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Adams

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[54] **CAMBERING ATTACHMENT FOR TRUSS ASSEMBLY JIG USING CANTED ROLLER PRESS**

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[51] **Int. Cl.**[2] **B23P 11/00**

[58] **Field of Search** ..... 29/432; 227/152; 100/DIG. 13, 173, 160, 168, 153, 172, 176; 269/321 F

[56] **References Cited**

UNITED STATES PATENTS

3,100,301	8/1963	Black	100/DIG. 13
3,667,379	6/1972	Templin	100/176 X
3,749,391	7/1973	Templin	100/DIG. 13 X
3,855,917	12/1974	Farrell et al.	100/35
3,868,898	3/1975	Sanford	227/152 X

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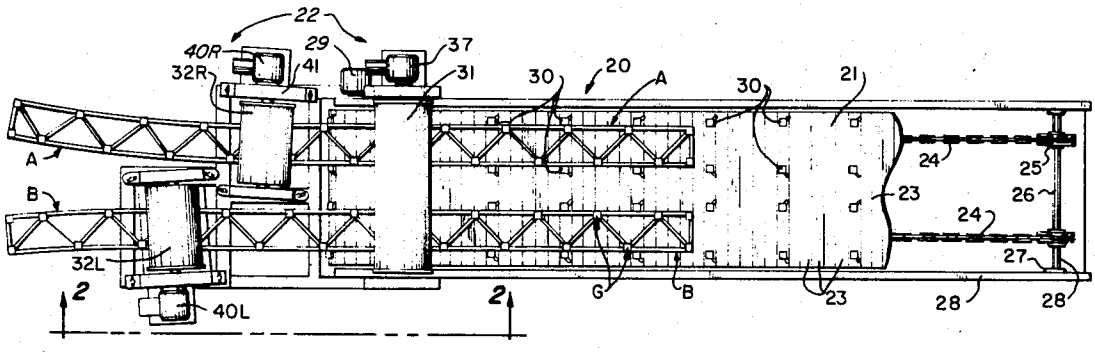
[57] **ABSTRACT**

Joist trusses, having generally parallel upper and lower chord members, are necessarily manufactured with a camber and preferably upon an assembly jig having a longitudinally disposed, movable, endless belt-like support surface for supporting precut wooden members arranged into the shape of a joist truss. Clamping devices, mounted upon the support surface, hold the precut members in place and spiked, metal gusset plates are placed at opposite sides of each joint of the truss. Two pairs of opposing, transversely-disposed rolls, arranged as roller presses, are located at one end of the support surface, with a first pair of rolls being positioned to receive both the support surface and the assembled truss thereon, so as to partially impale the gusset plate spikes into the members. The second pair of rolls are positioned beyond the support surface to tightly press the gusset plates against the sides of the truss as it passes through these rollers. The second pair of rolls are skewed, or angled from a normal transverse axial position to impart a predetermined camber into a truss as it moves through these rolls.

