

[54] **METHOD OF PREFABRICATING A TRUSS**
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Related U.S. Application Data

[60] Continuation-in-part of Ser. No. 191,347, Oct. 21, 1971, abandoned, which is a division of Ser. No. 853,456, Aug. 27, 1967, abandoned, which is a continuation-in-part of Ser. No. 658,193, Oct. 3, 1967, abandoned.
[52] U.S. Cl. **144/326 R**, 52/691, 144/309 L, 144/314 B, 144/323
[51] Int. Cl. **B27c 9/00**
[58] **Field of Search** 144/3 R, 2 R, 309 R, 309 L, 144/312, 314 R, 314 B, 319, 323, 326 R; 52/262, 92, 741, 692, 691, 693

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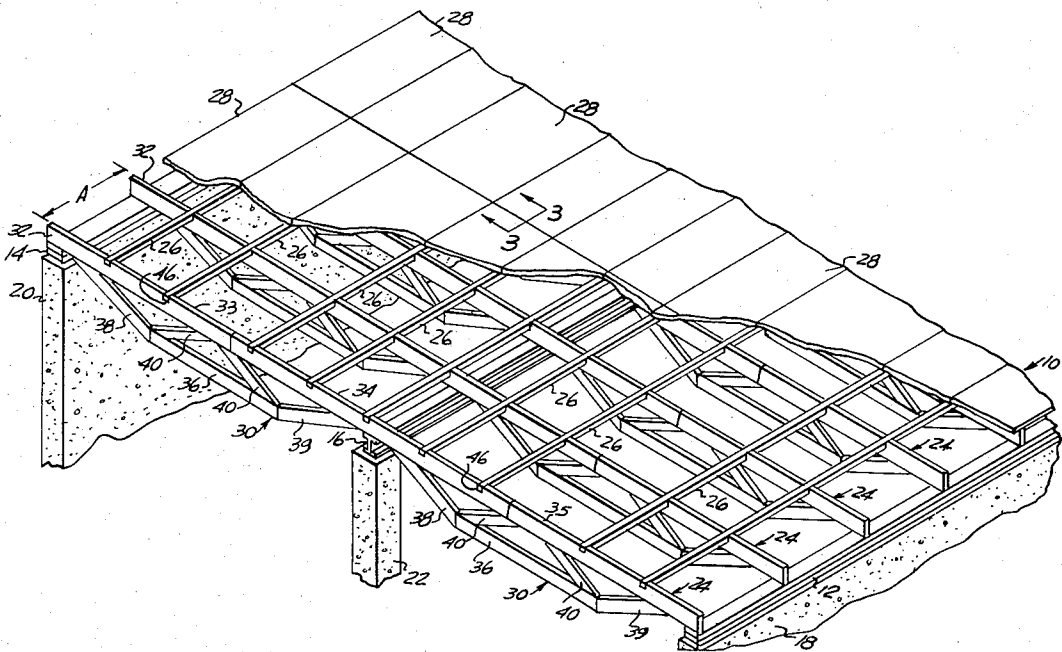
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[57] **ABSTRACT**

A wooden floor or roof structure comprises a plurality of floor or roof panels supported in a common plane by a series of spaced parallel prefabricated wooden trusses. Each truss comprises an elongated horizontal wooden upper chord having its end spanning a pair of walls and a wooden lower chord having a length less than the distance between the supporting points of the upper chord. The chords are joined by a plurality of wooden web members with established axes of equal lengths, the ends of said webs cut with a first cut made at a predetermined reference pitch and a plurality of said ends cut with second cuts which do not pass through the established axes.

