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2,770,846

TRUSS SHOE

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2 Sheets-Sheet 1

Fig.1.

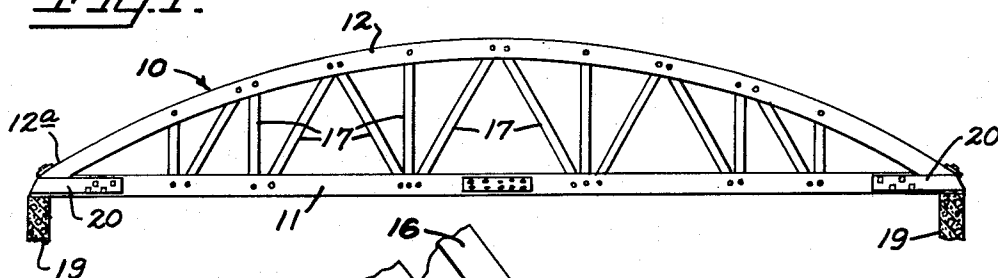


Fig-2.

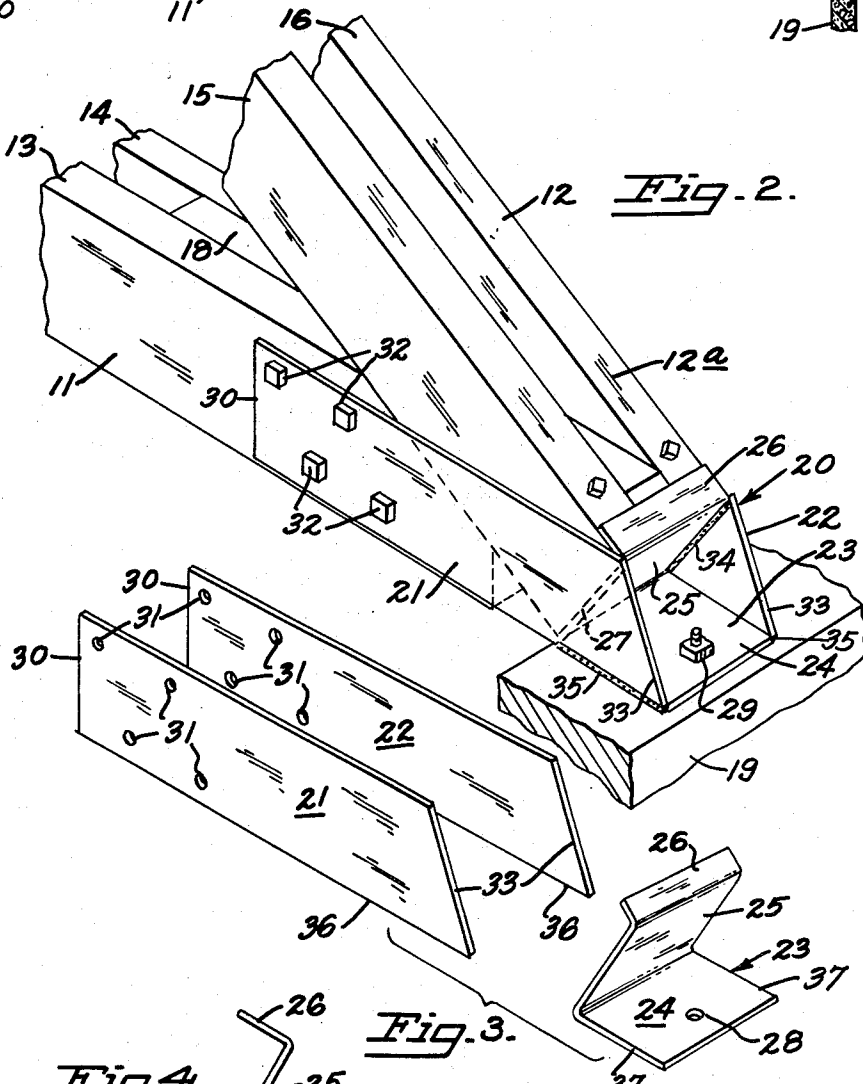


Fig. 3.

