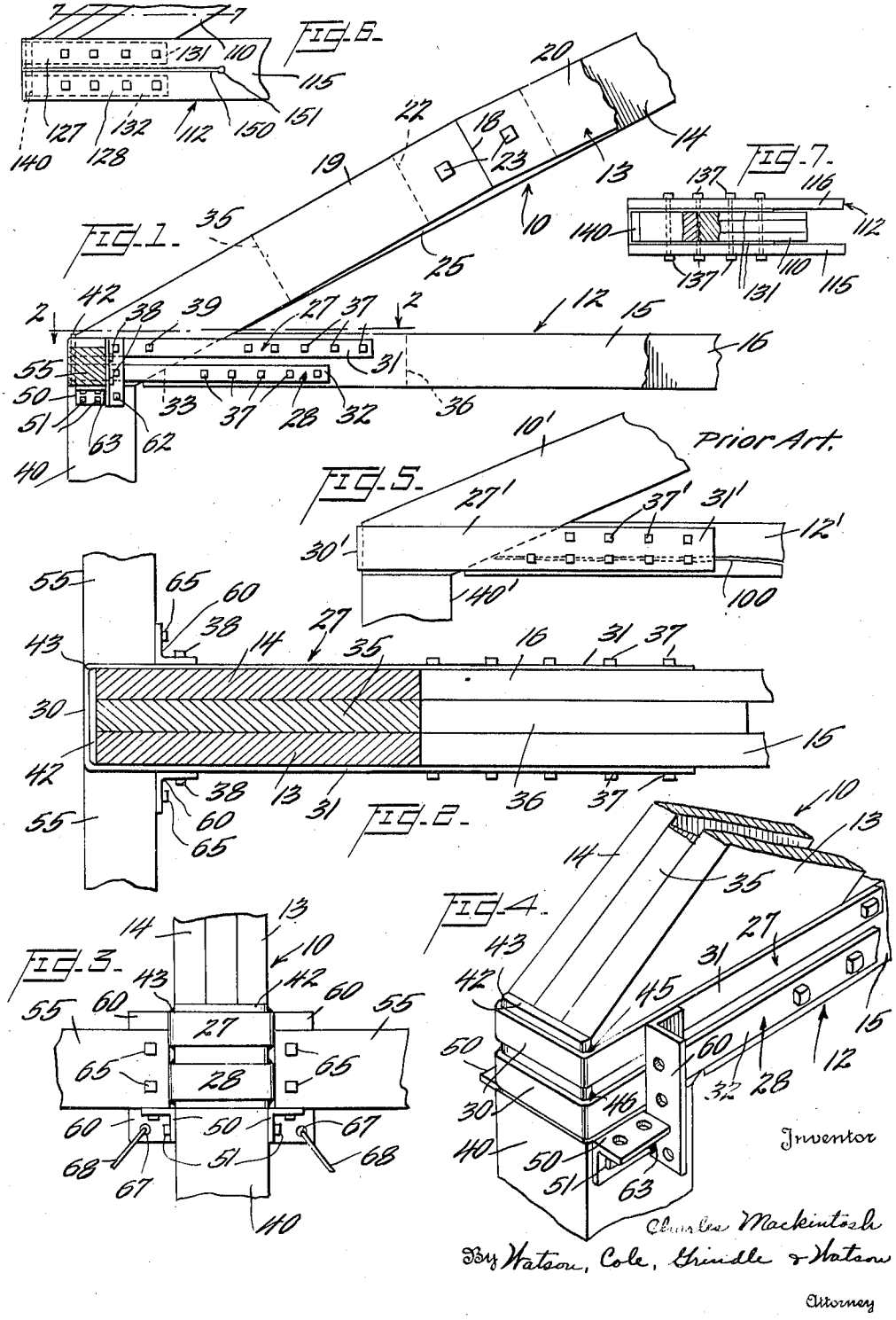
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HEEL CONNECTION

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HEEL CONNECTION

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This invention relates to truss constructions, for example, such as are used in supporting roofs of building structures of various kinds, and has for its general object the provision of a novel and improved heel connection at the junctions of the upper and lower chords at the ends of the truss.

