

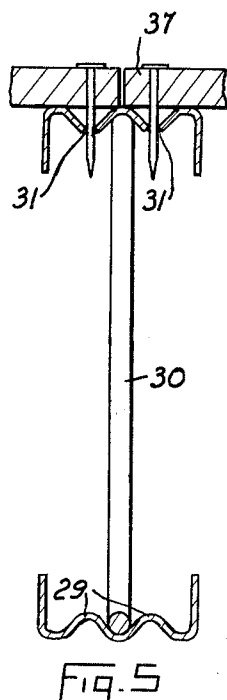
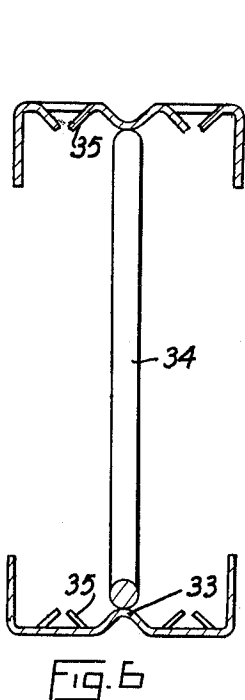
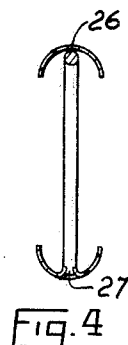
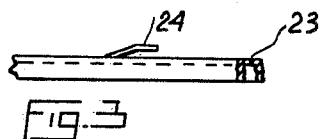
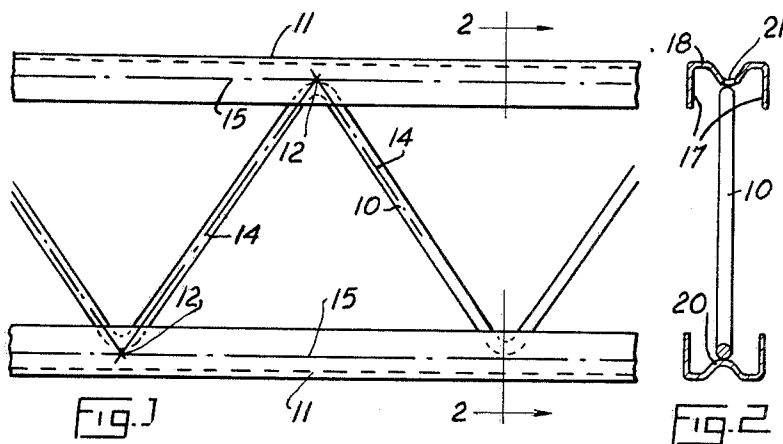
Nov. 24, 1964