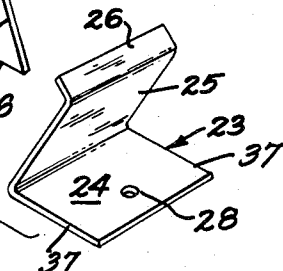
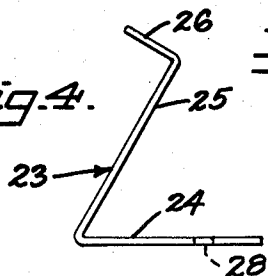


Fig. 4.



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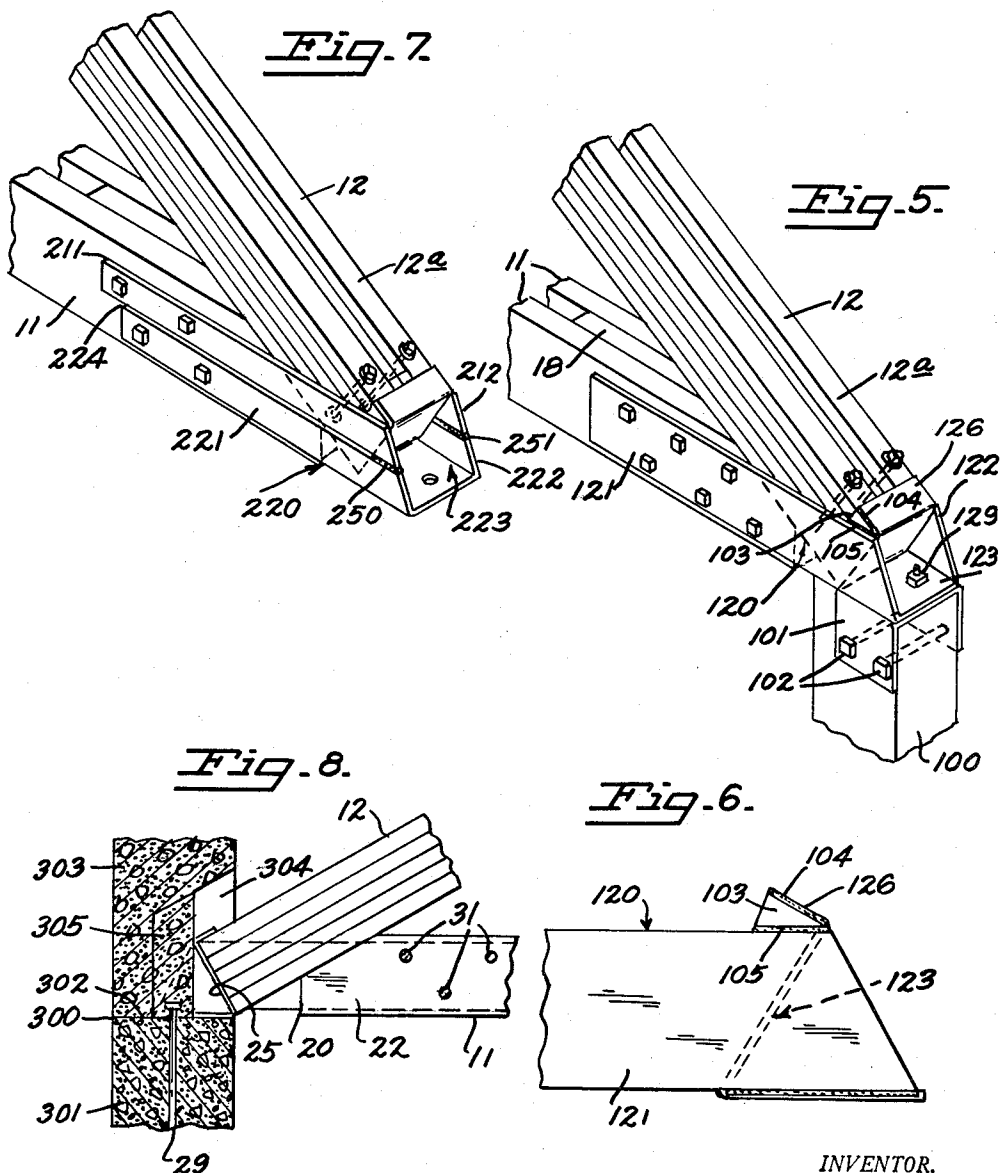
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TRUSS SHOE

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2 Sheets-Sheet 2



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TRUSS SHOE

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11 Claims. (Cl. 20—.5)

This invention relates to a truss shoe, which may rest on a wall, column, or horizontal beam and which serves to support one end of a truss and to connect its lower and upper chords. It is especially useful with a "bowstring truss"—so called because the lower chord is generally straight like a bowstring, while the upper chord is generally curved out like a bow.

