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Adams

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[54] **CAMBERING ATTACHMENT FOR TRUSS ASSEMBLY JIG**

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[52] **U.S. Cl.** **29/432**; 100/160; 100/173; 100/DIG. 13; 227/152

[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

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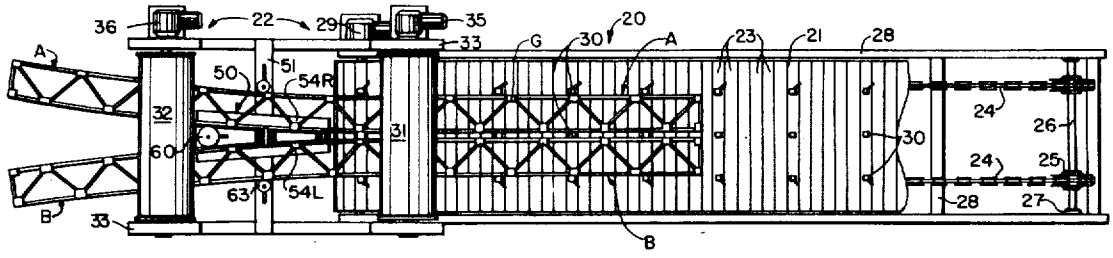
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Primary Examiner—Victor A. DiPalma
Attorney, Agent, or Firm—Richard D. Law

[57] **ABSTRACT**

Joist trusses, having parallel upper and lower chord members, are necessarily manufactured with a camber and preferably upon an assembly jig having a longitudinally disposed, movable, belt-like support surface for supporting precut wooden members arranged into the shape of a truss. Clamping devices, mounted upon the support surface, hold the precut members in place and metal, spiked gusset plates are placed at opposite sides of each joint of the truss. Two pairs of opposing, transversely-disposed rolls 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. A deflector is mounted between the first and second pairs of rolls to turn the truss slightly as it passes from the first pair of rolls and into the second pair to thus impart a predetermined amount of camber in the truss.