The means very commonly employed in effecting this connection involves the provision of a relatively broad generally U-shaped strap or "shoe" which embraces the ends of the members of the lower chord to which it is secured by means of a double row of bolts, and the bight of which provides a socket or stirrup within which the end of the upper chord is received and against which it abuts. One serious disadvantage of such constructions, especially when unseasoned or incompletely seasoned lumber is used, lies in the tendency of the members of either the upper or lower chords, or both of them, to split either along the lines of the bolt holes or between them. This is due to the subsequent shrinkage of the wooden chord members after being rigidly secured at spaced fixed points to the metal shoe.

In its preferred embodiment, the invention contemplates the provision of a heel connection for a truss of the general class described, in which the upper and lower chord ends are secured together to complete the unitary truss frame, by means of two or more spaced straps of generally U-shaped configuration. Each of the straps is preferably secured to the members of the lower chord by means of bolts which pass through the chord members and both of the parallel arms of the straps. The spacing between corresponding arms of adjacent straps should, of course, be greater than the maximum expected shrinkage of the wooden members of the lower chord. The bights of the straps enclose the end of the upper chord and provide a plurality of stirrups for taking the endwise pressure of the upper chord elements. Preferably a thrust plate or block is inserted within the bights of the straps to provide a more solid and unitary surface for the upper chord.

In a modified form of the invention, the straps enclose the end portion of the upper chord only and the divided ends of the lower chord extend alongside of the end of the upper chord in overlapping relationship. The bolts securing the chords and the straps together pass all the way through the overlapping portions of the three members. If desired, the ends of the lower chord members may be kerfed or slotted so that slight relative movement may take place between the areas which are secured to the individual narrow straps.

Provision is also made for tying in the truss heel connection with the post or column upon which it is supported and also with the plates which extend between the posts at right angles to the truss, and which, together with the posts and sills, define the bays of the side walls of the building. These bays may be cross braced by means of diagonal tie rods or the like, provision being made in the novel heel connections for anchoring the upper ends of such rods.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawing in which one embodiment of the invention is illustrated by way of example.

In the drawing:

Figure 1 is a fragmentary view in front elevation of one end portion of a truss embodying the principles of the invention, one of the plates which connect successive trusses and columns being shown in cross section;

Figure 2 is a horizontal sectional view taken substantially on line 2—2 of Figure 1;

Figure 3 is a view in end elevation of the heel connection of the truss and showing other connecting elements for the posts or columns;

Figure 4 is a fragmentary perspective view of the heel connection, the roof plates being omitted for the sake of clarity of illustration;

Figure 5 is a view similar to Figure 1, but showing a prior art construction and the results of employing such a heel connection with unseasoned lumber;

Figure 6 is a fragmentary view in side elevation in a modified form of truss heel; and

Figure 7 is a view in horizontal section taken on line 7—7 of Figure 6.

The novel truss connection illustrated and described in the present specification is shown as embodied in a wooden building construction such as a warehouse, garage, or airplane hangar, and it is to be understood that these roof supporting trusses are provided at spaced intervals along the length of the building, the ends of the trusses being supported upon columns or posts which are in turn connected along the length of the building by sills and plates at the lower and upper ends of the posts respectively. However, it is understood that, within the scope of the broader aspects of the invention, the novel and improved heel connection may be embodied in truss assemblies of any type and adaptation.

In the exemplary embodiment illustrated, each

truss comprises an upper chord element 10 and a lower chord element 12, each of which is composed of one or more spaced timbers, the members comprising the upper chord 10 and indicated at 13 and 14 and those forming the lower chord 12 at 15 and 16. Of course, as in the usual case, the upper and lower chords are braced throughout their length by means of vertical or diagonal struts or webs, the ends of which may conveniently be received and secured between the upper chord timbers 13 and 14 and the lower chord members 15 and 16. Obviously, the members 13 and 14, and 15 and 16 are not continuous, but comprise a series of timbers spliced together at their abutting ends at intervals throughout the extent of the chords. For example, a splice in the member 13 of the upper chord is indicated at 18, the ends of the timbers 19 and 20 forming the member 13, abutting at the joint and being secured together by means of the block 22 which overlaps the ends of the timbers 19 and 20 and is secured to them by means of the bolts 23. The splices between the timbers of the upper chord elements 13 and 14 are staggered, the end timber of the element 14 being indicated at 25.