4 Claims, 11 Drawing Figures



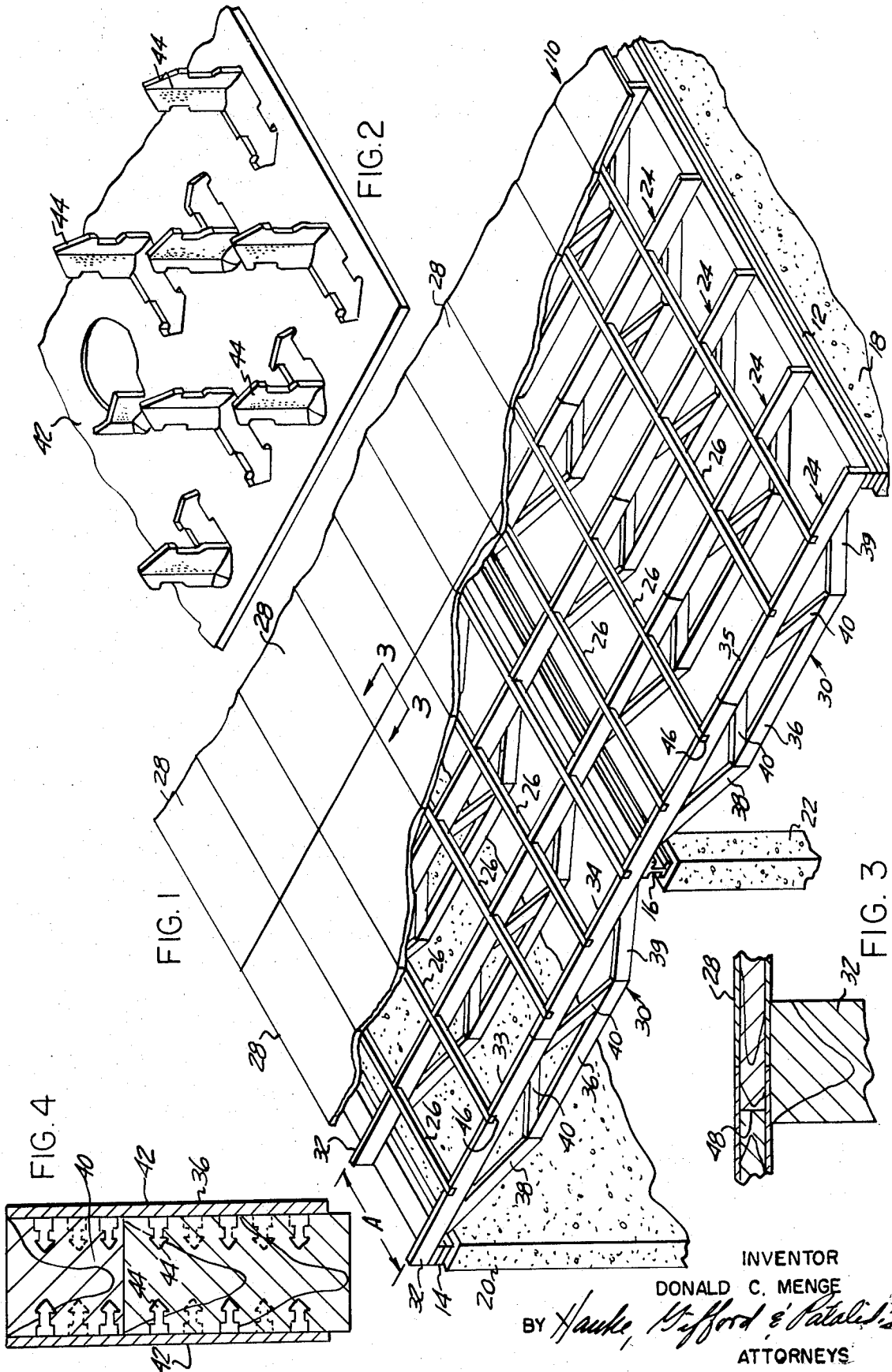


FIG. 5

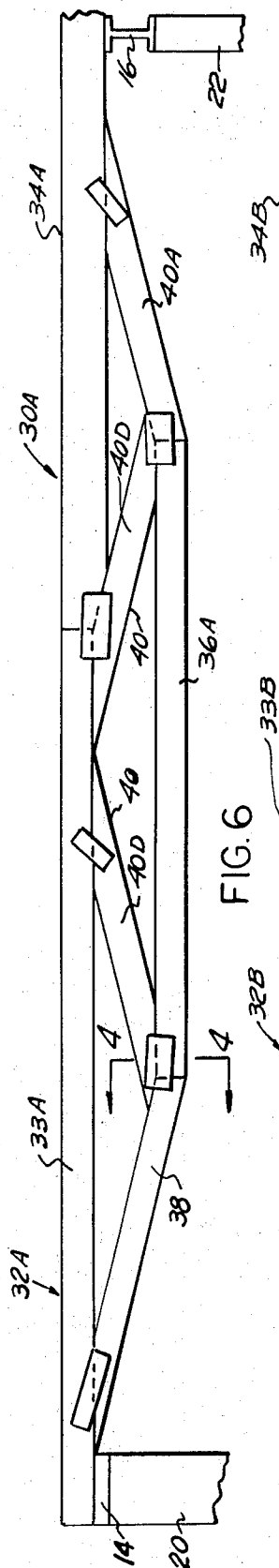
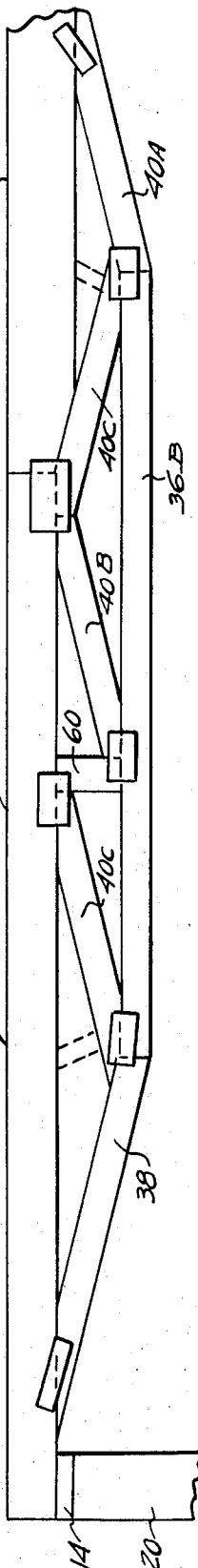