The invention solves longstanding problems that were not solved by truss shoes heretofore in use. For example, one truss shoe widely used in the past was made from a steel plate bent into the shape of a U. It was used with the flat leg portions in a generally vertical plane. The lower chord entered the shoe horizontally between the legs of the U and was secured between the legs by bolts. The upper chord entered between the legs at an angle and bore against the bottom of the U, which was often reinforced by a vertical plate. Since this end of the U was vertical, the end of the upper chord had to be cut at an angle thus giving it a low bearing value.

To cure this defect and to provide a bearing generally perpendicular to the end of the upper chord, a heavy plate was welded between the legs of the U at the correct angle. This structure was unduly heavy and required an excessive amount of welding.

Another defect of all these truss shoes was that they were bolted to the wall, beam, or column by means of a pair of outwardly extending angle clamps, secured each to the outside of one of the side plates of the U. This meant that each end of the truss was secured to its support by at least two bolts so that the connection was rigid. In some cases the wall or column support was broken when the truss for one reason or another exerted an angular stress on the shoe, because this rigid mounting of the shoe permitted no relative angular movement between the truss and the wall or column. Also, the column on which the shoe was secured had to be about twice as wide as the shoe, in order to accommodate the two angle clamps. In many cases this caused waste of materials and produced needlessly heavy columns.

Another difficulty with these U clamps was in aligning the bolt holes. It was difficult to align the holes through the side plates where the clamp was bolted to the lower chord, because the U might not be bent at exactly the right place, or one of the bends might have a wider radius than the other. The holes through the side angle clamps were even more difficult to align with the holes in the supporting member to which they were secured, and if a mistake was made in locating the holes in a concrete beam or column, new holes had to be drilled in the angle clamp. Rarely were the holes perfectly aligned.

My invention has solved these problems by providing a novel shoe made up of three pieces of material secured together. Two identically pierced side plates are joined in spaced apart relation by a transverse plate that is bent into a shape which when looked at from the side somewhat resembles a Z. I call this shape an "easy Z." In it, the upper arm of the Z is substantially perpendicular to the inclined connection leg. The lower arm extends

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in a plane substantially conforming to the lower edges of the side plates. The three parts of the Z shaped transverse plate combine with the side plates to provide a particularly effective and economical structure. The lower area preferably has a single bolt hole for securing the shoe in place on the support for the truss end. The inclined connecting leg of the Z plate is substantially at right angles to the end of the upper chord and the upper arm of the Z plate lies along the top of the upper chord to lock it in place.

Other features and advantages of the invention will appear from the following description thereof, with reference to the accompanying drawings. The description and drawings are illustrative only, in compliance with United States Revised Statutes, section 4888, and the details shown are not intended to limit the invention, the scope of which is defined by the appended claims.

In the drawings:

Fig. 1 is a view in elevation showing a truss shoe embodying the invention in place at each end of a bowstring truss and supporting it on a wall. The wall is shown in section and is broken off to conserve space.

Fig. 2 is an isometric view of one end of the bowstring truss installation of Fig. 1, showing a truss shoe embodying my invention. The outer portions of the truss chords are cut off, to conserve space, and so is the wall to which the shoe is secured.

Fig. 3 is an exploded isometric view of the truss shoe of Fig. 2, showing its three main components.

Fig. 4 is a view in side elevation of the Z-shaped plate that forms one component of the truss shoe.

Fig. 5 is an isometric view on a smaller scale than Fig. 2, showing a modified type of shoe secured on top of a wooden post instead of to a wall.

Fig. 6 is an enlarged view in side elevation of the shoe shown in Fig. 5, the side plates being broken off to conserve space.

Fig. 7 is an isometric view similar to Fig. 5 showing another modified type of shoe.

Fig. 8 is a view in elevation and in section showing an installation on a concrete pillar that extends above the shoe.

Fig. 1 shows a typical bowstring truss 10 having a horizontal lower chord 11 and an arcuate upper chord 12. These chords 11 and 12 usually comprise two spaced-apart beams, such as the lower beams 13, 14 and the upper beams 15, 16 shown in Fig. 2. Between the spaced-apart beams, there are vertical and inclined reinforcing beams 17, as in Fig. 1 and at the ends there are horizontal reinforcing members 18, as in Fig. 2.