7 Claims, 6 Drawing Figures



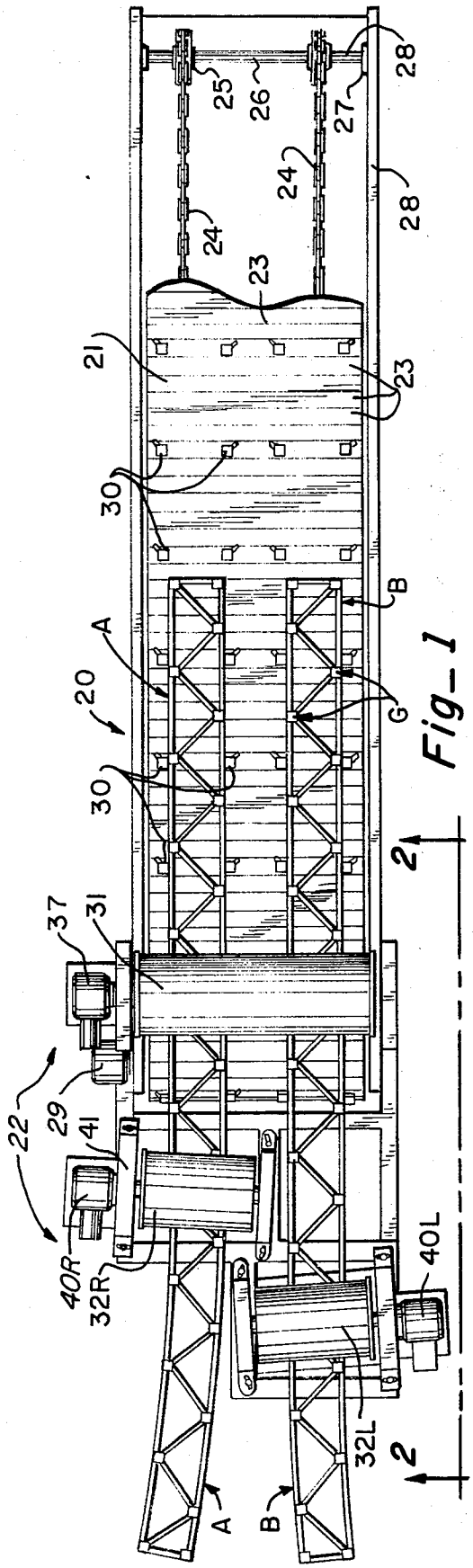

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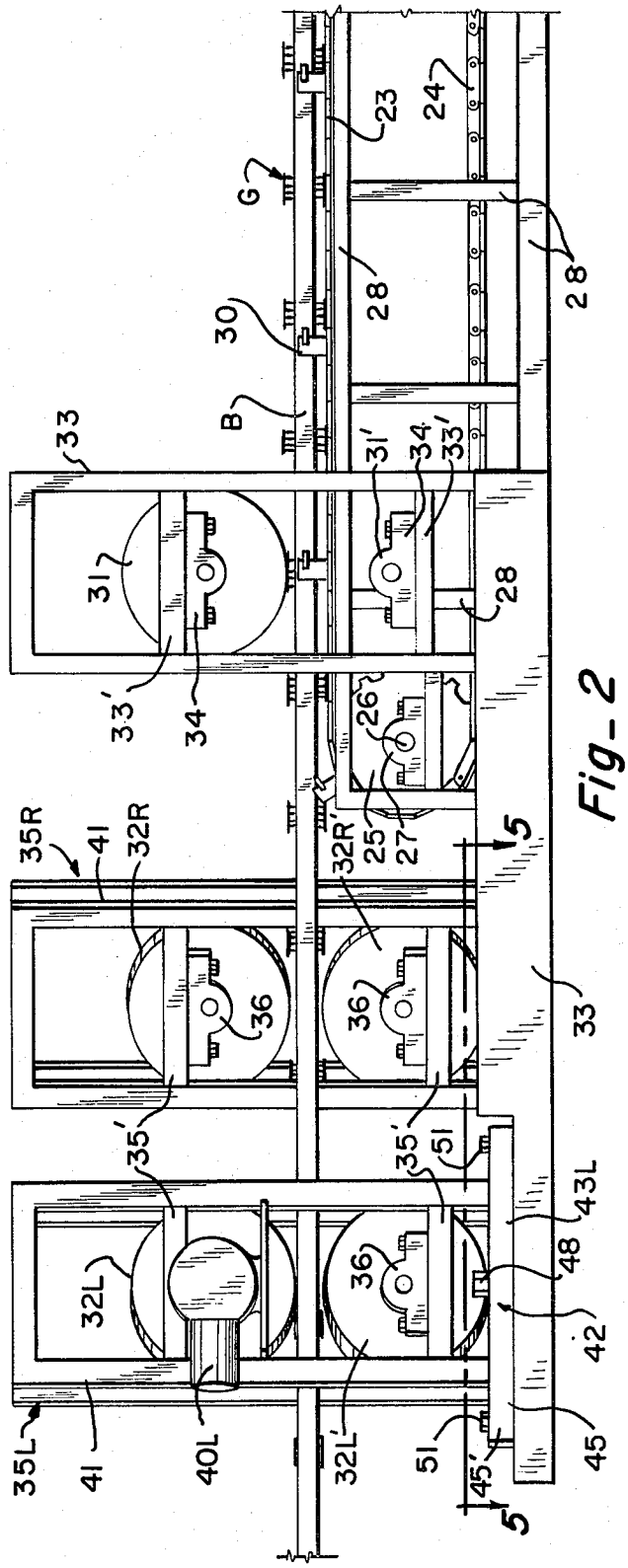
Fig_1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32L
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5

