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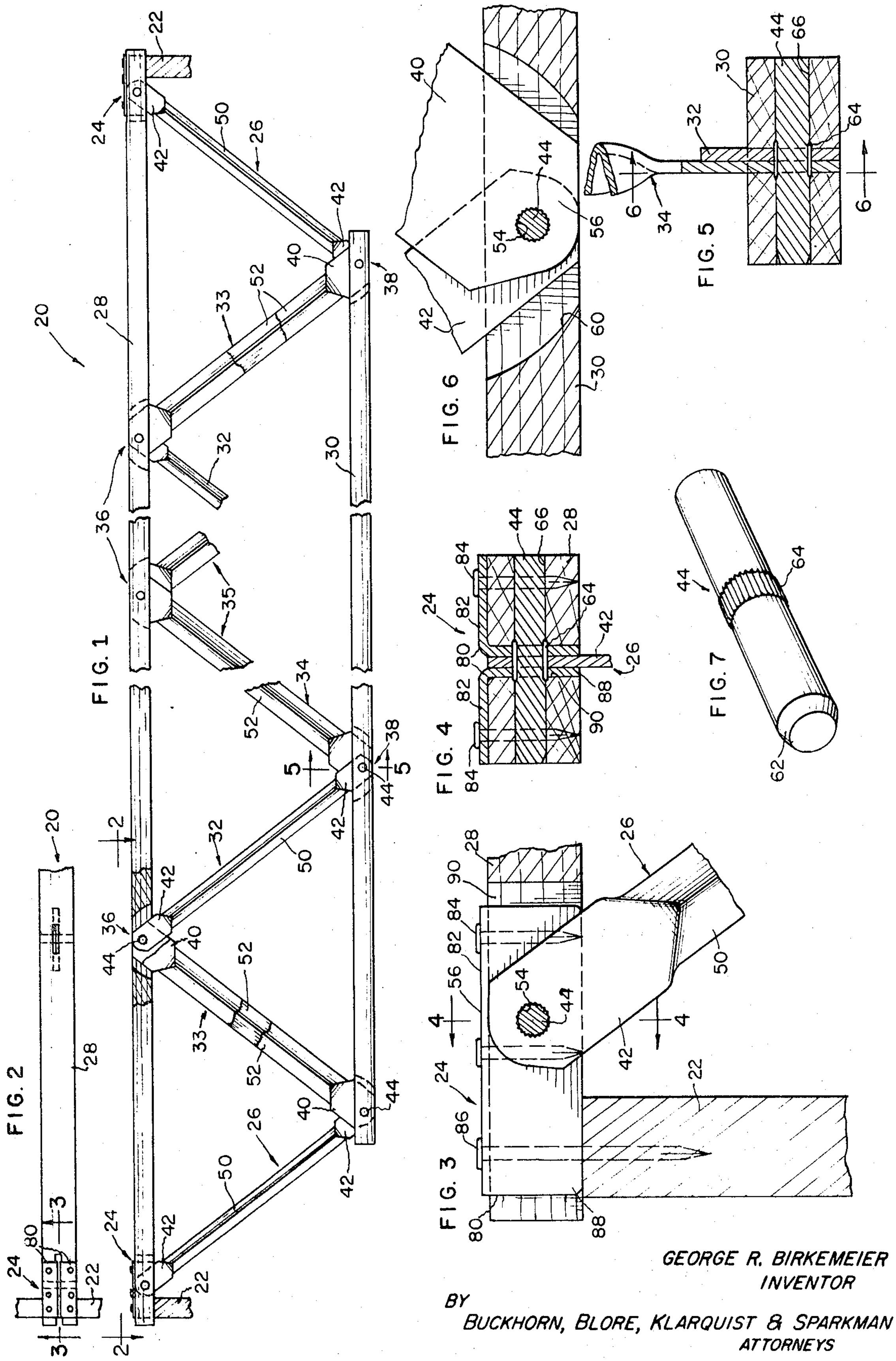
TRUSS JOISTS