The heel connection between the upper chord 10 and the lower chord 12 is effected by the composite shoe shown to the best advantage in Figure 4 of the drawing. The shoe comprises essentially the two vertically spaced U-shaped straps 27 and 28, the bights 30 of these straps passing around the end of the upper chord 10 and the arms 31 and 32 of the respective straps extending alongside of the end of the chord 10 and also extending along both sides of the end portion of the lower chord 12, which terminates at the diagonal line 33 in close proximity to the end of the upper chord 10.

In the simplest form of the construction, the spaced members 13 and 14 of the upper chord and members 15 and 16 of the lower chord are merely received between the arms 31 and 32 of the straps 27 and 28 and the respective timbers bolted to the straps, but in order to provide a more firmly braced construction, blocks 35 and 36 may be respectively interposed between the upper chord elements 13 and 14 and the lower chord elements 15 and 16 at the extreme ends to hold the elements apart and make a snugger and more rigid clamped connection at the shoe. The bolts 37 pass through the parallel arms 31 and 32 of the straps 27 and 28, through the members 15 and 16 of the lower chord, and through the insert block 36. Two vertically aligned bolts 38 and a bolt 39 are shown extending through the arms of the straps, the elements 13 and 14 of the upper chord, and the insert block 35. These latter bolts are optional but may be employed to further rigidify the heel connection. The extreme end of the upper chord 10 is beveled off horizontally to provide a firm seat upon the upper end of the column or post 40. This seat may be through direct contact of the chord with the top of the post, or a bearing plate of any conventional type may be interposed between the members. Since the lower chord 12 is a tension element and is sufficiently connected or tied into the trusses structure by means of the bolts 37 and the straps 27 and 28, this chord needs no further connection with the supporting structure.

In order to provide a more rigid unitary seat for the end of the upper chord 10 within the bights 30 of the straps 27 and 28, a thrust plate 42 is provided, this plate being of a vertical extent exceeding the combined height of the two straps and being provided preferably with rounded or beveled corners as at 43 in order to conform to the bights 30 of the straps. The reinforcing or thrust plate 42 may be tack-welded as at 45 and 46 to the respective straps 27 and 28 in order to maintain the relative positions of these elements.

In Figure 5 of the drawing, a heel connection is shown which typifies prior art construction in which the upper chord 10' and the lower chord 12' are joined by means of the broad U-shaped shoe 27', the bight 30' of which surrounds the end of the upper chord 10' which rests upon the post 40' and the arms or side webs 31' of the shoe embraces the ends of the lower chord 12'. Two rows of bolts 37' and 38' are employed for anchoring the lower chord 12' to the heel connection. In periods of great demand for lumber, as in war times or during buiding booms, it is difficult to obtain thoroughly cured and dried lumber for use in building constructions of this type, practically all of the supply being used as rapidly as it is cut. In such a case the unseasoned or only partly seasoned lumber is liable to great shrinkage after erection of the building and in a great percentage of the heel connections constructed in accordance with the prior art example shown, the lower chords have split at any one of three places in the vicinity of the shoe, either along the line of the lower row of bolts 38'—as shown at 100—along the line of the upper row of bolts 37', or at some point between these lines of bolt connections. Such failures are extremely common and one of the objectives of the present invention is to eliminate this source of weakness in the truss. It will be readily seen that in the use of the composite shoe afforded by the present invention, the lower chord members may shrink to their fullest extent without causing a split at the heel connection because of the flexibility of the compound shoe, the straps 27 and 28 being free to move with relation to each other in response to any shrinkage in the timbers.

In pursuing the further object of the invention, provision is made for extending the heel connection to provide guides and supports for the plates which tie the successive truss and column structures together. Angle brackets 50 are disposed upon either side of the post 40 adjacent the extreme upper end thereof. These angle brackets are bolted to the post by means of the bolts 51 which may be either screw bolts employed individually for the respective angle brackets or may be elongated and extended right through the post 40 and the flanges of the brackets of both sides thereof. The ends of the plates 55 rest upon and are secured to the horizontal flanges of the angle brackets 50 as clearly shown in Figure 3 of the drawing. The ends of the plates abut the shoe 27, 28 and are secured thereto in proper position by means of the vertically extending angle brackets 60, these brackets preferably extending from the lowermost point of the brackets 50 to the uppermost extent of the upper straps 27, as clearly shown in Figures 3 and 4 of the drawing. One flange of each bracket 60 is secured as by means of the bolts 38 to the heel connection, these bolts having been already described in relation to the connection between the shoe and the upper chord. Bolt 62 serves to connect the bracket 60 with the post 40 and the bracket 60 may be further connected with the horizontal bracket 50 as by means of the spot weld or tack weld shown at 63. Bolts 65 serve to connect the bracket 60 with the plate 55. In the