FIG. 6



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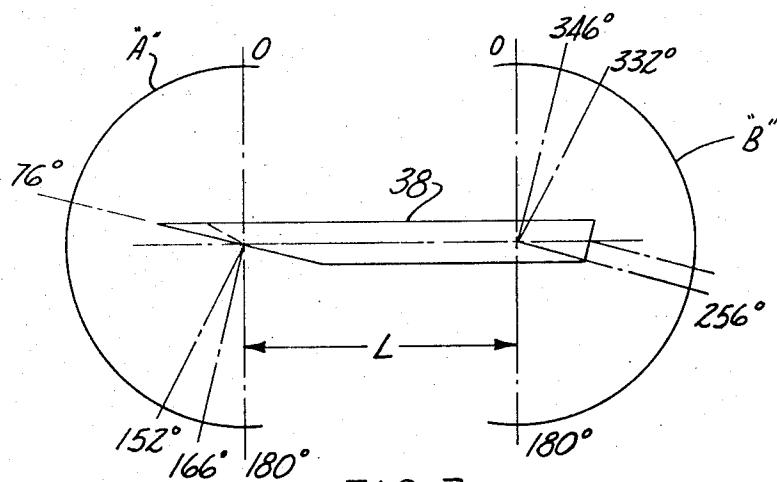


FIG-7

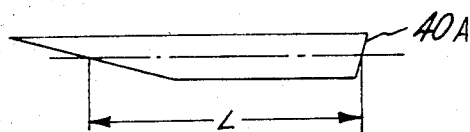


FIG-8

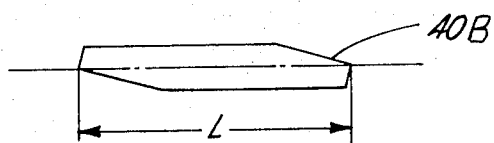


FIG-9

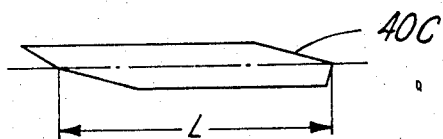


FIG-10

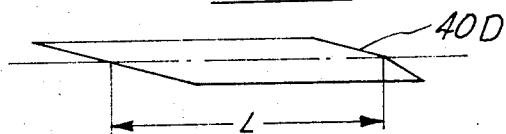


FIG-11

METHOD OF PREFABRICATING A TRUSS**CROSS REFERENCE TO RELATED APPLICATIONS**

This application is a continuation-in-part of my co-
pending application Ser. No. 191,347 filed Oct. 21,
1971, now abandoned. The latter application is a di-
vision of Ser. No. 853,456 filed Aug. 27, 1967, now
abandoned, which was a continuation-in-part of appli-
cation Ser. No. 658,193 filed Oct. 3, 1967, now aban-
doned.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

This invention relates to a method of fabricating
wooden floor and roof structures, and more specifically
to such a floor or roof structure wherein the floor pan-
els are supported by a series of prefabricated wooden
truss sections.