8 Claims, 7 Drawing Figures



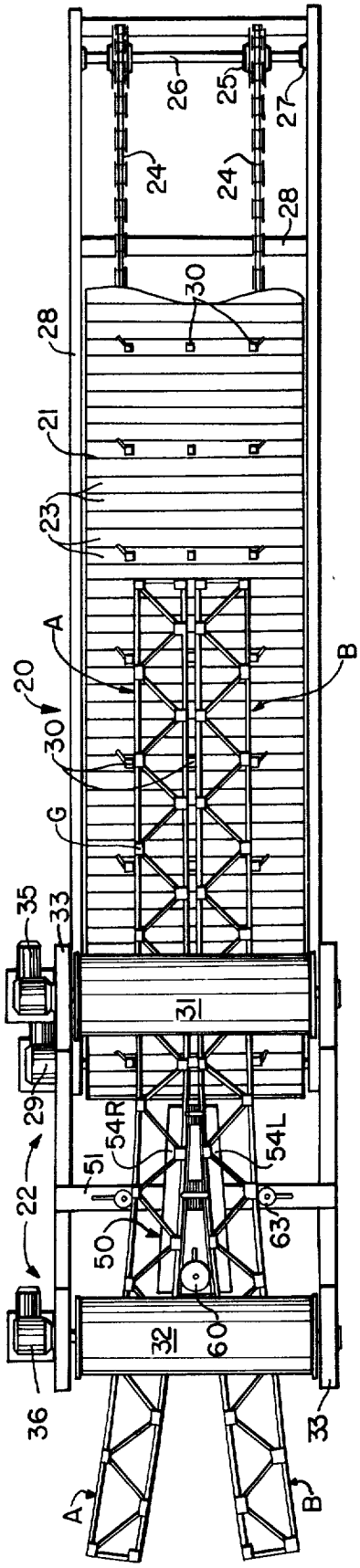


Fig_1

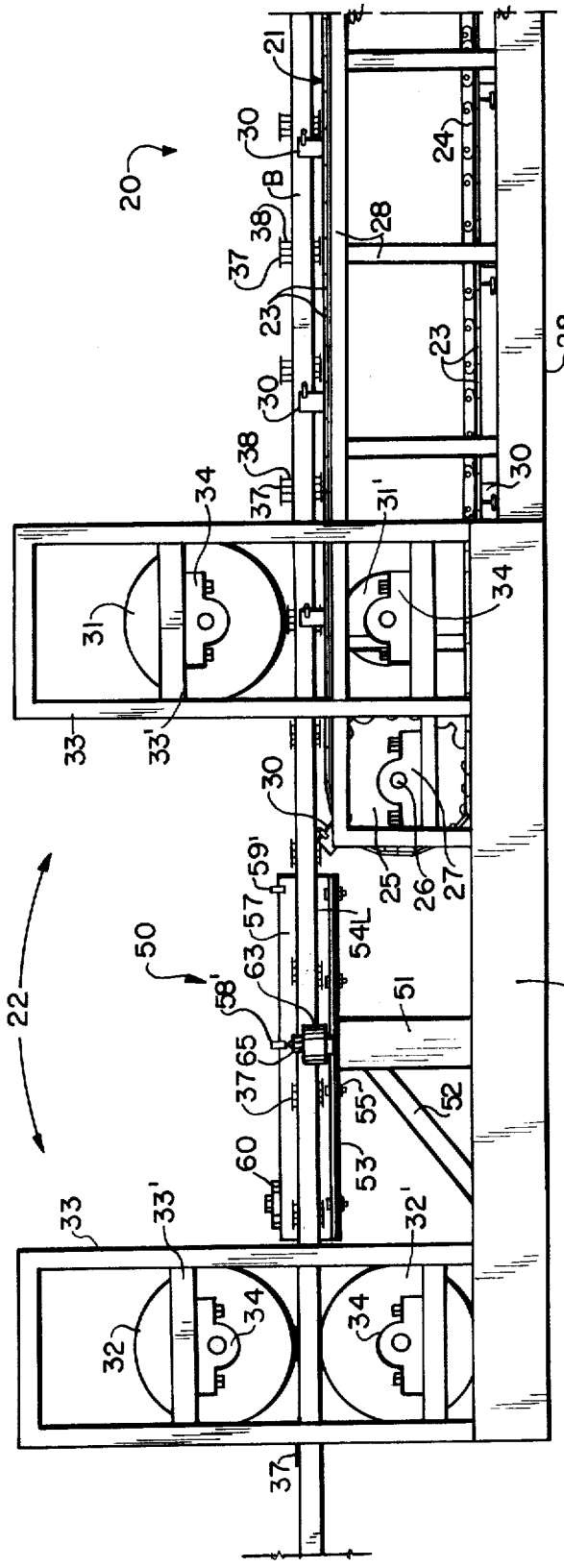