R. A. G. CAPE
LIGHT WEIGHT TRUSSES AND APPARATUS FOR THE
FABRICATING OF SAME

3,158,731

Filed Jan. 17, 1961

3 Sheets-Sheet 1



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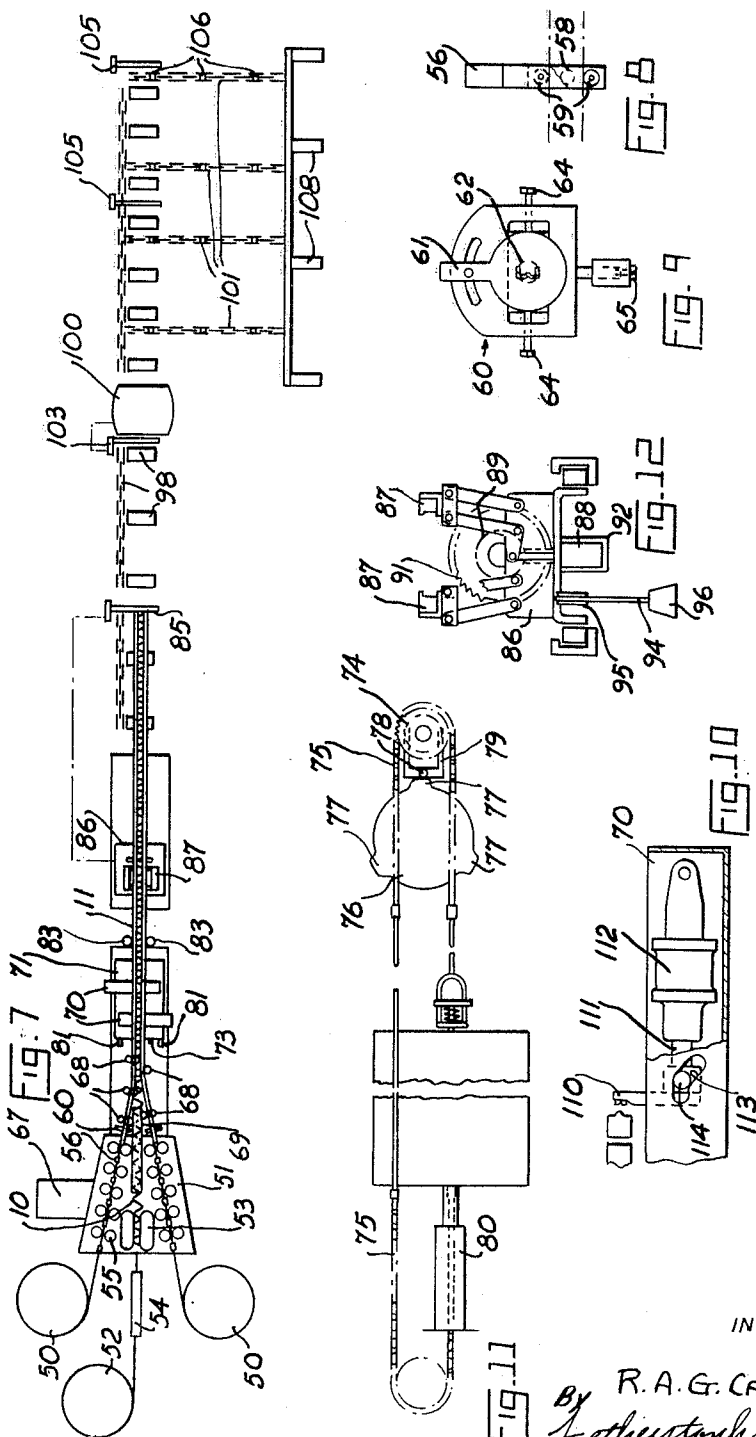
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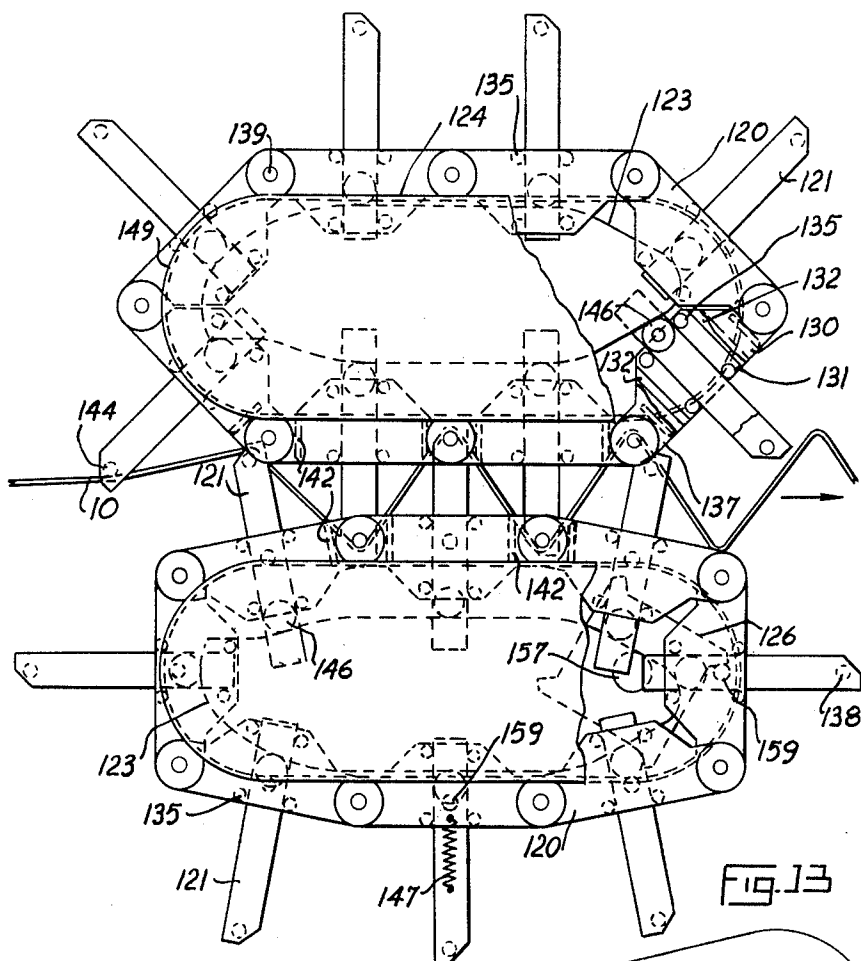