2. Description of the Prior Art

Conventionally, wooden floor and roof trusses of res-
idential buildings and the like comprise a series of
closely spaced parallel wooden joists which have their
ends mounted on sills, girders or other supports and,
depending on their lengths, may also have intermediate
portions supported by girders, walls or the like. The
rough floor, or roof boards, are then secured to the
upper edges of the joists. Such floor and roof structures
of this type are generally assembled on the job by
skilled tradesman and in the past were of a relatively
low cost. In recent years, substantial increases in the
cost of skilled labor and of lumber have contributed
greatly to the rise in the construction cost of such floor
and roof structures. Since conventional wooden floors
must support the full live load applied thereto they re-
quire a substantial depth. Furthermore, ducting, water
pipes and the like are normally supported below the
lower edge of the joists thereby creating an unfinished
appearance. If it is desirable to conceal the ducting,
water pipes and the like by attaching a ceiling to the
joist, difficulties arise because the ceiling must be sus-
pended below the joist at a distance sufficient to clear
the ducts, pipes and the like.

Workers in the art have been increasingly directing
their attention to a type of wooden floor or roof struc-
ture which overcomes many of the disadvantages of the
prior art structures. This type comprises wooden panels
supported on a series of wooden truss sections. Each
truss comprises an elongated horizontal wooden upper
chord having its ends spanning a pair of walls, and, in
some cases, an intermediate portion thereof is sup-
ported on an I-beam girder. A wooden lower chord
having a length less than the distance between the sup-
porting points of the upper chord is connected to the
upper chord by angularly inclined web members. Gains
have been made in the construction of trusses by the
use of nail plates to join adjoining elements and by the
use of standard size webs, as pointed out in the above
identified patent applications.

An important feature of the latter structures is a pro-
vision for increasing the depth, length, and load carry-
ing capacity of a truss without requiring any change in
the webs. Another important feature of the design of
the latter structure is the abutment of an end of a web
partly against a surface of a chord and partly against a
surface of another web for the more effective use of
nail plates in attaining rigidity in a truss. The present

invention involves an improved method for forming
webs for the foregoing trusses in an economical man-
ner.

SUMMARY OF THE INVENTION

The structure to which the method of the invention
is applied takes the form of a floor or roof structure
having panels supported on a series of wooden truss
section formed of a combination of lumber sections
joined together, preferably, by nail plates. The pre-
ferred wooden truss section comprises an upper chord
member having a plurality of aligned and abutting
wooden beams of a generally rectangular cross-section
of a predetermined width and depth; the ends of the
upper chord being supported on a wall anchored sill or
the like and, in some cases, its midsection supported on
an I-beam girder forming a pair of truss halves on either
side thereof. In those cases where an intermediate I-
beam support is used the mid-section of the upper
chord may, if desired, have a depth which exceeds the
depth of the end sections by a predetermined amount.
Each of the truss section halves is provided with a
straight elongated lower chord wooden truss member
extending parallel and spaced below respective upper
chord member halves. The lower chord is shorter than
the respective upper chord member section and is cen-
trally located with respect thereto. The upper and
lower chord sections are attached to each other by at
least one primary and by a plurality of secondary in-
clined web members which extend from the lower
chord and abut the lower side of the respective upper
chord member sections at portions respectively in-
wardly spaced from the ends of each truss half.

Each of the truss halves has at least one primary
wooden web member which abuts the end of the lower
chord member proximate the wall anchored sill end
and is inclined upwardly and outwardly therefrom to
abut the lower side of the respective upper chord mem-
ber section at a portion respectively inwardly spaced
from the end of the upper chord section disposed on
the wall anchored sill. When the upper chord is of uni-
form cross-section, there are two primary webs, one at
each end of the lower chord. When the upper chord has
a greater cross-section, at an I-beam support for exam-
ple, there is only one primary web, the other primary
web becoming a secondary web, as will be described
more fully hereinafter.

The secondary inclined wooden web members have
an equal axial length which is less than the axial length
of the primary wooden web member and are formed in
a unique manner to be described. The primary and se-
condary wooden web members are preferably attached to
the upper and lower chord members by nail plates.

The method of the invention comprises the steps of
(a) cutting a primary web member such that an end
thereof is cut at a predetermined reference pitch; (b)
cutting a plurality of secondary webs such that an end
of each said secondary web is made with a cut at said
reference pitch and such that said secondary webs, fol-
lowing a first cut at each end thereof, have established
axes of the same axial length; and (c) making second
cuts in a plurality of said ends of said secondary webs
to form a surface of a second pitch in said ends, said
second cuts passing outside said established axes.