Fig_2

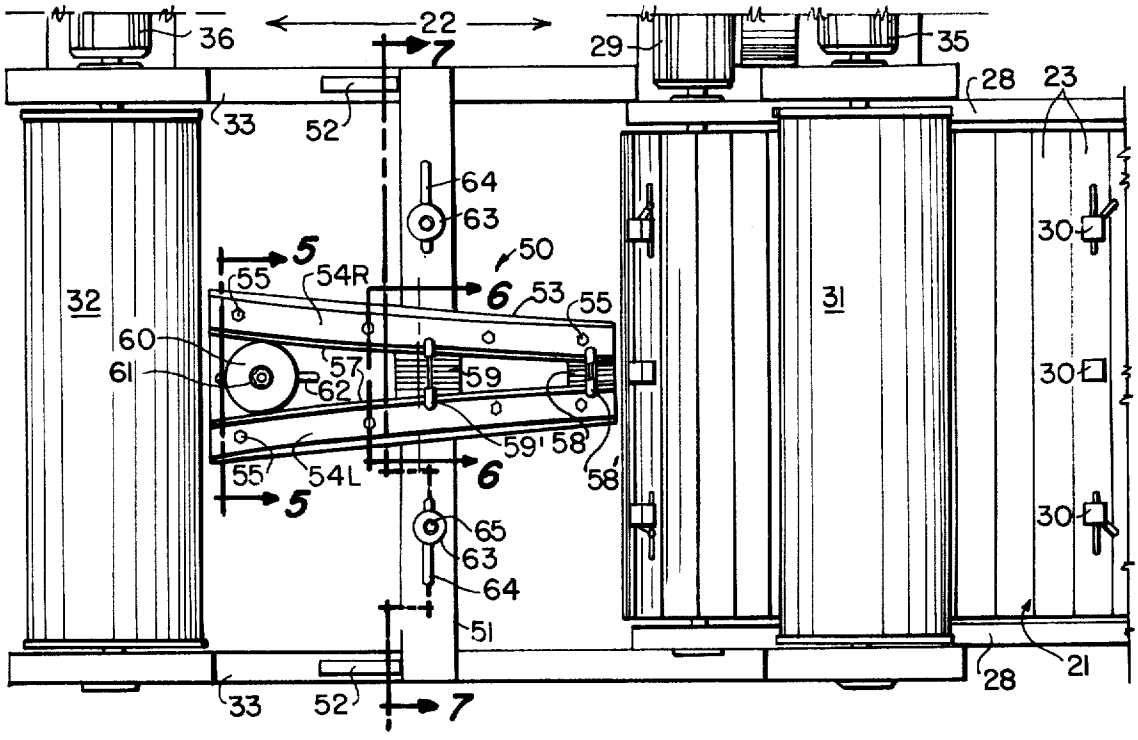
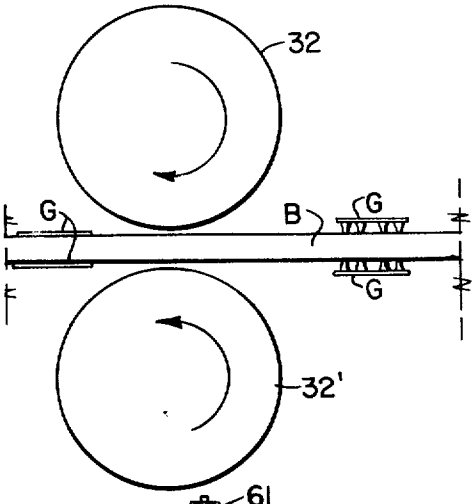