FIG. 13

FIG. 16

FIG. 14

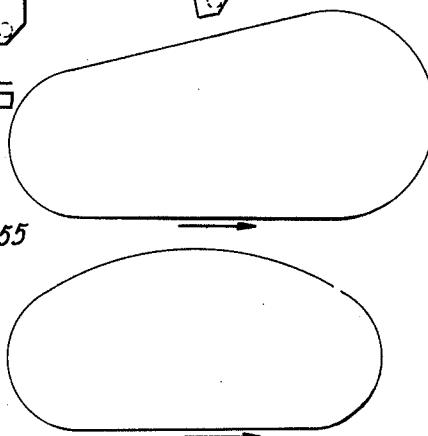
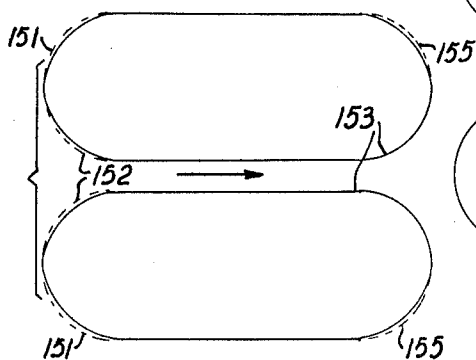


FIG. 15

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3,158,731

LIGHT WEIGHT TRUSSES AND APPARATUS FOR THE FABRICATING OF SAME

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19 Claims. (Cl. 219-79)

This invention relates to a novel light weight truss construction and to apparatus for fabricating such trusses.

Wood has been used for centuries as a construction material in the form of beams, studs, frames, etc. In more recent years, other materials have found favour by providing advantages not obtainable with wooden members. Development of metal substitutes was found to be practical and economical with the result that the substitutes have become primary construction items. Those which provide the combination of practicability and economy to the greatest degree are naturally more desirable and find greater acceptance in their sphere of use.

This invention relates specifically to a small light-weight metal truss, which by reason of adaptability, lightness, cheapness of fabrication and economy of erection, provides the building trade with a better and more desirable unit of construction than presently available. The truss may be used as studding in wall partitions, as lintels and frames for door and window openings, as beams for floor and roof loads and as columns for carrying or sharing compression loads. The truss is designed with specific features in mind, i.e. completely automatic continuous fabrication for low cost; high strength to weight ratio and high rigidity to weight ratio; ease and rigidity of connection to component members in a structure; simplicity of support for auxiliary construction materials, such as roofing, flooring, wall sheeting, board or lath and insulation, etc.; through-passage and support of piping, condulets and wiring; ranges in depth and in length.

The apparatus according to the invention is designed for complete and continuous automatic fabrication from a first station where coils of wire and strips are entered into the machinery to the last station where completed trusses are manually stacked for shipment. Thus chord materials in two separate lines are continuously formed in roller dies from coiled strip, while web wire is straightened then bent into a Warren type configuration from a coil and all three components are mechanically assembled, resistance welded, automatically cut to length and painted, while in uninterrupted motion, and then discharged sideways onto drying skids for bundling and shipping. All such automatic apparatus and its controls must be adjusted in exact synchronization to achieve accuracy of product and maximum production.

The invention is considered to reside in the operative combination of the elements of the machine for carrying out the above mentioned operations in a continuous automatic manner.

In addition, the invention includes the provision of a novel web bender designed on entirely new bending principles.

The web bender is similar in effect to a pair of mating gears, both having infinitely large radii between which thin material is bent to form shapes approximating Warren type web configurations. In such a comparison, each gear is replaced by a stationary double track which in plan may be considered to be straight on adjacent sides, straight or curved on the opposite sides and rounded at both ends. Around each double track a series of joined links may be rotated. Each link contains a centrally located tongue (representing a gear

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tooth) which may move normal to the link in its centerline plane, but whose axial movements are controlled by bearing at its inner end against a cam within each double track. The outer ends of the tongues contact the web material which bends reversely around each consecutive tongue when the links are in motion.

Rotary motion of the links around the tracks produces a continuous uninterrupted Warren type web member for continuously made trusses.

The invention is illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is a side elevation of a light weight truss according to the invention.

FIG. 2 is a section on line 2-2 of FIG. 1.

FIG. 3 is a fragmentary elevation of a modified embodiment of the chords.

FIGS. 4, 5 and 6 are fragmentary sections showing alternative chord sections.

FIG. 7 is a schematic view of the entire machine.

FIG. 8 is an elevation of a chord guiding device.

FIG. 9 is an elevation of a device for straightening the shaped chord.

FIG. 10 is a fragmentary elevation of the welding machine.

FIG. 11 is a fragmentary plan of the drive for the welding machine carriage.

FIG. 12 is a fragmentary elevation of the flying saw.

FIG. 13 is a plan of the web bender.

FIG. 14 is a diagram of the track outline of the web bender.