Original Filed July 22, 1968

2 Sheets-Sheet 1



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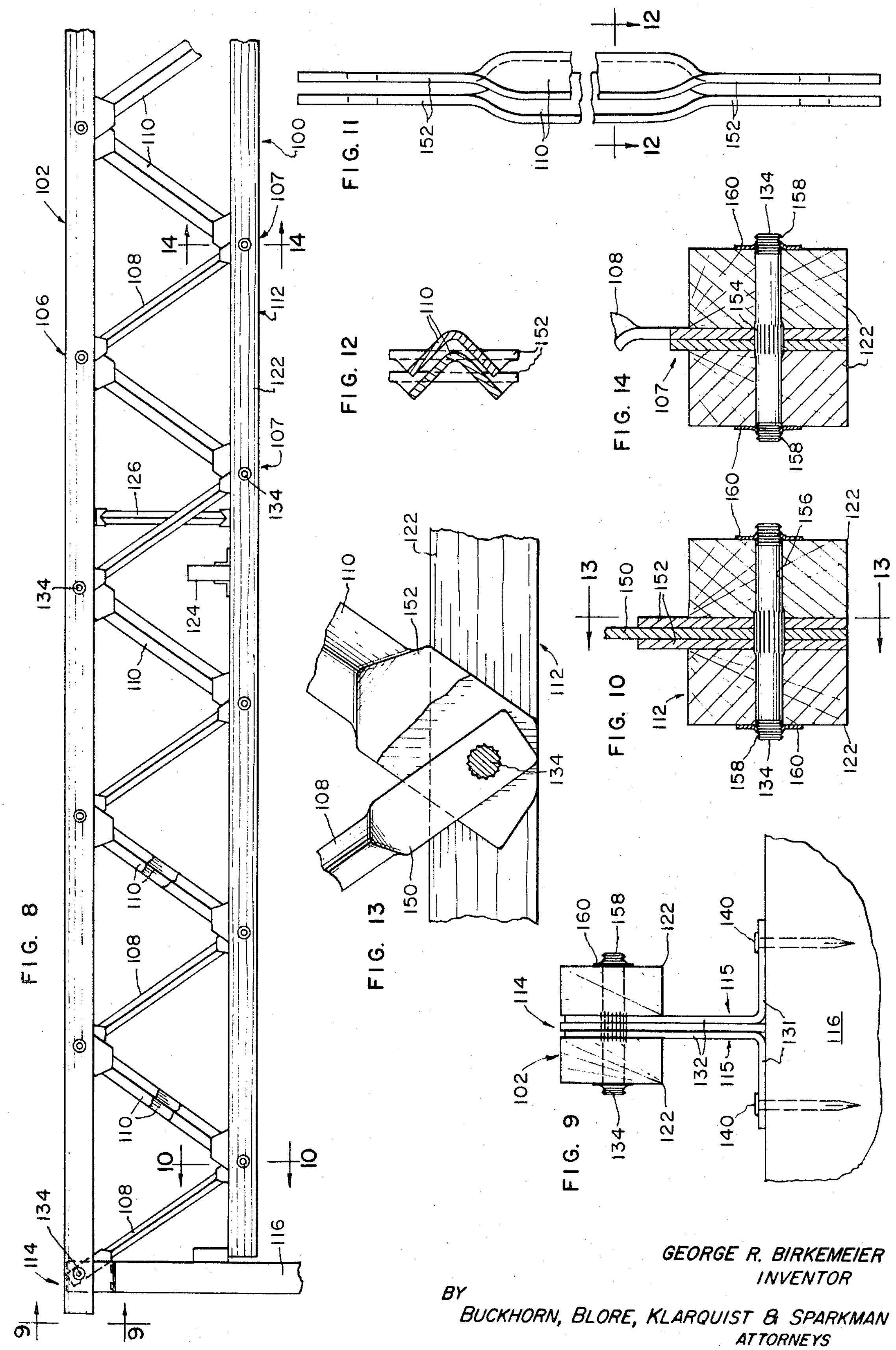

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TRUSS JOISTS

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Int. Cl. E04c 3/292
U.S. Cl. 52—289 14 Claims

ABSTRACT OF THE DISCLOSURE

A truss joist **20** includes compression webs **33** heavier than tension webs **32** and doubled in the higher loaded portions. Joints **36** include knurled pins keyed to the webs and rotatable in the chords. Heel joints **24** include angle members extending beyond the pin **44** over the bearing wall **22** and anchored by nails **84** to the upper chord and by nails **86** to the bearing wall. A high load truss joist **100** includes two boards for each chord with cupped spring washers **160** retaining the boards on pins **134**. Heel joints **114** include vertically spacing angle members secured to the bearing wall.