Fig_3



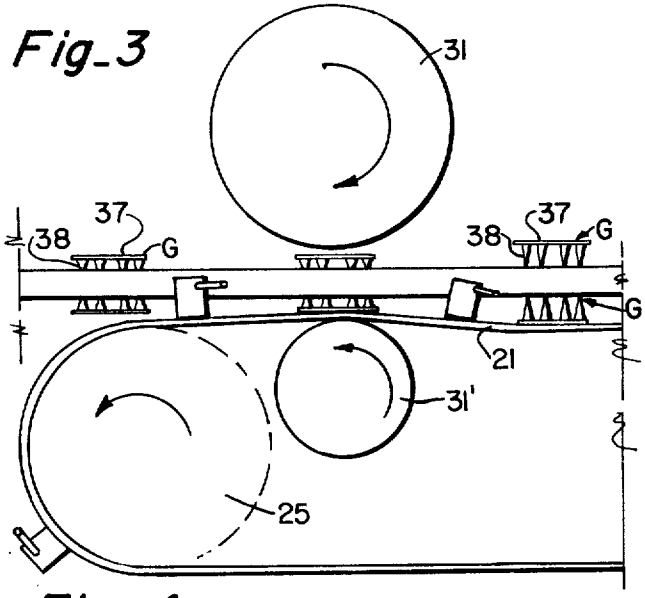


Fig_4

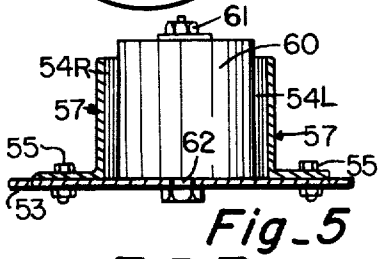


Fig_5

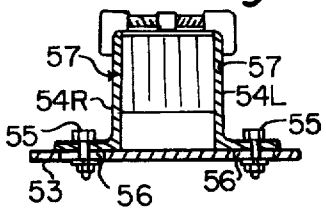


Fig_6

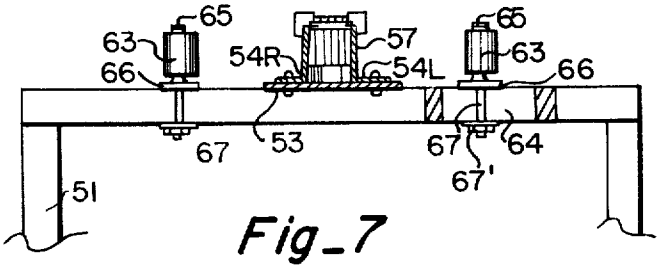


Fig_7

CAMBERING ATTACHMENT FOR TRUSS ASSEMBLY JIG

The present invention relates to assembly jigs for forming assembled precut wood members into a structural 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 attachment for imparting a predetermined amount of camber to a joist truss as it moves through the jig.

A joist truss may be defined as having generally straight, parallel upper and lower chords (with right angle end members) with a zigzag array of diagonal web members between these chords. 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. Accordingly, joist trusses are used extensively for supporting floors and flat roof decks. In the past, some joist trusses have been manufactured of steel, wooden chords and steel diagonals, etc., but recently, many such trusses are geing constructed of wood. These joists 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 machine is an assembly jig, generally comprising a movable, table-like support surface, preferably an endless belt structure, whereon the upper and lower chords and the web members are positioned and held to form the truss. Gusset plates are then placed at each joint, and thereafter, movement of the support surface passes the preassembled truss through upright pairs of opposing rolls 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 set straddles, above and below, the top stretch of the movable surface and functions to partially impale the gusset plate spikes into the wooden members to hold the truss together. The second set of rolls is beyond the movable surface and functions to fully 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. 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 toward 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 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 engineering specifications usually require that a joist truss by cambered. A common procedure for forming a camber in a joist truss is to arch the truss the desired amount when it is being formed upon the support surface of an assembly jig, with restraining clamps mounted along arcs upon the table holding the truss in the cambered po sition 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 group of joist trusses even though each truss is arched the same amount when such trusses are formed by roller presses affixing toothed gusset plates to the joints. Further, there is such a great stress exerted on the truss going through the roller presses as to cause shifting of the truss between the first and second set of rolls. In the manufacture of a large number of trusses, as for a large building, it was found that a number of trusses had to be rejected because of either insufficient camber or too much camber.

The present invention was conceived and developed with such consideration 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 truss to be held together with spiked gusset plates at the truss joints. Two pairs of opposing rolls in tandem at the discharge end of the support surface receive held trusses and press the gusset plate spikes into the wooden members in a two-step, single-pass operation. A deflector between the pairs of roller presses deflects the truss slightly in its movement from the first to the second pair of rolls to impart an arc or the camber to the truss. It was ascertained that this deflector would not only impart a camber to the truss whenever it was laid out in a straight, longitudinal alignment upon the support surface, but also, it would cause the camber to be predictable and consistent from truss to truss during manufacture.

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 for each joist truss manufactured in a preset jig.

Another object of the invention is to provide, in a truss assembly jig, a deflector for forming a camber in a moving bed joist truss manufactured therein which does not require any significant modifications in such a truss assembly jig, nor require any extra steps in the formation of a 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 incorporates the improved cambering deflector between the two sets of compressing rolls, illustrating,

also, a pair of trusses extending partially through the machine, as during a truss forming operation.

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

FIG. 3 is a plan view of the discharge end of the truss assembly jig, with the trusses partially shown in the apparatus.

FIG. 4 is a diagrammatic view of the roll arrangements and of a truss passing through the rolls to permit the first pair of rollers 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.

FIGS. 5, 6 and 7 are fragmentary sectional details as taken from the respective indicated lines 5—5, 6—6 and 7—7 at FIG. 3.