FIG. 15 is a diagram of a modified track outline of the web bender.

FIG. 16 is a diagram of a further modified track outline of the web bender.

Referring to FIG. 1 the truss consists of a formed wire web 10 and two chord members 11 having a contour known as a Warren truss.

The web 10 is formed of rounds or wire bent to produce a series of continuous V shapes. The apices of the V's are resistance welded to the chords. The junctions of the web and chords are known as panel points 12. The isosceles triangles between three subsequent panel points are termed panels. The panel length is the distance between adjacent panel joints 12 on the same chord. The depth of the truss is controlled by the depth of the V's of the wire web. The panel length and the truss depth may, therefore, be varied as required by forming the web accordingly.

The apices of the web at panel points 12 are radiused to provide sufficient contact area for carrying the heavy currents required for resistance welding, and also to have the web diagonals 14 coincide with the centres of gravity 15 of the chords at the panel points 12, for better absorption of the shear forces under load.

The chords may vary widely in cross-section according to requirements.

As shown in FIG. 2, the chords 11 are formed in the shape of a channel having flanges 17 at right angles to the channel web 18. The channel web is formed with a stiffening groove 20 along its centerline, to which is welded the truss web 10. For a given length between panel points 12 the groove is provided with a slit 21 to provide a means of holding nails or screws. Such fasteners are securely held in position by the wedging action of the lips of the slit 21.

This form of chord provides a good bearing area for securing wall or ceiling panels to the outer faces of the truss.

When nails or screws are not to be used the groove may be eliminated as shown in FIG. 3, wherein the channel has a flat web 23. Where the truss is designed to carry a plaster wall or ceiling, tabs 24 may be provided

instead of the slits 21 (FIG. 2). A wire mesh may then be placed over the trusses and held in place by bending the tabs 24.

A flat web such as 23 of FIG. 3 is subject to a certain amount of flexing under normal loads. This may be avoided by merging the web with the flanges up to a half-tubular shape 26 as shown in FIG. 4. In this latter embodiment slits 27 with intumed lips are provided in the channel between panel points.

Where a greater channel width is required, the channel web may be provided with more than one stiffening groove. FIG. 5 shows a truss having chords with two continuous grooves 29 on either side of the centerline of the channel web, to which the truss web 30 is welded. Nailing slits 31 are provided in the grooves 29 at any location, but preferably the grooves are not broken at the panel points. The slits 31 may be located opposite each other or they may be staggered.

The grooves 29 may be spaced closely together so that the web 30 fits in the recess between them; this facilitates alignment of the web with the centerline of the chord during automatic fabrication.

FIG. 6 shows a triple groove construction with a central, continuous, unbroken groove 33 to which is welded the truss web 34, and two slit grooves 35 one on either side of the central groove 33. The two side grooves 35 are shown to be interrupted at the panel points but they may also be continuous.

A double nailing slit as shown in FIGS. 5 and 6 is of particular advantage when a butt joint between two wall or ceiling panels 37, as illustrated in FIG. 5, is located over the centerline of the truss, a nailing slit being thus provided on each side of the butt joint.

End reaction seats and connections for the trusses may be added as required according to conventional practice.

The machine assembly for fabricating the trusses in a continuous and automatic operation is shown in FIG. 7. The individual machine elements are shown schematically and some details of construction are given in FIGS. 8 to 12.

The web bender, is illustrated in greater detail in FIGS. 13 to 16.

A description of the machine and its operation follows.

Stock material in coils 50 of cold rolled and tempered or hot rolled strip should preferably be supplied by the mills, accurately cut to width and should unwind without edge-wise camber. The strip, however, may vary in width and be curved edge-wise.

The coils of strip 50 may be mounted in any convenient manner for uncoiling without friction into the pair of cold forming units 51 of the machine. The tail end of each coil being processed is in turn welded to the start of a new coil for unbroken feed into the cold forming machine. Such welding may be done by means of manual tungsten inert gas welding, or by means of resistance welders.

Coils of wire 52 are also separately mounted in rotating supports preferably with the coil axis vertical to produce free uncoiling of the wire. Again as with the strip, the start of a new coil may be welded to the tail end of a coil being processed. Before going into the web bender 53, the wire is passed through a conventional wire straightener 54.

The cold forming machine 51 is actually two machines in one, where two chords 11 are simultaneously formed. The distance between entrance ends of the pair of cold forming units 51 of the machine where the strips are fed into the rolls, is further apart than the exit ends so that the chords on emergence come together during assembly.