Still further objects, advantages and applications of
the present invention will become apparent to those

skilled in the art when the accompanying description of some examples of the best modes contemplated in practicing the invention are read in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a wooden floor structure illustrating the type of structure to which the present invention is applied, parts of the floor paneling broken away and the nail plates removed for the purposes of clarity;

FIG. 2 is a fragmentary view of a typical nail plate employed in joining the chords and webs together;

FIG. 3 is a view taken along lines 3—3 of FIG. 1;

FIG. 4 is a view taken along lines 4—4 of FIG. 5;

FIG. 5 is a view of a prefabricated truss half having a predetermined longitudinal length and a predetermined uniform depth;

FIG. 6 is a view of a truss half similar to the one illustrated in FIG. 5 and in which the longitudinal length and depth of the truss has been increased while the axial length of inclined wooden web members remains constant;

FIG. 7 is an enlarged view of the primary web member illustrated in FIGS. 5 and 6 together with angular markings representing saw positions;

FIGS. 8 through 11 illustrate the secondary wooden web members utilized in the construction of the embodiments disclosed in FIGS. 5 and 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, and especially FIG. 1, where there is illustrated a floor structure 10, having its opposite ends mounted on sills 12 and 14, and an intermediate portion supported on an I-beam 16. The sills 12 and 14 are preferably anchored to walls 18 and 20 respectively and the I-beam 16 is supported on columns 22 (only one of which is shown) such that the upper surface of the sills 12 and 14 and the upper surface of the I-beam are disposed in a common horizontal plane.

The floor structure 10 comprises a series of wooden spaced parallel trusses 24 spanning the walls 18 and 20 and the I-beam 16 and preferably interconnected by a series of cross members 26. The upper surface of the cross members 26 and the truss 24 lie in a common plane and support a plurality of rectangular interconnected panel sections 28.

Each truss 24 is preferably symmetrical about its midpoint and comprises a pair of truss halves 30. Each truss 24 includes an elongated upper chord member 32 which consists of a series of butt joined standard size lumber sections. Each of the upper chord members has a width and depth of a predetermined amount. As illustrated in FIG. 1, lumber sections 33, 34, and 35 are provided with the same width and depth. However, as will be explained hereinafter, the depth of the intermediate section 34 may be increased so as to provide an increased load capacity. The overall length of the truss 24 can vary to suit the size of the particular structure and, depending on its length, may comprise a single piece of lumber or several pieces. It will be apparent that the structure referred to above as "truss halves" in the context of FIG. 1 are, in fact, each a complete truss.

A straight elongated lower chord member 36 is associated with each truss section half 30 and has a length that is shorter than the distance between the support points for the upper chord halves, and is centrally located with respect to those support points. Each lower chord 36 is preferably of a standard lumber size, which corresponds to the rectangular cross sectional dimensions of the upper chord members 33 and 35.

Primary wooden web members 38 and 39 abut the ends of each lower chord member 36 at the ends proximate the support points 14, 16 and 12 of the upper chords and are inclined upwardly and outwardly to abut the lower side of the upper chord 32 at positions inwardly spaced from the support points 14, 16 and 12.

The primary wooden web members 38 and 39 are identical when the intermediate section 34 is of the same rectangular cross-sectional dimension as the end section 33 and 35.

As shown in FIG. 1 each of a pair of secondary inclined web members 40 abut the top side of each lower chord section 36 adjacent an end thereof and each is inclined inwardly and upwardly so that the upper ends thereof abut the lower side of the upper chord sections 33 and 35. The webs 38, 39 and 40 consist of sections of lumber which usually have a size corresponding to the cross sectional dimension of the upper and lower chord sections 33, 35 and 36, but can be of a different size. The specific relationship between the various web members will be discussed in greater detail hereinafter.

The upper chord sections 33, 34 and 35, the lower chords 36 and the web members 38, 39 and 40 are preferably joined together by nail plates 42 (FIGS. 2 and 5) having integral nail elements 44. The nail plates 42 differ from one another only with respect to the number of nail elements which correspond to the configuration of the joint with which they are associated. For purposes of illustration, and for ease in understanding the drawings, the nail plates have been illustrated as being attached to the truss members in FIGS. 5 and 6 only.

A suitable nail plate is described in U.S. Pat. No. 3,011,226 issued to D. G. Menge on Dec. 5, 1961. As best seen in FIG. 2, the nail elements 44 preferably are punched from the plate and therefore form an integral part of the plate.

Referring to FIG. 4, a typical joint is illustrated as comprising the abutting web members 40 and 36 with the nail elements 44 impressed horizontally into the side surfaces of the abutting members. Nail plate 42 joins each vertical surface of the abutting members 40 and 36. This arrangement provides a strong mechanical connection between adjoining wooden members disposed in the same plane and is capable of withstanding substantial tension and compression stresses.