Referring more particularly to the drawings, FIG. 1 illustrates a truss assembly jig **20** of a type whereon two joist trusses A and B may be assembled at one time, as upon an assembly belt **21.** For clarity, the produced camber of each truss is distorted.

This belt **21** constitutes the movable support surface or bed for carrying the preassembled trusses and for moving the trusses into and through two upright pairs of rolls positioned as roller presses. These rolls, arranged in tandem, 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 roll 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 and/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 or stretch 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 adjustably 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 such components are fastened together by the toothed gusset plates G.

The roll assembly **22** includes a first pair of opposing, upright rolls **31** and **31'**, through which a truss or a pair of trusses first move, and a second pair **32** and **32'**, through which a truss or pair of trusses moves for finishing. Each pair of rolls is carried in a structural framework **33** which may be separate or common, for example, consisting of longitudinal, transverse and upright members at both sides of the rolls in any suitable, essentially conventional arrangement. This framework **33** is integrated with, and may be a continuation of, the framework **28** heretofore described. The framework **33** includes shelf members **33'** at each side of each roll to carry bearings **34** to support the shafts of the rolls.

The first set of vertically disposed rolls **31** and **31'** is located near the discharge end of the assembly belt **21,** with the upper roll being above the upper stretch or reach of the belt **21,** and the lower roll **31'** being underneath this belt. The upper roll **31** of the first pair, above the belt **21,** is driven in synchronism with the movement of this belt by a suitable motor **35** which is preferably an electrical-motor, gear-reducer combination. The lower roll **31'**, on the other hand, is an idler and functions to support the assembly belt **21** against pressures imparted by the upper roll when a truss passes underneath it.

The lower roll **31'** may be of reduced diameter, if necessary, to fit between the upper and lower reaches of the belt **21,** as illustrated. Since the lower roll **31'** is positioned to contact the underside of the upper reach of the belt **21,** the roll will be formed with suitable circumferential slots, not shown, to provide clearance for the chains **24,** and it will also be shortened, if necessary, to clear members of the framework **28.**

The upper roll **31** is adjustably spaced above the surface of the assembly belt to permit truss components and gusset plates G, assembled upon the assembly belt **21,** to pass underneath this roll. The spacing of the roll **31** above the belt is such that it will engage the gussets G placed upon the truss, and will press the gusset plate spikes only part way into the truss. A truss thus moves between the two pairs of rolls **31** and **31'** and then **32** and **32'** to complete the operation of pressing the gusset plates in place.

The second pair of rolls **32** and **32'** is located a short distance beyond the end of the assembly belt. Accordingly, whenever a truss, having its components held together by the partially impaled spikes of the gusset plates G, moves beyond the first pair of rolls and from the support surface of the assembly belt, it will move into this second pair of rolls. The rolls **32** and **32'** of the second pair are spaced apart the thickness of the truss members so as to tightly press the gusset plates against the sides of the truss and thereby complete the truss. The upper roll **32** of the second pair is driven in synchronism with the movement of the truss as it moves from the assembly belt **21** and from the roll **31,** by a suitable motor **36** which is preferably an electrical-motor, gear combination. The lower roll **32'** is an idler. If desired, the bearings **34** of the upper or lower roll **31** or **31'** may be spring mounted to yield slightly in response to variations of the thickness of the truss. Such a mounting is not shown since it is essentially conventional.

The gussets G, which fasten the truss members together, are flat metal plates **37.** Each plate has punched out spikes **38,** outstanding from one face, and preferably, these spikes **38** are formed integrally with the plate **37** 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 both at the upper and under faces of the truss members at each joint when the truss members are preassembled on the belt **21.** 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 supported on the belt surface with gusset plates under-

neath them. The spikes **36** 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 members forming the truss by a single pair of rolls. Accordingly, the gusset plate spikes are pressed into the wooden members of the truss approximately half way or so as they pass through the first pair of rolls **31** and **31'** and are completely pressed in place by the second pair of rolls. This initial, partial impalement of the gusset plate spikes by the rolls **31** and **31'** does hold the timber components of the truss together to such a degree as to make the truss rigid, so rigid, in fact, that a truss may then move from the support surface of the belt **21** to cantilever the gap between the end of the belt **21** before the second pair of rolls engages the end of the truss, to finish the truss, as in the manner indicated at FIG. **4.**