The bowstring truss 10 bridges the distance between two walls or other supports 19 and its beams are tied together and supported at each end by a truss shoe 20, the subject of the present invention. As shown in Fig. 3, my new truss shoe 20 has three basic components, the two side plates 21 and 22 and the transverse plate 23.

The shape of the plate 23 is what I call an "easy Z" i. e., it has, in general, the shape of the letter Z, with an extended horizontal base 24, an inclined connecting leg or bearing plate 25, and a short upper arm or top plate 26 substantially perpendicular to the leg 25 (see Fig. 4). The arm 26 preferably lies parallel to and against the upper face, 12a of the upper chord 12, (see Figs. 1 and 2) while the leg 26 is perpendicular thereto, providing an ideal bearing for the straight cut end 27 of the upper chord beams 15 and 16. Preferably, the plate 23 is bent from a single steel plate having the required width and thickness. The base 24 is preferably performed by one or more openings 28, through which may be passed a bolt 29, for securing the truss shoe 20 on top of a column, beam or wall 19.

Near their outer ends 30, the side plates 21 and 22 have a plurality of perforations 31 to receive bolts 32 that secure the shoe 20 to the lower chord beams 13 and 14 of the truss and to the center reinforcing member 18. The inner end 33 of the side plates 21, 22 is preferably inclined at an angle approximately equal to the angle of inclination of the leg 25, but sloping in the opposite direction. (See Figs. 2 and 3.) This gives the shoe strength where it needs it most at the greatest saving in weight and size. It also gives access to the nut and bolt 29 during installation.

The side plates 21 and 22 are made exactly alike so their holes 31 will align when they are joined to the plate 23 by welding. One weld 34 preferably joins each inner face of the plates 21, 22 to its adjacent side edge of the connecting leg 25. Preferably these welds are made on the side of the leg 25 opposite to the side against which the upper chord 12 bears. Another weld 35 secures the lower edge 36 of each side plate 21, 22 to the edges 37 of the base leg 24, the weld 35 preferably being along the outside corner, as shown in Fig. 2.

In making an installation like that shown in Figs. 1 and 2, where the truss is supported on a wall 19, the bolt 29 is usually anchored in place when the wall 19 is poured, if the wall is concrete, or, if not, the bolt 29 is secured to the wall in some other manner. The truss shoe 20 may then be secured to the wall 19 by lowering it onto the bolt stud 29. This gives the truss a one-point suspension at the center line of the shoe 20, allowing the truss some desirable angular play in relation to the wall. Having only a single hole 28 to align with a single stud 29 the time saved is substantial as compared with the prior art truss shoes which had two or more holes to align. Usually one hole was out of alignment.

Another important feature of the hole 28 is its location in between the side plates 21 of the truss shoe, so that the entire width of the shoe need not exceed the outside width of the chords 11 and 12 that it anchors plus the thickness of the side plates. This contrasts strikingly with prior art truss shoes where outwardly extending angle clamps were secured to the shoe. This usually made the truss shoes about twice as wide as the truss and required more space and wider columns for their support and fastening.

After the truss 10 has been constructed and its ends cut off at the correct length, a truss shoe 20 is installed at each end. The inclined leg 25 is set flush against the end of the upper chord 12, with the upper leg 27 resting on the upper surface 12a of the upper chord beams 15 and 16. Next the side plates are bolted to the lower chord beams 13 and 14. The completed truss 10 is then ready to be hoisted into position, and secured there on the single stud 29.

The upper leg 26 has the important function of holding the upper chord beams 15 and 16 in place. With earlier truss shoes there has been a tendency for the upper chord beams to straighten and pull out of the shoe. The upper leg 26 provides a positive stop.

Figs. 5 and 6 illustrate a modified form of truss shoe 120 secured atop a column 100 instead of on a wall 19. In order to get a metal-on-metal bearing, a downwardly pointing U-clamp 101 is secured to the upper end of the column 100 by bolts 102, and the truss shoe 120 is then placed on top of the clamp 101 and secured there by the bolt 129. Since the bolt 129 lies between the side plates 121 and 122 of the shoe 120, rather than outside them as in prior art shoes, the column 100 need not be any wider than the shoe 120.