Referring to FIG. 1, the trusses 24 are preferably arranged at a center to center distance indicated at "A" of 4 feet. Other standard center to center dimensions including 32 inches or 2 feet centers depending on the load requirements may be utilized. The upper chord 32 preferably has a series of regularly spaced recesses 46 arranged to accommodate the cross members 26. It can be seen that the cross members 26 extend normally through the axis of the trusses 24 and their spacing accommodates the size of the floor panels 28.

The floor panels 28 are preferably rectangular 4 feet by 8 feet plywood sections, and arranged with their

long sides perpendicular to the axis of the trusses 24. The length of the short sides of each panel corresponds to the distance between adjacent cross members 26. Thus, the cross members 26 are arranged with four foot centers. This arrangement permits the joist between abutting floor panels to be supported on a cross member 26 or on the upper side of the upper chord 32. As can be seen in FIG. 3, the panels 28 can be interconnected to one another as at joint 48 and supported on the upper surface of the upper chord 32.

Referring to FIGS. 5 and 6, there are illustrated two different configurations which the truss 24 may take, including different longitudinal lengths and depths. These serve to illustrate the relationship between the primary web member 38 and the secondary web members 40A and 40D as well as to illustrate the relationship among the several secondary web members.

It may be noted that in FIG. 1, web 39 is a primary web made exactly like primary web 38. It will be noted as the description proceeds that web 40A, which replaces web 39 when chord section 34 is made of a larger cross section lumber, becomes a secondary web to be made by the method of the invention directed to secondary webs. This latter feature enables one to increase the load carrying capacity of the truss without introducing a web requiring a diversionary method of manufacture.

In FIG. 5 the truss 30A is illustrated as having upper chord members 33A and 34A, the upper chord member 33A being a standard size 2 x 4 lumber whereas the intermediate portion 34A is a standard size 2 x 6 lumber size. The lower chord section 36A is a standard size 2 x 4 rectangular section, as are the secondary web members 40A and 40D. The web member 38 is the primary member of the truss 30A and the pitch at which its ends are cut are used as reference pitches in cutting the secondary webs. In the particular embodiment disclosed in FIG. 5, all three secondary web members 40A and 40D have the same axial length, and have an end cut at a reference pitch. In addition, the two secondary web members designated 40D have an end made by two saw cuts in a manner to be explained in detail hereinafter. It may be noted that although secondary web 40A has the same axial length as secondary web 40D it has the reference pitch of primary web 38 on both ends respectively. In the embodiment of FIG. 5, the truss has a depth of 14½ inches measured from the top side of the upper chord 32A to the bottom side of the lower chord 36A, and the primary web member 38 rises 1 inch for every 4 inches of longitudinal run.

In the embodiment illustrated in FIG. 6, the upper chord member 33B of the truss 30B is made of a standard 2 x 6 lumber size whereas the chord member 34B is of a 2 x 8 lumber size. The longitudinal length of the truss 30B is greater than that of the truss 30A disclosed in FIG. 5 and has a uniform depth of 16½ inches measured from the top of the upper chord 32B to the bottom side of the lower chord 36B. In the same manner as the webs in FIG. 5, the secondary webs 40A, 40B, 40C have the same axial length which is the same as the axial length of webs 40D of the FIG. 5. Similarly each of the ends of each of said secondary webs has at least a partial cut at a reference pitch of primary web 38. It may be noted that the ends of secondary webs 40B and 40C have a second cut at a different pitch. The latter will be described in greater detail hereinafter.

Thus, although the embodiments disclosed in FIGS. 5 and 6 have different longitudinal lengths and different uniform depths, the primary web members 38 are identical in both, and all of the secondary web members 40A, 40B, 40C and 40D have the same axial lengths as well as having the similarities in the pitch of their respective ends as indicated.

Although a variety of means may be employed for cutting the primary and secondary web members, the preferred means for cutting is a lumber cutting apparatus disclosed in my U.S. Pat. No. 3,578,043.

