiking of a web to a chord comprising a channel member with the channel unobstructed for its entire length, having two spaced-apart co-planar base plates providing between them an opening of sufficient size to receive the web therethrough, each said base plate having a bolt opening therethrough, and a pair of parallel side plates having bolt openings therethrough.

9. The connecting member of claim 8 in which each bolt opening through one said side member is aligned with a bolt opening through the other said side member.

10. The connecting member of claim 8 in which said base plates are welded to said side plates, whereby said side plates hold said base plates together in proper alignment and said base plates hold said side plates together in proper alignment.

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