The organization thus far described is essentially known, and it can be used in the manufacture of joist trusses, as shown, and also other types of trusses, such as A-frame trusses. In the manufacture of joist trusses, a selected camber is necessary and, as heretofore pointed out, the conventional procedure is to include a camber when the truss is preassembled by deflecting the upper and lower chords and holding them in a deflected position with the restraining clamps **30** upon the assembly belt. It was also pointed out that this procedure has not been satisfactory. In the present invention, a joist truss is preassembled upon the assembly belt with the upper and lower chords being essentially straight and aligned in spaced parallelism with the longitudinal axis, and with the movement of the belt **21.** The clamps on the assembly belt are easily mounted in straight lines. A deflector **50** is mounted upon framework **33** between the first and second pairs of rolls to engage the upper chord of a truss, as it moves from the first pair of rolls **31** and **31'** and before moving into the second pair of rolls **32** and **32'**. This deflector shifts or turns the truss laterally a small distance before it is gripped by the second pair of rolls. The result is a selected camber in each truss, and this same camber is imparted to each and every truss of a run which is formed in the apparatus.

In the preferred embodiment heretofore mentioned, the belt **21** is of a width sufficient as to permit two joist trusses to be manufactured at the same time, and operators at each side of the truss assembly jig **20** can preassemble the components of opposing joist trusses A and B simultaneously. With this arrangement, the deflector **50** can be located at the longitudinal center of the apparatus, so that the lateral forces produced by deflecting each truss will oppose each other and minimize the strain imparted on the deflector.

This deflector assembly **50** may be mounted upon a standard, which may be a bent **51,** an inverted U-frame, extending transversely across the apparatus at an approximate half-way location between the end of the assembly belt **21** and the second pair of rolls **32** and **32'**. This bent is reinforced, as with suitable braces **52** to provide adequate rigidity. This deflector assembly **50** is in the form of an elongated, symmetrical wedge having a narrow, longitudinally triangular base plate **53** affixed to the top of the bent **51** to be at the longitudinal center of the apparatus. The base plate **53,** so affixed to the top of the bent **51,** may also be supported and reinforced by other structural components, not shown, if this becomes necessary.

Two slightly curved, flexible, opposing structural angles **54R** and **54L** are mounted upon this base plate **53,** as by bolts **55** extending through their lower horizontally disposed legs which rest upon the base plate. The bolts **55** extend into laterally slotted holes **56** in the base plate **53,** as best shown in FIG. **5,** for adjustment of their position. Accordingly, the upright legs **57** of these angles form curved slide surfaces whereagainst the upper chords of two opposite trusses will bear when they are being deflected to receive a camber.

The slotted holes **56** in the base plate **53** permit adjustments to vary the angle of the wedge-like slide surfaces of the upright angle legs **57** to provide different cambers in different sizes of trusses. Also, a set of shims **58** held by a clamp **58'** is fitted between the opposing upright angle legs **57** at the leading end of the deflector, adjacent to the end of the belt **21,** to hold these legs apart the same distance as is the spacing apart of the trusses, as may be established by a center row of restraining clamps **30** which engage both trusses, as illustrated at FIG. **1.** A second set of shims **59** held by clamps **59'** is fitted between the opposing upright angle legs **57** above the bent **51,** the approximate half-way position on the deflector. These shims can be varied to adjust the divergence between the angle legs **57.** Finally, a spacer cylinder **60** is mounted between the opposing upright legs **57** upon the base plate **53.** A lock bolt **61** extends through this cylinder **60** and fits in a longitudinal slot **62** in the base plate **53,** and when tightened, the bolt **61** holds the cylinder in place upon the base plate. Adjustment movement of this cylinder along the slot **62** deflects the angles **54L** and **54R.**