The lumber cutting apparatus disclosed therein is comprised of a longitudinal support table provided with slides supporting two or more substantially semi-circular plates arranged for movement toward and away from each other. Intermediate the plates, the support table carries one or more lumber supports for arrangement of the lumber in a longitudinal direction between the plates. The plates carry pedestals which pivotally secure swingable saw carriages for rotation around the semi-circular plates on adjustable vertical axes extending through pedestals. The saw carriages are comprised of arms pivoted for a longitudinal rocking motion or movement back and forth across the vertical pivot and selected angular positions transverse to the longitudinal support table. The arms carry circular power saws at one end and are retained and guided at the opposite ends by spring loaded roller adjustable means to keep the arms normal in a horizontal position relative to the vertical pivot axis. The saw arm arrangement is such that the arms may be raised manually to allow the insertion of the lumber to be cut. The saw arms are pivoted on rocking members in the form of uprights which are pivoted to the vertical pivot member for rocking movement in such a way as to assure a straight horizontal back and forth movement of the saw arms upon application of a manual push or pulling force thereto during the lumber cutting operation. The vertical swing pivots further carry on each an index arm for travel around the semi-circular plates, which are provided with a scale indicating angular points around the arc of the semi-circular plates for positioning of the saw carriage in any desired angular position depending upon the required end cuts for any particular truss member or web section. Oppositely adjusted stops are provided along the arc of the semi-circular plates and these, as well as the other end of the index arm, may be provided with magnets in order to lock the saw carriage into selected angular positions for a series of identical angular end cuts. At each cutting section, longitudinal lumber stops are provided to align the lumber in a longitudinal direction. The lumber supports intermediate the saw carriage carry adjustable clamps to clamp the lumber prior to the start of the cutting operation. The vertical axis around which the saw carriage swing are adjustable in relation to the longitudinal center line of the lumber to be cut to allow relatively long angular cuts as is required in certain of the web members. The lumber cutting apparatus as disclosed in the aforementioned patent application permits the cutting of the ends of the webs at a proper angle for assembly into the prefabricated truss.

Referring now to FIG. 7, there is illustrated the method by which the secondary web members 40A, 40B, 40C and 40D are cut. An already cut primary web member 38, illustrated in the embodiments disclosed in FIGS. 5 and 6, is shown in an enlarged form in FIG. 7

with left and right hand semi-circles disposed on the opposite ends thereof and numbered respectively from 0° to 180° and from 180° to 360°. The semi-circles are representative of the scale plates described hereinbefore in reference to the lumber cutting apparatus disclosed in my U.S. Pat. No. 3,578,043.

The primary web 38 of FIG. 7 has a saw cut on its left end (as shown) made by a saw setting of 166° (the actual saw cut being perpendicular to the saw setting on the saw scale plates). The pitch of the left end of primary web 38 becomes a reference pitch. Similarly, web 38 has a saw cut on its right end made by a saw setting of 256°. The pitch of the right end of the primary web 38 also becomes a reference pitch. Usually a large number of primary webs are cut and put into storage before adjusting the saw to cut at the axial length "L," the length of the secondary web members. As indicated by the letter "L" and the position of the semi-circles in FIG. 7 the latter represents the saw position for cutting secondary webs.

In FIGS. 8 through 11, each of the secondary web members is illustrated and so arranged that upon inspection of the figures as a whole it can be easily seen that the axial length "L" of each of the individual secondary web members is equal to the other secondary web members. The primary web member 38, illustrated in FIG. 8, has an axial length of approximately 3 feet, 2 inches for the truss illustrated in FIGS. 5 and 6, whereas the axial length "L" of each of the secondary web members 40 A-D is 2 feet, 6 inches. For ease in describing the pitch angles of each of the secondary web members 40 A-D, the power saw which is disposed along the semi-circle on the left hand side of the primary web member 38 and scaled from 0° to 180° will be designated as power saw "A," whereas the power saw which is disposed on the right half circle scaled from 180° to 360° will be designated as power saw "B."

A piece of lumber (for example, a 2 × 4) is placed on the longitudinal support of the lumber cutting apparatus, as hereinbefore described, and cutting of the web member 40A is accomplished by positioning the power saw "A" at the 166° scale mark (a reference pitch). A cut is then made to form the left end of web 40A (as shown in FIG. 8). The power saw "B" is placed at the 256° mark (a reference pitch) and a cut is made to form the right end of web 40A. The pitches of the two cuts are identical to those made in forming primary web 38.

In order to obtain the secondary web member with a configuration as disclosed in FIG. 9 and designated by the numeral 40B, a piece of lumber is placed within the lumber cutting apparatus, power saw "A" is positioned at the 166° mark and a first cut is made (for abutment against a juxtaposed surface of a chord). Power saw "A" is then repositioned at the 76° mark and a second cut is made, (for abutment against a juxtaposed surface of a web) finishing the left end of the secondary web member 40B. The power saw "B" is positioned at the 346° mark and a first cut is made on the right end of the web member 40B. The saw "B" is then set at the 256° mark and a second cut is made to complete the right end of web 40B. Saw "A" at position 166° cuts at the same pitch as saw "B" at position 346°.