Each pair of cold forming units 51 has a series of pairs of rolls 55 which intermittently shear the strip for nailing slots, bend the grooves to provide nailing slot

and welding grooves, form the flanges and set the nailing slots to an accurate gap. It is essential that a common plane, normal to the axes of the rolls should pass through the center of each roll. Also the centerline of the strip in its width must coincide with the common roll plane to ensure uniformity of chord profile. To do this, ahead of the first pair of rolls and also between each of the pairs of rolls, there is a device 56 which maintains the centerline of the strip on the common plane of the rolls and straightens out the edge-wise curvature of the strip. These devices, as shown in FIG. 8, consist of a lever free to rotate on an axis 58 which is fastened to the bed of the machine so that the center of the axis coincides with the common plane of the rolls. The lever supports two rollers 59 which have a clear distance between them slightly greater than the maximum width of the strip. The lever may now be rotated angularly on the axis and held by force of friction so that the two rollers simultaneously contact the two edges of the strip. The centerline of the strip is thus maintained straight and in the common plane of the rolls.

Formed chords from the cold forming machine may not emerge straight. The chords may be bent up or down or sideways or spiralled. In order to provide straight chords, two further devices 60 are used which impose loads to counter the distortion and thus produce a straight product. As shown in FIG. 9, these devices consist of a lever 61 which may be rotated on axis 62 and displaced laterally by screws 64 or vertically by a screw 65. The chords 11 pass through suitable openings in the lever.

A single motor 67 drives both sets of rolls 55 and the web bender 53 at identical relative output speeds through suitable gearing.

Formed and straightened chords 11 emerge from the cold forming units 51 in a horizontal plane and at an angle to one another. Pairs of form fitting rolls 68 then guide the chords in horizontal curved path to bring the chords parallel and spaced apart. At the same time, the web 10 emerges from the web bender in a higher plane on the centerline. Guides 69 curved in the vertical plane support the web until it emerges between the two chords into the welding unit.

Two resistance welders 70 of a special design are mounted together on a frame carriage 71. The two welders are spaced at $2\frac{1}{2}$ panel distances apart. The carriage 71 supporting the two welders is driven forward and is returned for each of the two welds simultaneously made between the truss web and the two chords. At the start of the forward carriage motion, a push button 73 is released which starts a series of welding operations including squeeze, weld, hold and release for each cycle. This forward motion is obtained from a clutch 74 (FIG. 11) and chain drive 75 from the cold rolling machine. The clutch 74 is operated by a rotary plate 76 driven by the cold-rolling machine and having three cams 77 engaging a follower 78 on a lever 79 which operates the clutch. Thus for each panel spacing formed in the chords, the clutch engages and causes the forward motion of the welding carriage. After a predetermined forward movement, during which the welding cycle is completed, one cam 77 engages the follower 78 and the clutch disengages and forward motion stops. At this point, an air cylinder 80, under continuous preset pressure, drives the carriage back against stops 81 and against the push button 73. The carriage then remains stationary until the next panel points of the truss move opposite to the welding electrodes, when again the follower 78 drops off cam 77 and the clutch is engaged for another welding cycle.

The construction of the welders is shown in FIG. 10; the moving electrode 110 is secured to the piston rod 111 of a pivotally mounted air cylinder 112, and is guided upwardly into welding position and downwardly in web

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clearing position by a slot 113 engaging a bearing or roller 114 mounted on piston rod 111.

The chord cold forming rolls are of identical diameter for each relating pair of rolls in each of the two cold forming machines. All rolls are driven at identical speed. Nevertheless, it is possible that the output from one cold former will be different from the other. In consequence, one chord of a truss would tend to become longer than the other and cause a camber in the finished trusses.

To prevent this from happening, a roller 83 on each side of the truss is provided to guide the truss as it emerges from the welding machine. These rollers are adjustable to counteract the camber tendency of the truss. Actually they compel the chords to emerge from the cold forming machine at an identical rate since the two chords are joined together by the truss web.

The product from the welding machines is a continuous truss which must be cut to order length. This is accomplished by means of an adjustable roller operated valve 85 and a flying saw carriage 86.

The carriage supports clamp jaws 87 which are opened and closed by a piston 88, a motor 89 to drive a circular cut-off wheel 91 and a piston 92 which feeds the cut-off wheel into the work.

Control circuits (not shown) regulate and time the clamp, the motor and its elevating piston. The roller operated valve 85 feeds the timer portion of the control circuits. In this connection it will be appreciated that the control circuits may be actuated by air, hydraulic or electrical devices of conventional design.

In use, the flying saw carriage 86 is stationary while the fabricated truss advances. When the forward end of the truss lifts the roller of the preset length gauge 85, it actuates the motor and the clamp. The clamp jaws then grip the advancing truss and the carriage moves along with the truss. Immediately afterwards, the saw piston lifts the motor with its rotating blade to make the cut, while carriage and truss move together. After a preset time interval, the saw retracts, the motor rotation stops and lastly the clamp jaws open. The carriage is then free to return to its original starting point by reason of a rope 94, pulley 95 and counterweight 96.