lowermost portion of the angle bracket 60 and in alignment with the openings provided with the bolts 65, an opening 67 affords means for securing the diagonal tie rods 68 to the heel connection. These tie rods provide cross bracing for the bays of the side walls of the building and the lower ends thereof may be secured to the lower portions of the next adjacent columns 40 or to the sills of the building structure in the vicinity of such columns, as well known in the art.

In the modification illustrated in Figures 6 and 7 of the drawing, a portion of the upper chord is indicated at 110 and the end of the lower chord at 112. The end of the upper chord is embraced by spaced U-shaped strap members 127 and 128 each provided with parallel arms 131 and 132. A plate 140 is inserted in the bight of the straps to take the thrust of the chord. The lower chord 112 comprises two members 115 and 116 which extend alongside of the end of the upper chord and fit closely against the outer sides of the arms of the straps. A row of transverse bolts 137 pass through the arms 131 of the straps and also through the enclosed end of the upper chord and the upper portions of the members 115 and 116 of the lower chord. A similar row of bolts 137 pass through the arms 132 of the lower strap 128 and the lower portion of the chord members 115 and 116. Certain of these latter bolts also pass through enclosed portions of the end of the upper chord.

Optionally, the members 115 and 116 of the lower chord may be kerfed as at 150 so as to inhibit the splitting of the chord elements due to contraction of the wood. These kerfs are preferably made by drilling an opening through the chord members as at 151 and then sawing a slit longitudinally from the end of the members to meet the drilled opening. If desired, it is within the purview of this invention to kerf the ends of the members 15 and 16 of the lower chord 12 in the embodiments previously described.

By means of the structures just described, there is provided a convenient and useful building connection which greatly facilitates the erection of wooden buildings of various types and definitely obviates serious deficiencies in prior constructions. It is understood that various changes or alterations can be made in the embodiment illustrated and described herein without departing from the scope of the invention as defined in the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A truss construction comprising in combination, an upper chord, a lower chord, and a connection between said chords at the adjoining ends thereof, said connection comprising a plurality of vertically spaced U-shaped straps, each of said straps embracing the end of at least one of said chords and separately secured to said chords by fastening means disposed in a single substantially straight line and means connecting said portions of the straps together to form a unitary connection element which will permit some independent movement of said straps to accommodate any possible changes in the vertical transverse dimensions of the members of the truss.

2. A truss construction comprising in combination, an upper chord, a lower chord, and a connection between said chords at the adjoining ends thereof, said connection comprising a plurality of U-shaped metal straps embracing the end of at least one of said chords, well distributed across the height of the lower chord and spaced apart by at least the distance equal to the maximum shrinkage at such spaces of the wood of which the lower chord is composed, each of said straps being secured to the lower chord by fastening means disposed in a single substantially straight line substantially parallel with the direction of longitudinal extent of said lower chord.

3. A truss construction comprising in combination, an upper chord, a lower chord, and a connection between said chords at the adjoining ends thereof, said connection comprising a plurality of U-shaped straps, the arms of said straps being disposed parallel with said chord ends and each secured thereto by fastening means disposed in a single substantially straight line, one of said chords being kerfed along a line between the straps.

4. A truss construction comprising in combination, an upper chord, a lower chord comprising two substantially horizontal parallel members spaced apart and extending along both sides of the end of the upper chord, and a connection between said chords comprising a plurality of vertically spaced U-shaped straps embracing the end of the upper chord and having their arms disposed between said upper chord and the members of the lower chord, said straps being spaced apart to accommodate any change in the vertical transverse dimensions of the lower chord, and fastening means passing through each of said arms and both chords and disposed in a single substantially straight line.