Figs. 5 and 6 also show another modification which has advantages where the force of the upper chord 12 against the shoe is especially great. A pair of triangular gusset plates 103 are secured by welds 104, 105 between each side plate 121, 122 and the upper leg 126 of the Z-plate 123. This gives an additional length of weld, further

strengthening the shoe against the thrust of the upper chord 12.

Fig. 7 shows another modified form of truss shoe 220 which has an advantage where steel side plates of sufficient width are unavailable and where allowance is to be made for some shrinkage in the lumber comprising the lower chord 11. In the shoe 220, the Z-plate 223 is welded between two pairs of spaced-apart side plates 211, 221 and 212, 222. This space 224 between the pairs of side plates is whatever is needed to allow for the shrinkage of the lumber. The Z-plate 223 may be identical with the plate 23 shown in Figs. 2-4, and it is welded to the side plates in a similar manner. In addition, there is a butt weld 250 outside the Z-plate 223 and beyond the lower chord 11, between the pair of spaced plates 211, 221, and there is a similar butt weld 251 between the spaced plates 212, 222. The use of the spaced apart side plates 211, 221 and 212, 222 permits the beams of the chord 11 made of lumber that is not thoroughly seasoned, to shrink without splitting badly.

Fig. 8 shows how the truss shoe 20 may be used on a concrete column 300 that extends above it. The column 300 may be constructed in one of two ways. One way is to pour the lower portion 301 up to the level 302, install the shoe 20 and then pour the upper portion 303, leaving a pocket 304. The pocket is to prevent the concrete from coming into direct and permanent contact with the wooden chords 11, 12, as this might result in dry rot. With my new truss shoe 20, the concrete may be poured in the shoe behind the connecting leg 25. In Fig. 8 the concrete portion 305 represents the additional wall thickness thus obtained.

The alternative method in erecting the column 300 is to pour the column to its full height leaving the pocket 304 and also a pocket where the portion of concrete 305 is shown. After the shoe 20 is secured in place by the bolt 29, the portion 305 is filled in, strengthening the column 300.

The truss shoe of my invention has many other advantages over the prior art, and can be used in other installations and with other types of trusses. What I claim as my invention is:

1. In a truss adapted to be secured to vertical support members and having a horizontal lower chord and a sloping upper chord whose ends lie just beyond the ends of the lower chord, the ends of said upper chord being cut off substantially perpendicularly to said upper chord, the combination therewith of a metal truss shoe at each end of said truss for securing the truss chords together and for securing said truss to said vertical support members closely adjacent the ends of said upper chord, each said shoe comprising a pair of parallel side members lying against the vertical outside faces of said lower chord and bolted to said lower chord, said members having outer portions that extend beyond the end of said lower chord, whereby the tension of said lower chord is transferred effectively to said side members substantially centrally therealong; and a transverse member in between and joining said outer plate portions, said transverse member having a horizontal base portion connecting the lower edges of said outer plate portions, having its inboard end out beyond the end of said lower chord, and having at least one bolt opening therethrough for connection to said vertical support member, which underlies substantially the entire said base portion, said transverse member also having an inclined bearing-plate portion in between said side members extending upwardly and outwardly from the inboard end of said base portion and bearing against the perpendicularly cut end of said upper chord, the end face of said upper chord being supported on the level of the lower chord in a pocket provided by said side members and said bearing-plate portion, said upper chord thrust therefore being resolved substantially centrally against said inclined bearing-plate portion, the main bearing area of said base portion on

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said vertical support member lying directly below said bearing-plate portion, said base portion being shorter than the area on its level that would be formed by a continuation of said upper chord, so that the point of intersection of said upper chord thrust and said lower chord tension lies directly above said vertical support member, whereby all the three forces of the truss, the upper chord thrust, the lower chord tension, and the reaction of the vertical support, are resolved concentrically in said shoe.

2. The combination of claim 1 in which said transverse member comprises a unitary metal plate bent to provide said base and bearing plate portions and having the side edges of both said portions welded to said side members, whereby said resolution of forces in said shoe coact with the unitary transverse member and are transferred continuously along and through its welded side edges to the base portions of said shoe to provide great strength and stability per weight of said side members and said transverse member.