This application is a continuation of application Ser. No. 749,253 filed July 22, 1958, now abandoned.

This invention relates to improved truss joists, and more particularly to improved composite wood-steel truss joists.

Truss joists of the type having wooden chords and metal webs known hitherto have had some serious defects. One has been that some of their heel joint constructions have necessitated notching supporting plates on the walls. Variations of the positions of the inside face of each wall required the notches to be of different depths, or all of maximum depth, in order to provide clearance for the webs of the joists. It would be desirable to provide a truss joist structure having a heel joint eliminating the need for notching the supporting plates. Another problem of the prior art truss joists has been that the webs have been expensive and not of a type permitting doubling up of the webbing where required. It would be desirable to provide inexpensive webs which can be doubled to accommodate higher loads. Another problem of prior art truss joists has been that flanges of the heel joints thereof project out beyond the sides of the chords and tend to catch on objects and bend in the handling thereof. Also, in some types of prior art truss joists, too loose a fit is made between the webs and pins connecting the webs to the chords which permits inelastic deformation and poor tolerance characteristics. It would be desirable to provide a truss joist in which there is no inelastic deformation between the webs and the pins connecting the webs to the chords. Another defect overcome by the present invention is that of end distances of webs being too short.

An object of the invention is to provide new and improved truss joists.

Another object of the invention is to provide new and improved composite wood-steel truss joists.

A further object of the invention is to provide a truss joist having a flush heel joint which is adjustable relative to a wall plate without notching the wall plate and which does not have flanges extending beyond the sides of the chords.

Another object of the invention is to provide a truss joist having a cantilever type heel joint which obviates notching the wall plate supporting the heel joint.

A still further object of the invention is to provide inexpensive, high strength webs for a truss joist.

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Another object of the invention is to provide a truss joist having webs which nest in one another to permit doubling of the webs for high load portions of the joist.

Yet another object of the invention is to provide truss joists having joints between the webs and chords which have no inelastic deformation.

Another object of the invention is to provide simple, inexpensive, quickly assembled joints between webs and chords of truss joists.

A further object of the invention is to provide truss joists having long end distances of webs thereof.

The invention provides new and improved truss joists of the composite, wood-steel type including joints between webs and chords thereof in which connecting pins have drive fits with the webs so that there is no inelastic deformation therebetween and very close tolerances are provided. In a truss joist forming one specific embodiment of the invention, an upper wooden chord and a lower wooden chord are provided with centrally located kerf slots extending completely therethrough into which extend flat end portions of steel webs having angular central portions. Pins having longitudinally knurled collar portions are driven through crossbores in the chords and bores in the end portions of the webs with the knurled collar portions cutting their way through the bores in the webs to provide interference fits therebetween, and a heel joint at one end portion of the upper chord has a pair of flanged plates having vertical flanges in a slot in the end portion of the upper chord and connected by a pin to the chord, the end portion of the upper chord resting directly on the wall of a building structure and horizontal flanges of the flanged plates resting on the top of the upper chord.

In a truss joist forming an alternate embodiment of the invention, an upper chord is formed of two parallel wood members on edge and the lower chord is similarly formed, and the webs, both tension and compression, are steel plates formed into angles except for flat end portions. The tension webs and the compression webs are joined together and to the chords by pins preferably having annularly knurled end portions and spring washers locked on the end portions. The webs are adapted to nest in each other and are used singly in the central portion of the joist where loads are lighter than on the portions nearer the ends of the joist and, in the latter, to accommodate the higher loads, a pair of webs nested in each other are used for a single compression webbing, the flat end portions of the pair of webs of a compression webbing bracketing the flat end portion of the adjacent tension web to balance the load on the connecting pin of the joint. Heel joints include pairs of angle members having vertical flanges whose upper portions are positioned between the wood members and connected to the wood members of the upper chord and the end tension webs by a pin. Horizontal base flanges of the angle members rest on and are secured to a plate of the wall.