Fig_2

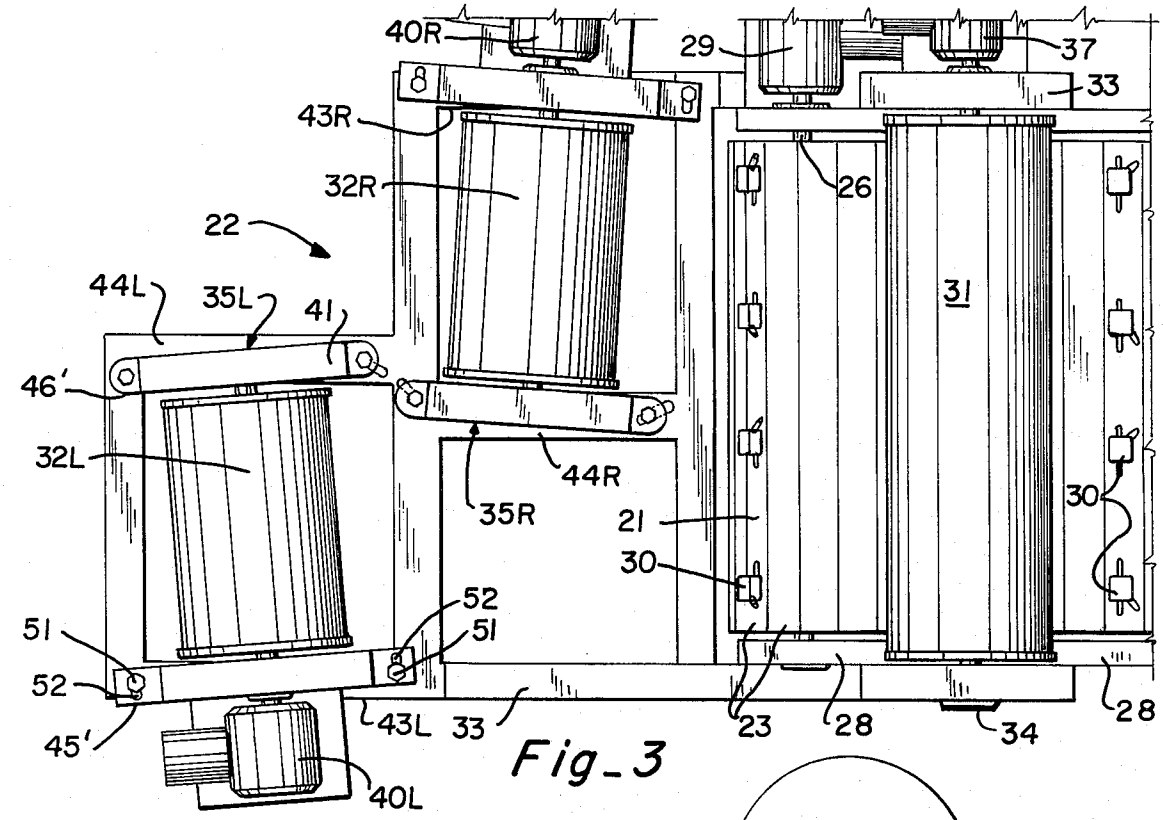

Fig_3

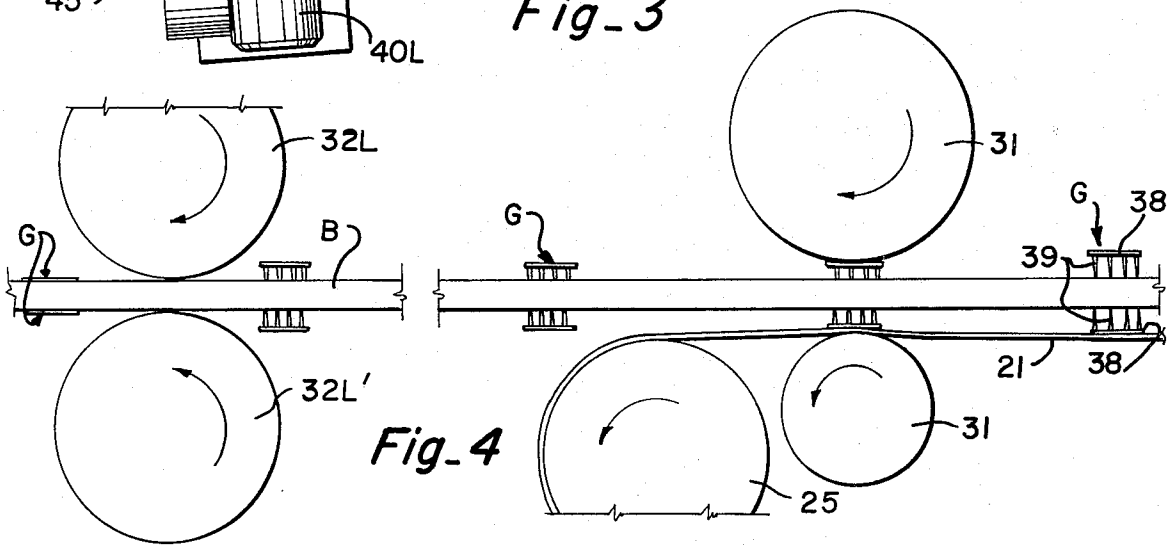

Fig_4

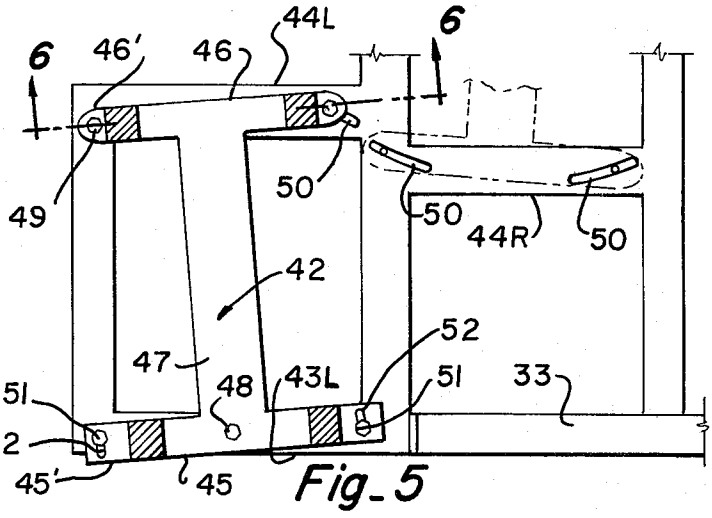

Fig_5

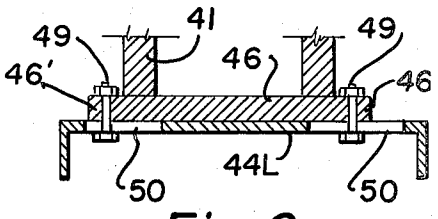

Fig_6

CAMBERING ATTACHMENT FOR TRUSS ASSEMBLY JIG USING CANTED ROLLER PRESS

The present invention relates to assembly jigs for forming assembled precut wood members into a structural joist truss, and more particularly to the manufacture of joist trusses upon such assembly jigs. The primary object of the present invention is to provide, in a truss assembly jig, a novel, improved and simplified mode of imparting a predetermined and accurate camber to a joist truss as it moves through the manufacturing jig.

A joist truss may be defined as having generally straight, parallel upper and lower chords with a zigzag array of web or diagonal members between these chords, and including perpendicular ends. Such trusses are comparatively shallow and the ratio of height to span may be as small as **1** to **20**, in contrast with other types of trusses where a desirable height-to-span ratio is more nearly **1** to **5** or more. Accordingly, joist trusses are used extensively for supporting floor and roof decks. In the past, some joist trusses have been manufactured of steel beams and rods, wood and steel, etc., but recently, some joist trusses are being constructed of wood (generally 2×4's) and have become very popular for use in lieu of scarce, more expensive timber joists.

Other factors which have brought about an increased use of joist trusses, and also, various other types of timber trusses, are the development of improved truss components and methods for manufacturing the trusses. Spiked gusset plates, which are affixed to a truss at each side of each joint of the truss, have simplified the problems of holding the web and chord members together. Assembly jigs or truss forming machines have been developed to manufacture the trusses. One such an assembly jig generally comprises a movable, table-like support surface, preferably an endless belted structure, whereon the upper and lower truss chords and the web members are positioned and held by clamps in the form of the truss. Gusset plates (spiked, metal plates) are then placed at each joint, and thereafter, movement of the support surface passes the preassembled truss through upright pairs of opposing rolls arranged as a roller press, to press the spikes of the gusset plates into the wood. Preferably (and the type of apparatus with which the present invention is concerned), two sets of rolls are used. The first roller press set is at, and above and below the movable surface and functions to partially impale the gusset plate spikes into the wooden members to hold the truss together. The second roller press set is beyond the movable surface and functions to press the gusset plates in place tightly against the sides of the truss and produce a finished truss.