3. The combination of claim 1 in which each side member is a unitary metal plate.

4. The combination of claim 1 in which each side member comprises a plurality of metal strips.

5. In a truss adapted to be secured to vertical support members and having a horizontal lower chord and a sloping upper chord whose ends lie just beyond the ends of the lower chord, the ends of said upper chord being cut off perpendicularly to said upper chord, the combination therewith of a metal truss shoe at each end of said truss for securing the truss chords together and for securing said truss to said vertical support members closely adjacent the ends of said upper chord, each said shoe comprising a pair of parallel side plates lying against the vertical outside faces of said lower chord and bolted to said lower chord, said plates having outer portions that extend beyond the end of said lower chord, whereby the tension of said lower chord is transferred effectively to said side plates substantially centrally therealong; and a transverse member in between and joining said outer plate portions, said transverse member having a horizontal base portion connecting the lower edges of said outer plate portions, having its inboard end out beyond the end of said lower chord, and having at least one bolt opening therethrough for connection to said vertical support member which underlies substantially the entire said base portion, said transverse member also having an inclined bearing-plate portion in between said side plates extending upwardly and outwardly from the inboard end of said base portion and bearing against the perpendicularly cut end of said upper chord to receive its thrust, said upper chord thrust therefore being resolved substantially centrally thereagainst, the main bearing area of said base portion on said vertical support member lying directly below said bearing-plate portion, said transverse member also having a top-plate portion perpendicular to said bearing-plate portion and lying against the upper face of the end portion of said upper chord, the end face of said upper chord being supported on the level of the lower chord in a pocket provided by said side plates, said bearing-plate portion and said top-plate portion, said base portion being shorter than the area on its level that would be formed by a continuation of said upper chord, so that the point of intersection of said upper chord thrust and said lower chord tension lies directly above said vertical support member, whereby all the three forces of the truss, the upper chord thrust, the lower chord tension, and the reaction of the vertical support, are resolved concentrically in said shoe.

6. The combination of claim 5 in which said transverse member comprises a unitary, metal plate bent to provide said base, bearing-plate, and top-plate, portions and in

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which the edges of said base and bearing-plate portions are welded to said side plates, whereby said resolution of forces in said shoe coact with the unitary transverse member and are transferred continuously along and through its welded side edges to the base portions of said shoe to provide great strength and stability per weight of said side plates and said transverse member.

7. The combination of claim 6 in which each said side plate has an isosceles triangular portion defined on one side by the weld to said bearing-plate portion and on the other side by the outer end of said side plate, whereby said bearing-plate portion is supported in a true position and whereby the thrust against said bearing-plate is transmitted to said base portion through said triangular portion.

8. The combination of claim 6 in which said top-plate portion extends above said side plates and in which a triangular side portion is welded to each said side plate and said top plate between them.

9. The combination of claim 5 in which there is but a single bolt opening through said base portion.

10. A truss shoe for securing together the upper and lower chords of a wooden truss and for resolving their forces concentrically, including in combination: a unitary transverse sheet steel plate having a horizontal base portion with at least one bolt opening therethrough, an outboard end and an inboard end, said plate also having an inclined upper-chord bearing portion extending upwardly and outwardly from the inboard end of said base portion; and a parallel pair of elongated vertically disposed sheet steel side plates welded to the opposite side edges of said transverse plate and extending horizontally a substantial distance several times as long as the length of said base portion, beyond the inboard end thereof to provide lower-chord support members and having bolt openings therethrough, whereby forces of tension placed along said side plates and forces of thrust placed against said inclined bearing portion intersect over said base portion for concentric resolution of forces that may be placed thereon.

11. A truss shoe for securing together the upper and lower chords of a wooden truss and for resolving their forces concentrically, including in combination: a unitary transverse sheet steel plate having a horizontal base portion with at least one bolt opening therethrough, an outboard end and an inboard end, said plate also having an inclined upper-chord bearing portion extending upwardly and outwardly from the inboard end of said base portion; said plate also having a top-plate portion extending generally upwardly perpendicularly to said bearing portion from the upper end thereof; and a parallel pair of elongated vertically disposed sheet steel side plates welded to the opposite side edges of said transverse plate and extending horizontally a substantial distance beyond the inboard end thereof, several times as long as the length of said base portion to provide lower-chord support members having bolt openings therethrough, whereby forces of tension placed along said side plates and forces of thrust placed against said inclined bearing portion intersect over said base portion for concentric resolution of forces that may be placed thereon.

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