A complete understanding of the invention may be obtained from the following detailed description of truss joists forming specific embodiments thereof, when read in conjunction with the appended drawings, in which:

FIG. 1 is a side elevation view of a truss joist forming one embodiment of the invention;

FIG. 2 is a top plan view of the truss joist of FIG. 1;

FIG. 3 is an enlarged, vertical, sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is an enlarged, vertical, sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an enlarged, vertical, sectional view taken along line 5—5 of FIG. 1;

FIG. 6 is an enlarged, vertical, sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is an enlarged, perspective view of a connecting pin of the truss joist of FIG. 1;

FIG. 8 is a side elevation view of a truss joist forming an alternate embodiment of the invention;

FIG. 9 is an enlarged elevation view taken along line 9—9 of FIG. 8;

FIG. 10 is an enlarged, vertical section taken along line 10—10 of FIG. 1;

FIG. 11 is an enlarged view of webbing of the truss joist of FIG. 8;

FIG. 12 is an enlarged, sectional view taken substantially along line 12—12 of FIG. 11;

FIG. 13 is an enlarged, vertical, sectional view taken along line 13—13 of FIG. 10; and

FIG. 14 is an enlarged, vertical, sectional view taken along line 14—14 of FIG. 8.

EMBODIMENT OF FIGS 1 TO 7

Referring now in detail to the drawings, a truss joist **20** (FIG. 1) spanning the distance between and supported by walls **22** by heel joints **24**, provides clearance so as to fit on the walls regardless of tolerance variations in the spacing between the two walls **22**. The heel joints are adapted to provide either a cantilever support as in the illustrated embodiment or to have the joints directly centered over notched plates (not shown) on the tops of the walls, the notches in the plates being provided for clearance of end tension webs **26**. The truss joist includes an upper chord **28** and a lower cord **30** connected together by the end tension webs **26** of steel, intermediate steel tension webs **32** and steel compression webs **33**, **34** and **35**, the heel joints **24** and joints **36** and **38**. The chords **28** and **30** may be wood 2" x 4"s to which the webs are connected at joints **38** by pins **44**. The tension webs, while in some conditions as, for example, in a windstorm which tends to lift the roof, have compression loads, need be lighter or less strong in compression than the compression webs and are narrower than the compression webs. The loads on the several webs increase progressively proceeding from the two center webs **35** outwardly to the heel joints **24**. To accommodate the higher loading in long joists, two nested web members may be used for each outer web needing greater strength than a single web member while each web near the center of the joist is a single web. In the joist **20** being described, extra strength over a single web member for each outer tension web is not needed and each of the tension webs is a single web member. For a joist designed to have a higher load than that of the joist **20**, the tension webs **26** and **32** can be doubled. The outer compression webs **33** each is two web members, two web members, like the web members **34** and **35**, being nested together with flat end portions **40** bracketing flat end portions **42** of the tension webs at the joints **36** and **38** to provide symmetrical or concentric loading on connecting pins **44** of the joints and the adjacent portions of the chords **28** and **30**. Also, to provide high strength for compression loads, each compression web **33**, **34** and **35** is of the same thickness but is wider than each of the tension webs **26** and **32**. For normal length joists or joists with light loads, the webs may all be single rather than double as are the webs **33**.

The webs **26** and **32** to **35** are formed from flat strip stock with central angle portions **50** and **52** formed into the angles to siffen or make the webs strong or columnlike in compression except for the short end portions **40** and **42** which are left flat with holes **54** punched therefrom. Ribs (not shown) or other stiffening may be provided at the portions of the end portions **40** and **42** between the chords and the angle portions **50** and **52**. The angle portions laterally extend equidistantly beyond the two faces of the end portions of the webs. The angle portions extend substantially to the portions of the flat end portions which are supported by the chords.

At the joints **36** and **38**, which are the same but inverted, between the chords **28** and **30** and the webs, the end portions **40** and **42** of the webs fit closely in slots or kerfs **60** in the chords. The slots **60** extend completely through the chords to provide clearance for the long end distances of the webs. The pins **44** are precisely machined, and have chamfered ends **62** to facilitate driving and have enlarged, knurled keying portions or ribs **64** which cut into material around the holes **54**, as the pins **44** are driven through the holes **54**, and key the pins rigidly to the webs. The keying portions form interference fits with the end portions **40** and **42** and hold the pins against longitudinal movement as well as against rotary movement relative to the holes **54**. The pins fit snugly in crossbores **66** in the chords.