Prior to cutting a truss to length, the end projecting past the flying saw runway is supported on a roller runway 98. This runway is over-driven by a variable speed drive so that a cut-off length of truss immediately leaves the saw. The cut section then proceeds uninterrupted through a paint booth 100 to one of two locations where the painted length is discharged sideways onto drying skids 101.

As the truss enters into the paint booth 100, it triggers a valve 103 which opens the discharge of four paint guns (not shown) simultaneously spraying the work. The guns are symmetrically arranged in a circle around the truss, although staggered in the length of the paint booth. As the trailing end of the truss leaves the booth, the paint guns are closed.

The paint system is one which uses a high pressure paint supply to create a mist discharge from the guns without the necessity of a simultaneous air discharge. Consequently, the paint booth can be sealed off except for small entry and exit openings at each end, which are shaped approximately to the profile of the truss. Paint discharge into the atmosphere is almost negligible. Overspray within the booth is drained back into the paint reservoir. Paint thickness on the trusses is controlled by the speed with which the trusses move through the booth while supported and moved by the variable speed roller runway 98.

The roller runway continues beyond the paint booth for a length sufficient to allow the longest length of truss to be painted without interruption. At the end of the runway and again at a point about midway from the paint booth, roller operated valves or switches 105 are placed in fixed position. Each valve or switch controls a drive (not shown) which operates a chain conveyor on each

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of two side traverse skids 101. Long lengths of trusses will be discharged sideways onto both drying skids. Short lengths of trusses are discharged separately onto either drying skid. The chains of the conveyors are provided with upstanding projections 106 which move the trusses.

When the side-discharge skids are filled, continued production will tumble the dry trusses individually onto lower skids 108 where the trusses are checked and bundled for shipping.

Referring now to FIG. 13, the web bender consists essentially of two chains of links 120 in which each link contains a tongue 121 which bears axially against a cam plate 123 located between each of two double tracks 124 which support the links. In addition, a driver sprocket 126 produces the required motion of the links and tongues for web forming.

The number of links 120 in each chain is not a fixed quantity. No fewer than 6 links however can be used and no more than 10 are necessary. It is essential that the length of adjacent sides of the tracks be two links in length. The opposite side of each track may be equal or shorter in length and the two curved ends may be of equal or different diameters. The periphery of the tracks is developed to allow the links to rotate freely and snugly.

The length of each link in a chain is equal to the panel spacing of the Warren web configuration of the finished truss, less an appropriate amount to allow for spring-back of the web wire after forming.

Each link 120 in a chain, is essentially the same excepting possibly the ends where links are joined one to another. Each link may have male and/or female end configurations in order to join the links together into an endless chain.

The links consist of two side plates 130, 131 separated by means of a pair of fillers 132. At the middle of each link and between the two fillers, there is a space for a component tongue 121. This space also contains bearings or rollers 135 which accurately guide the component tongues and allow only an axial movement of the tongues. An additional space 137 between side plates also exists at each end of each link. This space permits the bending end of a tongue from the opposite chain of links to enter freely, so that the centre of the bending pin 138 of the tongue corresponds or nearly so, to the center of the axle 139 joining the links together. It is obvious that the axles joining any two links together are not continuous through the side plates, but instead at each link junction there are two axles which are securely retained in the side plates of one link and pass through the other side plates of an adjoining link to allow pivoting of the links about the center of the axles. These axles project beyond the outer surface of the links with provision for attachment of an outboard roller 140 to each separate axle. These rollers bear against grooves in the edges of the track 124 to permit rotation of the chain of links around the track. The rollers are in pairs at each axle centerline to procure stability against tilting and ensure that all movable parts rotate around the trackway in a common plane.

Additionally, each link contains two bending anvils 142 near each end located inwards from the axles. Their function is to produce bending of the web wire 10 in close proximity to the bending pin 144 of each tongue of the opposing trackway, which enters into the space 137 between adjacent anvils and link side plates.

If the bending anvils were not used, it is possible to produce a Warren type web but the diagonals between the apex curves would not be straight. A non-uniform bend would occur in which the diagonal on one side of an apex was reasonably straight for approximately half of its length while the diagonal on the other side of the apex would be curved. Curved diagonals would reduce compression capacity of the diagonals and increase the deflection of the truss having diagonals subject to tension loading.