To further restrain the trusses as they move in the curved path defined by the angle legs **57,** as described, a roll **63,** to bear against the lower chord of a truss, is mounted at each side of the top of the bent **51** in a transverse slot **64.** This roller is held on an upright shaft **65** to rotate thereon. The lower end of the shaft is formed with a flange **66** which rests upon the top of the bent **51.** Thence, the shaft extends downwardly as a bolt shank **67** which fits through the slot **64** to be held by a nut **67',** as best illustrated at FIG. **7.** The roller **63** is set to bear against the lower chord of a truss moving past the deflector to better hold the upper chord in place against the deflector slide surface **57.**

The operation of the apparatus is apparent from the foregoing description. First, the divergence of the deflector is established by adjusting the shims **58** and **59,** and setting the spacer cylinder **60** in its slot **62** to provide a selected curvature of the upright angle leg **57,** the slide surface. Next, the rollers **63** are set to correspond with the depth of the trusses being manufactured. These settings can be determined by experimentation for any given truss. The trusses are then preassembled upon the assembly belt and passed through the rolls in a conventional manner with camber being imparted by the deflector.

If one truss is to be manufactured at a time with the apparatus, the symmetrical arrangement cannot be used to minimize strains on the apparatus. Additional braces may be necessary. However, if the apparatus is to manufacture only one truss at a time, the deflector construction will be essentially the same, although additional braces and struts will be needed to hold the upright leg **57** of a single deflector angle **54** at the proper position with respect to the longitudinal movement of a truss passing through the rolls.

I have now described my invention in considerable detail. However, it is obvious that others skilled in the art can build and devise alternate and equivalent constructions which are nevertheless within the spirit and scope of my invention. Hence, I desire that my protection be limited not by the constructions 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 joist 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 with the longitudinal upper and lower chords being essentially straight and parallel;

b. a first pair of spaced apart 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 wooden truss members as the truss moves thereunder towards the discharge end of the surface;

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

the improvement, comprising deflector means between the first and second pair of roll means bearing against the upper chord of a truss passing from the support surface and to the said second pair of roll means whereby to longitudinally deflect the truss and impart a camber to the truss as it passes through the second roll means.

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

the deflector means includes a curved surface whereagainst the upper chord of the truss slides as it moves from the first roll means and to the second roll means.

3. The organization defined in claim **2,** including:

an upstanding roller at the side of the deflector means which bears against the lower chord of the truss opposite to the aforesaid curved surface to hold the truss against the curved surface to thereby effect a positive camber curve in the truss as it moves past the deflector means.

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

the support surface is arranged to permit two longitudinally extended trusses to be preassembled thereon and then formed simultaneously and in symmetrical opposition with each other, and the deflector means is located at the extension of the longitudinal center line of the support surface with a deflecting surface at each side of the longitudinal center line extension being in symmetrical opposition to engage both trusses simultaneously.

5. The organization defined in claim **4,** wherein:

the deflector means is carried upon a flat support surface extending from the discharge end of said movable support surface and to the second pair of roll means, and includes:

a pair of elongated, curved, upright members forming opposed diverging curved surfaces which are slidably engaged by the opposing upper chords of a pair of trusses moving through the apparatus.

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

the said upright members are adjustably fastened to the support surface and the divergence of the members is established by spacer means placed between the members.

7. The organization defined in claim **5,** including:

a roller at each side of the deflector means adapted to engage the lower chord of each truss moving therethrough to push the upper chords of the trusses against said upright surfaces to effect a positive camber in each truss as it moves past the deflector means.

8. The method of forming a wooden joist truss, including longitudinal upper and lower wooden chords with wooden crossbracing members, with a predetermined camber, the steps of:

a. assembling truss components on a movable surface with the upper and lower chords held by clamps along straight lines and parallel to each other;

b. placing toothed gusset plates in opposed relation on each side of each joint in the joist truss;

c. moving the assembled components through a first set of roller presses to initially partially embed the teeth of the gusset plates in the wooden members sufficiently to hold the members in position free of the clamps;

d. deflecting the truss as it exits from the first set of rollers so as to arc the upper and lower chords at a predetermined camber; and

e. passing the arced joist truss through a second set of rollers to press the gusset plates fully into the wooden members, to form a rigid joist truss with a predetermined, accurate camber.

* * * * *