Since timber is moderately elastic, a truss will deflect under load even when the components are tightly knit together at the joints by the gusset plates. This movement is pronounced as a joist truss is moved through the double roller press assembly. Such deflection is not significant on an A-frame type truss, such as may be used for supporting a roof, but it becomes quite important in joist trusses which are supporting a floor. The floor must be flat and not sag at the center of the span when the trusses are supporting a load. To avoid such a sag, it is a common practice to provide a predetermined camber in the joist trusses. Thus, once a group

of cambered trusses are positioned across an open span and covered with a floor deck, they will deflect from an arched, cambered form to lie flatly or even have a slight upward crown at the center of the span.

This practice of providing camber is well known and proper architectural specifications require that a joist truss be cambered. A common procedure for forming a camber in a joist truss is to arch the truss when it is being formed upon the support surface of an assembly jig, using the restraining clamps upon the table holding the truss in the cambered position until the gusset plates are affixed in place. However, it has been found that it is difficult to produce a consistent, predetermined camber in a truss even though each truss is arched the same amount, when such a truss is formed by the two roller press sets on the jig. There is a substantial stress exerted on a truss as it passes through the roller presses, and a truss with its preformed camber generally substantially changes, forming non-uniform trusses. In the manufacture of a large number of the same size of trusses, a number of the trusses must be rejected because of either insufficient camber or too much camber.

The present invention was conceived and developed with such considerations in view, and the invention comprises, in essence, a truss assembly jig having a movable support surface with clamps thereon to hold precut wooden members in the form of a joist truss and with spiked gusset plates at the truss joints, two pairs of opposing rolls (forming two roller presses) in tandem at the discharge end of the support surface to receive one or two trusses and to press the gusset plate spikes into the wooden members in a two-step, single-pass operation, and an arrangement where the second pair of rolls is skewed, or angled slightly from a normal straight line traverse, axial alignment with respect to the movable surface, to impart a predetermined camber to the truss. It was ascertained that the second, angled roller press set would not only impart a camber to the truss when it is laid out in a straight, longitudinal alignment upon the support surface, but also, it would cause the camber to be predictable and consistent for a large number of similar size of trusses being manufactured.

Thus, another object of the invention is to provide a truss assembly jig which is capable of manufacturing cambered joist trusses having a selected, specified camber which will be consistently the same in each of a large number of joist trusses manufactured in the jig, and minimize the number of trusses which have to be rejected.

Another object of the invention is to provide, in a truss assembly jig, an adjustably angled roller press for forming a predetermined camber in a joist truss manufactured therein which does not require any significant modifications to a double roller press, truss assembly jig, nor require any extra steps in the formation of a predetermined, cambered truss manufactured therein.

Another object of the invention is to provide a modified truss assembly jig to produce, accurately and consistently, camber in joist trusses manufactured therein which is simple, economical, reliable, rugged and durable.

With the foregoing and other objects in view, all of which more fully hereinafter appear, my invention comprises certain constructions, combinations and arrangements of parts and elements as hereinafter described, defined in the appended claims and illustrated,

in a preferred embodiment, in the accompanying drawings, in which:

FIG. 1 is a plan view of a truss assembly jig of a type which manufactures two trusses at a time, and which is arranged with two sets of oppositely-skewed discharge rolls to impart camber to trusses manufactured on the jig, and with trusses being illustrated as passing through the rolls.

FIG. 2 is a side elevation view of the discharge end of the truss assembly jig as from the indicated line 2—2 at FIG. 1, but on an enlarged scale.

FIG. 3 is an enlarged, plan view of the discharge end of the truss viewed at FIG. 2, but without trusses in the apparatus.

FIG. 4 is a diagrammatic view of the two roller press arrangements and of a truss passing through the rolls to permit the first pair of rolls to partially impale the gusset plate spikes into the truss and the second pair to press the gusset plates against the truss members to complete the truss.

FIG. 5 is a fragmentary portion of a sectional plan view as taken from the indicated line 5—5 at FIG. 2, but with some parts being removed to show constructions otherwise hidden from view.

FIG. 6 is a fragmentary sectional detail as taken from the indicated line 6—6 at FIG. 5.