The tongues 121 are uniform in outer contour and

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preferably either square or rectangular in cross-section, to assist in avoiding any rotary tendency of the tongue about their own longitudinal axes. The length of all tongues is uniform for any fixed web contour, but the length varies with the depth of the Warren type web configuration for any other web size.

Each tongue has a tongue bending pin 138 about which the web wire is formed during bending and a tongue cam roller 146 which in bearing against the cam 123 fixes the extent of axial movement of the tongues. In addition, light springs 147 may be used to assure that the tongue cam rollers are in contact with the cam as each tongue in turn enters into the space between the corresponding two links of the other trackway to avoid jamming under power.

In any uniformly bent Warren type web, the length of web material along its centerline from the apex of one bend to the apex of the next nearest bend must be constant. Similarly, the distance along the web centerline from the point of first contact of the tongue bending pin with the web to the corresponding point on the next nearest bend, must be the same constant. Also as the angle of bend of the web increases during bending, the first initial contact point between web and the tongue bending pin must be maintained without slipping. The locus of movement of the tongue bending pin 138 to accomplish this is predicated by the location and contour of the cam 123.

The cam contour is determined by accurate layout and close matching tolerances. The location of the cam relative to the track contour must also be accurately positioned and maintained.

For convenience, the cam is placed centrally between each pair of tracks and is thus central with the links and tongues. The tongues make contact with the cam through the medium of the tongue cam roller 146 which permits reduction of wear by rolling action, compared to sliding contact between tongue and cam.

Two sets of tracks 124 are essential and each set is composed of two tracks. Each set of tracks carries a similar set of links which rotate at similar speeds around the tracks, but the links are angularly disposed one to the other by half a link length. The spacing between tracks must be accurately maintained for any fixed Warren web configuration. In practice, the distance between tracks 124 is made adjustable to permit bending of various depths of web. A change in web depth also requires a change in tongue length and a change in the anvils 142.

The double track in each set is a convenience in supporting the links and tongues to assure the rotary motion in a common plane. Also the double track permits central location of the cam 123 in the plane of the centerline of tongues and links. Again for convenience the outer edges 149 of the tracks are not flat, but are grooved to restrain the link rollers 140 from side movement to assure link rotation also in a common plane.

The contour of the bottom of the groove around the tracks again must be accurately determined and machined to permit rotation of the links around the track without binding or without excessive looseness. Although the tracks appear in FIG. 13 to consist in plan of two half circles joined to a middle rectangle, purely circular ends will not allow rotation of the links except with excessive looseness. Thus in FIG. 13, if the ends were circular, the links could be made to fit snugly around the track as shown in the upper portion of the machine, but the links could then not be rotated, because of binding, to the position shown in the lower portion of the machine.

The track profile must be modified from purely circular ends as shown in FIG. 14. Here the left hand side is shown with a modification of both quadrants 151, 152 of the curved end, while in the right hand side, one quadrant 153 is shown circular, while the other

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quadrant 155 is shown modified. Either modifications are feasible for smooth angular rotation of the links around the tracks without looseness or binding. The more acceptable method however, is shown in the right hand end of this view where the four quadrants 153 nearest adjacent tracks are circular. This then permits a more feasible draughting method of determining the locus of movement of the tongue bending pin from the point of first contact between pin and web material to completion of each angular bend of the web.

In the two adjacent sets of tracks as shown in FIG. 14, the length of the rectangle between end quadrants is equal to two link lengths. It is also quite feasible or even desirable to change the profile of the tracks to that shown in FIG. 15. In this case the length of the straight portion of the adjacent track sides is maintained to two link lengths. However the remaining profile may be further altered, as shown in FIG. 16, to provide a small radius of curvature at the entry end to reduce the length of tongue extension and a large radius at the exit end to avoid the overlap on tongue retraction. The remaining profile joining the two end curves may be straight or curved, providing the links can be rotated to any position without binding or excessive looseness. In this development the sides of the two sets of tracks adjacent to one another are the flat sides.

The rotation of the links and tongues around the tracks is most satisfactorily produced by reason of a torque load applied through a shaft 157 to a sprocket 126 which drives against a pin 159 located on each link of one chain of links.

In the automatic fabrication of the trusses, it is essential to produce the same length of roller formed chords and bent web in a given time. For synchronization, the same motor drive for the cold forming rollers can be used through suitable gearing to achieve proper speed of output of the bent web.

The sprocket 126 is located for convenience on the under side of the middle cam 123 and between the double tracks 124. Teeth on the sprocket overlap the links and act against pins 159 fastened to each link of one of the chain of links to produce peripheral movement of the chain of links around the tracks.

It is unnecessary with this machine to drive both chains of links with separate sprocket drives. One driven set only will also drive the non-sprocketed chain by reason of the entry of tongues into corresponding recesses of the opposite chain of links.