5. A truss construction for supporting roofs of buildings or the like comprising, in combination, an upper chord, the ends of which are adapted to rest upon a supporting structure, a lower chord providing a tension element of the truss and suitably connected with said upper chord at intermediate points, the ends of said upper chord overlapping the corresponding ends of the lower chord in a longitudinal direction, a heel connection for each of the adjoining ends of the two chords which comprises a plurality of relatively narrow U-shaped straps, the respective arms of which extend along opposite sides of the lower chord in parallel spaced relation to each other, each pair of arms being secured to said lower chord along a single straight line, the bights of said straps embracing the end of said upper chord to take the thrust thereof and means connecting said straps together adjacent their bights not only to provide a unitary connection member but to permit some independent relative movement of said straps to accommodate any change in the vertical transverse dimensions of members of the truss.

6. For use in providing connections between one end of a roof truss of a building and the adjacent columns and plates, a unitary assembly comprising a plurality of parallel spaced apart U-shaped straps, the arms of which are adapted to embrace an end of said truss, a thrust plate received within the bights of said straps for directly receiving the thrust of the truss, means securing said thrust plate to said straps, an angle bracket on each side of the assembly connecting the arms of said straps adjacent the bights thereof and having a flange adapted to abut and be secured to the adjacent plate.

7. For use in providing connections between one end of a roof truss of a building and the

adjacent columns and plates, a unitary assembly comprising a plurality of parallel spaced apart U-shaped straps, the arms of which are adapted to embrace an end of said truss, a thrust plate received within the bights of said straps for directly receiving the thrust of the truss, said thrust plate being tack welded to said straps, an angle bracket on each side of the assembly connecting the arms of said straps adjacent the bights thereof and having a flange adapted to abut and be secured to the adjacent plate, another angle bracket secured to the lower end of each of said first named brackets, adapted to underlie the adjacent plate, and having flanges adapted to be secured to the plate and the column.

8. A truss construction comprising, in combination, an upper chord, a lower chord, and a connection between said chords in the adjoining ends thereof, said connection comprising an end abutment member and a plurality of vertically spaced, relatively narrow straps rigid with and extending from said member along each side of said chord ends, fastening means securing said straps to at least one of said chords, said straps being spaced apart to accommodate the maximum expected change in the vertical transverse dimensions of the chord to which it is secured.

9. A truss construction comprising, in combination, an upper chord, a lower chord, and a connection between said chords in the adjoining ends thereof, said connection comprising an end abutment plate and a plurality of vertically spaced straps secured to and extending from said plate along each side of said chord ends, and fastening means securing said straps to at least one of said chords, said straps being spaced apart to accommodate the maximum expected change in the vertical transverse dimensions of the chord to which it is secured.

10. A truss construction comprising in combination, an upper chord, a lower chord, and a connection between said chords at the adjoining ends thereof, said connection comprising a unitary member of generally U-shaped configuration embracing the end of at least one of said chords, said member comprising a transverse base element adapted to abut said chord end, and a plurality of metal straps secured to said base element and extending along each side of the chord ends, said straps being well distributed across the height of the lower chord and spaced apart by at least the distance equal to the maximum shrinkage at such spaces of the wood of which the lower chord is composed, each of said straps being secured to the lower chord by fastening means disposed in a single substantially straight line substantially parallel with the direction of longitudinal extent of said lower chord.

11. A truss construction comprising, in combination, an upper chord, a lower chord, and a connection between said chords at the adjoining ends thereof, said connection comprising a unitary member of generally U-shaped configuration, said member comprising a transverse base element adapted to abut said chord end and a plurality of metal straps secured to said base element, said straps being disposed parallel with said chord ends and each secured thereto by fastening means disposed in a single substantially straight line, one of said chords being kerfed along a line between the straps.

12. As an article of manufacture for use in providing connections between the upper and lower chords of a roof truss or the like, a unitary substantially U-shaped member adapted to embrace the ends of a truss, said member comprising a substantially rectangular base plate and a plurality of parallel spaced arms extending from each of a pair of opposite side edges of the plate and perpendicular to the plane of the plate, the spacing between said arms on the same side of the member being equal to any expected shrinkage of a wooden structural member to which the arms may be secured, said arms being of strap metal of some slight flexibility to accommodate relative movement due to such shrinkage.

13. The truss construction as set forth in claim 5 in which the strap connecting means comprises a unitary thrust plate received within the bights of all of said straps and bearing against the end surface of the upper chord.

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