Referring more particularly to the drawings, FIG. 1 illustrates a truss assembly jig 20 of a type whereon either one or two joist trusses A and B may be assembled at one time, as upon an endless, assembly belt 21. This belt 21 constitutes the movable support surface for carrying preassembled trusses and for moving the trusses through rolls arranged in upright pairs as roller presses. These rolls constitute a double roller press assembly 22 to press spiked gussets G into the preassembled truss members to complete a truss as it moves through the roller press assembly, all as hereinafter further described.

The assembly belt 21 is essentially a conventional unit which may be constructed as a continuous web or as a longitudinally extended array of slats 23 mounted on chains 24, as indicated at FIGS. 1 and 2. The chains of this assembly belt 21 are extended about end rolls or sprockets 25 which, in turn, are mounted on shafts 26. The shafts, in turn, are carried in bearings 27 supported in an elongated structural framework 28 consisting of longitudinal members, transverse members and uprights in any suitable, essentially conventional organization.

The belt 21, whose upper face constitutes a movable support surface whereon trusses are assembled, is driven by a motor 29 connected to the shaft 26 at the discharge end of the belt surface adjacent to the roller assembly 22, to operate in unison with the operation of the roller assembly, as hereinafter described. The belt 21 will include conventional components, not shown, such as take-up adjusting devices on the bearings 27. Suitable restraining clamps 30 will be provided upon the surface of belt 21 as spaced arrays extending along the longitudinal reach of the upper surface of the belt to hold the truss components in place when they are preassembled and before the truss components are fastened together by the gusset plates G.

The roll assembly 22 includes a first roller press including a pair of opposing, upright rolls 31 and 31' which extend across the belt 21 near its discharge end. The roll assembly 22 also includes lefthand and righthand roller press assemblies including pairs of opposing, upright, finishing rolls 32R and 32R' and 32L and 32L' located a short distance beyond the discharge end of the belt 21. These rolls may be carried in a common structural framework 33 consisting of longitudinal, transverse and upright members at both sides of the rolls in any suitable, convenient arrangement. The framework 33 is integrated with and may be a continuation of the framework 28 of the belt, heretofore described. This framework includes uprights at the rolls 31 and 31' and shelf members 33' in the uprights at each side of each roll 31 and 31' to carry bearings 34 to support the shafts of the rolls. The rolls 32R–32R' and 32L–32L' are carried in upright yokes 35R and 35L, respectively, which permit them to change alignment as hereinafter described and the upright members of these yokes include shelf members 35' to carry bearings 36 to support the shafts of the rolls.

The first set of rolls 31 and 31', located near the discharge end of the assembly belt 21, are positioned with the upper roll 31 being spaced above the surface of the assembly belt to permit truss components with gusset plates preassembled upon the assembly belt 21 to pass underneath this roll. The lower roll 31' is underneath this belt 21 and supports the belt. The upper roll 31 is driven in synchronism with the movement of the belt 21 by a suitable motor 37 which is preferably an electrical-motor, gearreducer combination. The lower roll 31', on the other hand, may be an idler (also may be driven) and functions to support the assembly belt against pressures imposed by the upper roll whenever a truss passes underneath it. It may be of reduced diameter, if necessary, to fit between the upper and lower reaches of the belt, as best illustrated at FIG. 2. Since the lower roll 31' is positioned to contact the underside of the upper reach of the belt 21, this roll will be formed with suitable circumferential slots, not shown, to provide clearance for belt chains 24 and it will be shortened, if necessary, to clear members of the framework 28.

The function of the first roller press set, including rolls 31 and 31', is to partially impale gusset plate spikes into the wooden truss components. The gussets G, which fasten the truss members together, are flat metal plates 38. Each plate has spikes 39 outstanding from one face and preferably, these spikes 39 are formed integrally with the plate 38 by punching and bending operations, cutting the spikes out of the surface of the plates. In the formation of a truss according to the invention, gusset plates are placed on both faces of the truss members at each joint when the truss members are preassembled on the belt 21 as best indicated at FIG. 4. To hold a truss in its preassembled form, the restraining clamps 30 upstand from the surface of the assembly belt 21 a distance sufficient to hold the wooden truss members when they are held above the belt surface by gusset plates underneath them. These clamps are arranged in straight lines, spaced apart to hold a truss of the desired width.