Each heel joint **24** (FIGS. 3 and 4) includes a pair of angle members **80** having top flanges **82** resting on and nailed to the top of the upper chord **28** by nails **84** and also are nailed to the wall **22** by long nails **86**. Vertical flanges **88** fit into an end slot **90** in the upper chord and have aligned holes receiving one of the pins **44** with interference fits. The two flanges **88** are on opposite sides of the web **26**. The heel joint permits the chord **28** to rest directly on the wall with the pin **44** and the web **26** spaced inwardly slightly from the inner face of the wall so that the wall need not be notched to provide clearance for the web. The load from the web **26** is transferred to the pin **44**. The vertical component of the load is transferred from the pin **44** to the angle members **80** and the horizontal component of the load is transferred by the pin to the chord **28**. The vertical component of the load is transferred by the top flanges **82** of the angle members, which extend over the wall **22**, vertically to the portion of the chord **28** thereunder, and from this portion of the chord to the wall **28**, this vertical component of the load being perpendicular to the direction of the grain in the wood chord.

EMBODIMENT OF FIGS. 8 TO 14

For very high loads, truss joists **100** are used. Each truss joist **100** includes an upper chord **102** connected by joints **106** and **107** and webs **108** and **110** to a lower chord **112**. Heel joints **114** including angle members **115** mount the truss joists on walls **116**. The webs **108** and **110** are similar to the webs **26** and **32** to **34** and the joints **106** are similar to the joints **24** except for pinning to the pairs of chord members **122** which make up the chords **102** and **112** and which may be 2" x 4". Bridges **124** and cross braces **126** tie the adjacent trusses **100** together.

Each heel joint **114** includes the angle members **115**, each having a base **131** and a vertical portion **132** connected by a pin **134** to the web **108** and to the chord member **102**. The pin **134** can be positioned directly over the wall **116**, the vertical portions **132** spacing the pin **134** sufficiently above the top of the wall to provide clearance for the web **108**. The joint **114** also may be positioned offset slightly from the top of the wall and be supported by ap late (not shown). Nails **140** or other fastening members secure the angle members **115** to the wall.

As illustrated best in FIGS. 11 and 12, the webs **110** nearer the ends of the truss joist bear higher loads and are doubled up, the two webs making up each webbing being nested with flat end portions **150** of the webs **108** being centered between two flat end portions **152** of the webs **110**. The pins **134** may be solid or tubular and may be smooth or may have raised longitudinal knurled keying portions or ridges **154** cutting keyways through the webs to form interference fits with the webs and fitting snugly in crossbores **156**. Outer end portions of the pins have annular threads or knurls **158** and cuppel spring washers **160** are snapped onto these end portions and are firmly locked on the pins. The annular threads or knurls may be omitted if less holding force is needed.

What is claimed is:

1. In combination:

a supporting member having a top of a predetermined width and an inner face, wood chord members including a top chord member having an end portion resting on the top of the supporting member,

web members connecting the chord members including an end web member,

load transferring angular plate means having an elongated top portion bearing on the top of the end portion of the top chord member and extending over the supporting member and also having a vertical portion extending downwardly from the top portion,

and pin means extending through one end portion of the end web member and the vertical portion of the plate means and at least partially through the top chord member,

the pin means being spaced substantially from the adjacent end of the top chord member and connecting the end web member to the top chord member and the plate means to transfer load from the end web member along the plate means toward the adjacent end of the chord member and through the plate means and the top chord member to the top of the supporting member,

the pin means being positioned sufficiently inwardly from the inner face of the supporting member to space the upper end portion of the end chord member inwardly from the inner face of the support member,

the top portion of the angular plate means extending from the pin means substantially to the adjacent end of the top chord member and across substantially the entire width of the supporting member to transfer load from the pin means to the supporting member through the upper chord member.

2. The combination of claim **1** wherein the angular plate means comprises a rigid angle having a top flange abutting the top face of the top chord member and a vertical flange abutting the top chord member.