Referring to the forming of the left end of web 40B, it will be noted that two saw cuts are made. It is always the case that the first saw cut on each end of a web establishes the axial length. When a second cut is made

on an end the second cut must not pass through the established axis but rather passes outside it; otherwise it will reduce the axial length. Thus, when the saw setting is at the 76° mark for the second cut on the left end of web 40B; the cut, as is apparent from FIG. 9; does not pass through the established axis. Similarly, the second cut made on the right end of web 10B at position 256° does not pass through the established axis. Visually, as shown in FIGS. 9, 10, and 11, second cuts appear to pass through the end of the respective axes which in the context of the invention is "outside the axis" because a saw cut at the exact end of the axis does not shorten the axis. It will be apparent that trusses can be designed which require second cuts spaced at various distances from the end of the axis.

In the same manner, the secondary web portions 40C and 40D are formed by placing them within the lumber cutting apparatus and making the appropriate cuts. The web member 40C is provided with saw cuts made at saw positions of 166° (reference) and 152° on the left end and with saw cuts made at saw positions of 346° and 256° on the right end. As described above, the second cuts, at 152° on the left and at 256° on the right do not pass through the axis established by the first cuts on each end. The web member 40D is cut at a saw position of 166° on the left end and of 346° and 332° on the right hand side.

Although the foregoing description of drawings referred to the web members as being made from 2 × 4 lumber by way of example, it will be apparent that all or some of such webs could have been 2 × 6, or all or some could have been 2 × 8, etc. If the axial length and pitch angles of two such webs are equal, they can be used interchangeable, regardless of cross-sectional dimensions, without changing the distance between the upper and lower chords.

It can thus be seen that the present invention has provided a method of building a series of improved trusses of various lengths, depths, and load capacities using mass produced web elements to join the upper and lower chords of the trusses. The webs lend themselves to mass production because they have a constant axial length, even though two saw cuts may be made on one or both ends thereof and even though the webs have differing cross sectional dimensions. It may be noted that all saw cuts are made on an end of a web at no more than two saw settings. The latter permits of a saw being rotatable between two stops which determine the pitch of the two cuts without requiring any decision or judgment on the part of the operator of the saw.

The fact that the lumber size is not a factor in the maintaining of a constant axial length and the cutting at a predetermined pitch permits of a substantial saving in avoiding time loss normally required in changing saw settings. In the method of the invention a number of webs, for example web 40B, can be made from 2 × 4 lumber and then production of web 40B can be switched to 2 × 6 or 2 × 8 lumber without changing the saw settings.

I claim:

1. In the method wherein an upper wooden chord and a lower wooden chord are joined by primary and secondary wooden web members to form a truss, and wherein saw cuts are made to form ends of said members to abut against surfaces of said chords and said members; the improvement which comprises the steps of:

A. cutting a primary web member such that an end thereof is cut at a predetermined reference pitch;

B. cutting a plurality of secondary web members with a first cut at each end thereof such that an end of each said secondary web member is made with a cut at said reference pitch and such that said secondary web members, following said first cuts at each end thereof, have established axes of the same axial length; and

C. making second cuts in a plurality of said ends of said secondary web members to form in each latter end a surface of a pitch which is different from the pitch of said first cut therein, said second cuts passing outside of said axes.

2. The method according to claim 1 wherein said first cut at both ends of a plurality of secondary web members is made at said predetermined reference pitch.

3. In the method wherein an upper wooden chord and a lower wooden chord are joined by at least one primary and by secondary wooden web members to form a truss the improvement which comprises the steps of:

A. cutting said primary web member such that an end thereof is cut at a predetermined reference pitch;

B. cutting said secondary web members with a first cut at each end thereof to form surfaces adapted to abut against the juxtaposed surfaces of a chord, at least one end of each said member being cut at said reference pitch; and said secondary webs, following said first cut, having established axes of the same axial length; and

C. making second cuts in a plurality of said ends of said secondary web members to form second surfaces in each latter end, said second surfaces adapted to abut against juxtaposed surfaces of other web members; each said second cut in an end having a pitch which is different from the pitch of the first cut therein; and each said second cut passing outside said axes.

4. The method according to claim 3 wherein said first cut at both ends of a plurality of secondary web members is made at said predetermined reference pitch.

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