The spikes 39 on a gusset plate may be as much as 1¾ inches long, and hence it is impractical to completely drive these spikes into the timber components by a single pair of rolls. Accordingly, the gusset plate spikes are driven into the wooden components approximately half way as they pass through the first pair of rolls 31 and 31'. They are subsequently completely driven in place by a pair of finishing rolls 32R and 32R' or 32L and

32L'. This partial impalement of the gusset plate spikes by rolls 31 and 31' does fasten the timber components of a truss together to such a degree as to make the truss rigid, so rigid, in fact, that the truss may then move from the support surface of the belt 21 to cantilever the gap between the end of the belt 21 to move into a pair of finishing rolls, as in the manner indicated at FIG. 4. However, there is a substantial stress on the trusses which may induce lateral movement imparting unwanted camber in the trusses.

The pairs of finishing rolls 32R and 32R' and 32L and 32L' are thus positioned to receive a truss having its components held together by partially impaled spikes of the gusset plates 38. The rolls of each pair are spaced apart a distance sufficient to tightly press these gusset plates against the sides of the truss members as the truss moves through the rolls. These finishing rolls may be mounted in a rigid manner in the yoke frames, 35R and 35L as illustrated, or they may be spring mounted in any suitable manner to yield a small amount whenever a truss passes through them, to allow for the gusset plate thickness and other variations in the thickness of the members. Each upper roll 32R and 32L is driven in synchronism with the movement of a truss moving from the first set of rolls 31 and 31', and from the belt 21, as by a suitable motor 40R and 40L, respectively, and each motor is preferably an electrical-motor, gear-reducer combination. The lower rolls 32R' and 32L' are idlers.

In accordance with the present invention, each pair of finishing rolls 32R–32R' and 32L–32L' is skewed or angled to place the roll axes at a small angle from a normal transverse alignment with respect to the longitudinal axis of the apparatus. Such an angle may be from 2° to 10° from the normal to the longitudinal axis of the apparatus. This angling of the rolls produces a predetermined camber in trusses being formed in the apparatus which is surprisingly consistent in the trusses. As a matter of convenience, righthand and lefthand rolls are used to manufacture two trusses at a time, and each pair of rolls is skewed to turn a truss passing therethrough outwardly and away from the longitudinal axis of the apparatus, as best illustrated at FIG. 1, thus preventing any interference of one truss with another.

It is apparent that this angle of skew may need to be changed whenever different sizes of trusses are being manufactured or a different camber is necessary, a means for adjustment may be necessary. Accordingly, the two pairs of finishing rolls, 32R–32R' and 32L–32L', are mounted upon shiftable frames, the aforementioned yokes 35R and 35L. The upright arms 41 of each yoke frame 35R and 35L, which carry the respective rolls, upstand from a flat crotch or base 42. This base 42 of each yoke rests upon the framework 33 as hereinafter further described.

The width of each pair of finishing rolls 32L–32L' and 32R–32R' is such as to extend to the longitudinal central axis of the apparatus, and to avoid a problem of overlap, the pair of rolls 32R–32R' is placed ahead of the pair of rolls 32L–32L', and closer to the end of the belt 21, as illustrated. It was ascertained that this difference with respect to the distance from the end of the belt 21 will not significantly affect the results of the trussforming and camber-producing operations and thus, the offsetting roll pattern is provided as a matter of convenience.

This offset pattern of the rolls requires an offsetting frame portion to properly support the base 41 of each yoke 35R and 35L, as best illustrated at FIGS. 3 and 5. The framework 33 thus includes a longitudinally spaced outward pad 43R and an inward pad 44R and 44L whereon the sides of the base 42 of the yoke 35R are mounted and corresponding longitudinal outward and inward pads 43L and 44L whereon the sides of the base of the yoke 35L are mounted. While this yoke may be formed in various ways, a preferred structure is illustrated at FIG. 5 where the base 42 of each yoke combines an outward side crossarm 45 and an inner crossarm 46 which are spaced apart by a transverse center section 47 in the general form of an "H" structure. The uprights 41 of each yoke upstand from these crossarms 45 and 46. The crossarms 45 and 46 rest upon their respective pads 43R and 43L and 44R and 44L. Each end of each crossarm 45 and 46 is formed with ears 45' and 46', respectively, for receiving tiedown bolts to secure the yokes 35R and 35L to the framework pads.