3. The combination of claim **1** wherein the end portion of the top chord member has a longitudinally extending slot therein extending to the end of the top chord member, and the angular plate means comprises a pair of angle members having vertical flanges positioned in the slot and having aligned holes therein fitting closely on the pin means and also being provided with top flanges resting on the top of the end portion of the upper chord member and extending substantially to the end of the top chord member.

4. The combination of claim **1** wherein the pin means and said one end portion of the end web are positioned beyond the supporting member and the angle members extend over at least the major portion of the width of the supporting member.

5. In a truss joist:

a wood chord member having a slot therein and a crossbore intersecting the slot,

a pair of metal webs having end portions positioned in the slot and having holes therethrough aligned with the crossbore,

and pin means extending through the crossbore and the holes,

the pin means comprising a pin having a central portion provided with raised portions and smooth cylindrical portions at each side of the central portion, the raised portions effectively engaging only the end portions of the webs and preventing longitudinal movement of the pin through the holes from normal forces on the pin.

6. The truss joist of claim **5** wherein the raised portions comprise keying ribs extending along the pin and through the holes and cutting into the portions of the webs around the holes.

7. The truss joist of claim **5** wherein the raised portions comprise keying ribs extending through the webs and having an interference fit therewith.

8. The truss joist of claim **5** wherein the slot extends completely through the chord and the end portions of the webs extend substantially completely through the slot.

9. In combination:

a bearing wall having a top and an inner face,

an upper chord having an end portion extending substantially completely across the top of a bearing wall and having a longitudinal slot extending substantially from the adjacent end of the chord to a point spaced substantially inwardly from the bearing wall,

the upper chord also having a transverse horizontal bore therethrough positioned inwardly from the inner face of the bearing wall and intersecting the slot,

a web having an end portion extending into the slot and provided with a hole aligned with the bore in the chord,

a horizontal pin extending through the bore and the hole,

and load-transferring elongated sheet metal support means having a first portion extending into the slot and engaging the underside of the pin and also having a second portion engaging the top face of the upper chord and extending along substantially the entire length of said top face of the adjacent end portion of the upper chord and extending over said bearing wall.

10. The combination of claim **9** wherein the sheet metal support means comprises a pair of angle members having vertical flanges extending into the slot and provided with bores receiving the pin and also having horizontal flanges engaging said one horizontal face of the upper chord.

11. The combination of claim **10** wherein the horizontal flanges rest on the upper face of the upper chord and have holes over the walls for nails to secure the joist to the wall.

12. The combination of claim **9** wherein the second portion of the sheet metal support means rests on the upper face of the upper chord.

13. In combination:

a supporting wall having a top and an inner face,

wood chord members including a top chord member having an end portion resting on the top of the supporting wall and having a vertical slot therein,

web members connecting the chord members including an end web member having an end portion extending into the slot,

load-transferring angular plate means having an elongated top portion bearing on the top of the end portion of the top chord member and also having a vertical portion extending downwardly from the top portion into the slot,

and pin means extending through said end portion of the end web member and the vertical portion of the plate means and at least partially through the end portion of the top chord member,

the pin means being spaced substantially from the adjacent end of the top chord member and connecting the end web member to the top chord member and the plate means to transfer load from the end web member through the plate means and the top chord member to the top of the wall,

the pin means being positioned at least partially inwardly from the inner face of the wall to space the end web member inwardly from the inner face of the wall,

the elongated top portion of the angular plate means extending from the pin means substantially to the adjacent end of the top chord member and substantially entirely across the wall to transfer load from the pin means to the wall through the end portion of the top chord member.

14. In a truss joist:

an upper chord,

a lower chord,

a plurality of tension webs secured to the chords in positions in which the webs are tensioned when the chords are placed under load,

a plurality of compression webs of which some are located near the center of the joists and others are located near the ends of the joists and in positions in which the compression webs are compressed when the chords are placed under load,

each of the compression webs including at least one web having plate-like end portions and an angular central portion,

each compression web located near the ends of the joists comprising a nested pair of the webs,

and pins connecting the webs to the chords and forming joints therewith,

the end portions of each nested pair of webs at each joint being positioned concentrically relative to the end portion of the web forming the joint therewith, the end portions of each nested pair of webs are positioned on opposite sides of the end portion of the tensioning web forming the joint therewith to make the loading at the joint concentric.

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