The outward crossarm 45 of each yoke base is pivotally connected to its pad 43R or 43L as by a pivot bolt 48 at the center of the crossarm. The inward crossarm 46 of each yoke is slidably carried upon its pad 44R or 44L by adjustment bolts 49 fitted in the ears 46' at each side of the crossarm. The bolts pass through holes in these ears and into radial slots 50 in the respective pads 44R or 44L. These slots are centered on the axis of the opposing bolt 48. To complete the arrangement, tiedown bolts 51 may be provided in the ears 45' of each outward crossarm 45 and these bolts are fitted in slots 52 in the ears and in the outward pads 43R and 43L which are also centered on the axis of the respective bolts 48.

The operation of this apparatus is manifest from the foregoing description. Whenever a pair of trusses, or a single truss for that matter, is to be formed in the apparatus, the finishing rolls 32R–32R' and 32L–32L' are skewed from a longitudinal axial alignment of the apparatus by shifting the base of the yokes 35R and 35L about the pivot bolt 48. the other bolts 49 and 51 are then tightened to secure the rolls in place at a selected angle of skew. Next, a truss is formed upon the belt 21 in a conventional manner and is allowed to move from the belt through the rolls 31 to partially impale gussets into the truss and thereafter, to move to the skewed, or angled, finishing roll. This angling of the roll then imposes a selected camber upon the truss through an action which, though observed, is not completely understood. However, in a run of a large number of trusses of the same size, these rolls will be skewed at selected angles, determined by experiment if necessary, and the camber in each and every truss will be consistently the same, and to the point where the number of rejects because of improper camber in the trusses, is absolutely minimized.

I have now described my invention in considerable detail. However, it is obvious that others skilled in the art can arrange and devise alternate and equivalent constructions and operations which are nevertheless within the spirit and scope of my invention. Hence, I desire that my protection be limited, not by the constructions and operations illustrated and described, but only by the proper scope of the appended claims.

I claim:

1. In a truss assembly jig for forming a timber truss having parallel upper and lower chords and diagonal

struts between the chords, with the truss members, the chords and the struts being fastened together by spiked gusset plates, the combination including:

a. a movable support surface whereon the truss members are placed in preassembled, longitudinal position to be thereafter moved to and from a discharge end of the support surface;

b. a pair of first roll means near the discharge end of the support surface including a roll spaced above the surface a distance sufficient to partially impale the gusset plates into the wood truss members as the truss moves thereunder towards the discharge end of the surface;

c. a pair of finishing roll means a short distance beyond the discharge end of the surface to receive a truss as it moves from the support surface, said finishing roll means having rolls spaced apart to press the gusset plates into and against the sides of the truss members to finish the truss; and

the improvement wherein: the finishing roll means is skewed at an angle from the normal transverse axial alignment with respect to the longitudinal axis of the support surface whereby to impart a camber to a truss passing therethrough which is initially placed in longitudinal alignment upon the support surface.

2. The apparatus defined in claim **1**, wherein:

the skew angle is from **2°** to **10°**.

3. The apparatus defined in claim **1**, wherein:

the said finishing roll means is carried in an adjustable frame means adapted to permit the same to be rotatably shifted to provide the aforesaid skew position.

4. The apparatus defined in claim **1**, wherein:

the said finishing roll means is carried in a yoke-like frame, the base of which is rotatably shiftable whereby to permit the rolls to be set at a selected skew angle.

5. The apparatus defined in claim **4**, including:

a second finishing roll means, with one finishing roll means being at one side of the apparatus, and the other finishing roll means being at the other side of the apparatus, whereby to permit the simultaneous formation of a pair of joist trusses on the apparatus.

6. The apparatus defined in claim **5**, wherein:

the second finishing roll means is longitudinally offset from the first to permit each roll means to extend to the center of the apparatus.

7. In the method of manufacturing a wooden joist truss, including longitudinal upper and lower wooden chords with wooden cross-bracing members, with a predetermined camber, which includes assembling wooden components, an assembly in the form of a joist truss with the upper and lower chord members in straight and parallel arrangement, placing toothed, metal gusset plates on each side of each joist, moving such assembly through a first roller press set at a normal angle to the longitudinal axis of the truss to partially embed the teeth of the gusset plates in the wooden members, and the improvement of passing the partially finished truss through a second roller press having the axis of its rolls set at a small angle to a normal position to the longitudinal axis of the truss passing through the first roller press to form a camber of predetermined dimensions in the truss.

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