No deformation of bends will take place when one chain of links only is driven.

Material such as wire drawn from a reel into the Web Bender will not issue sufficiently straight to assure that the diagonals of the Warren Type web are straight. For this reason, it is preferable to utilize a wire straightener 54 (FIG. 7) ahead of the Web Bender.

When a tongue in motion first contacts the wire, it will instigate a bend at the proper point only if the wire is reasonably in line with the centerline of the web bender. At high forming speeds, the entering wire, if free, could swing from side to side as each successive tongue made contact and instigate a reversing swing. The bends would then be initiated at points slightly in error.

The wire straightener 54 ahead of the web bender may be adjusted to create a slight tension to avoid the wire swing from side to side and compel initial contact points to take place close to the centerline of the machine and thus at theoretically correct locations for instigating the start of a bend.

The tension or load required to pull the wire through the straightener is supplied by the web bender, thus assuring exact synchronization of feed into and through the bender.

The embodiments of the invention in which an exclu-

sive property or privilege is claimed are defined as follows:

1. A machine for fabricating automatically a light weight truss having a pair of chords of strip material and a wire web welded to the said chords, the said machine comprising a pair of cold forming units to shape the said chords from a continuous strip of material, the said cold forming units being located on either side of the centre line of the machine, a web bender on said centre line of the machine, the said web bender having a series of slidable tongues adapted to bend the said wire web into a continuous series of V shapes in the plane of said pair of chords, means to guide the said chords into juxtaposed relation with the apices of the said V shaped formed web, a drive for said web bender and said cold forming units, the said drive continuously moving the said pair of chords through the said machine, a pair of resistance welding means located beyond the said web bender, the said welding means welding the apices of the said V shaped web to the said pair of chords, a carriage on which the said welding means are mounted, means associated with said carriage to advance the carriage during the welding operation between pairs of opposing points of said web and the adjacent chords, means for disconnecting said carriage advancing means from the said drive when the welding operation is complete, and means to return the said carriage when the said carriage is disconnected from the drive means for the start of another welding cycle.

2. A machine according to claim 1, in which the said wire web is fed to the said wire bender along the centre line of the machine and the said strip material forming the said chords is fed at an angle on either side of the centre line of the machine to make contact with opposing apices of the formed wire web beyond the web bender.

3. A machine according to claim 1 in which a pair of camber preventing rolls straighten the formed truss as it leaves the machine.

4. A machine according to claim 1 in which straightening means for said chords are interposed between said cold forming units and the point of contact of the chords with the said formed wire web.

5. A machine according to claim 2, in which centering devices for said chords alternate with the said guide rollers.

6. A machine according to claim 1, in which a wire straightener is located ahead of the said wire bender.

7. A machine according to claim 1 in which the said web bender comprises two co-planer sets of web-engaging tongues movable to project from opposite sides into a common central zone at the centre line of the machine, and means to advance the said tongues into said zone from opposite sides through the said zone with the tongues of one set alternating with the tongues of the other set.

8. A machine according to claim 1 in which the said web bender comprises two co-planer sets of web-engaging tongues movable to project from opposite sides into a common central zone at the centre line of the machine, and means to advance the said tongues into the said zone from opposite sides with a rotary and translational movement through said zone perpendicularly to the direction of movement with a lateral translational movement and with the tongues of one set alternating with the tongues of the other set, and out of said zone with a rotary and translational movement.

9. A machine according to claim 1 in which the said web bender has two co-planer closed tracks with facing sides, a set of endlessly connected links mounted on each track, a web-engaging tongue mounted on each link, means to turn said links around said track in unison, said facing sides of said tracks defining a central zone wherein said tongues are advanced with the tongues of one set alternating with the tongues of the other set.

10. A machine according to claim 1 in which the said web bender has two co-planer closed tracks with straight facing sides and rounded ends, a set of endlessly connected links riding each track, a web-engaging tongue mounted on each link perpendicular thereto and longitudinally slidable with respect to the link, means to turn said links around said tracks in unison, said facing sides of said tracks defining a central zone wherein said tongues are advanced with the tongues of one set alternating with the tongues of the other set, and means backing said tongues to keep them at a constant endwise position through said central zone.

11. A machine according to claim 1 in which the said web bender has two co-planer closed tracks with straight facing sides and rounded ends, a set of endlessly connected links riding each track, a web-engaging tongue mounted on each link perpendicular thereto and longitudinally slidable with respect to the link, means to turn said links around said tracks in unison, said facing sides of said tracks defining a central zone wherein said tongues are advanced with the tongues of one set alternating with the tongues of the other set, a cam inside each set of links, a cam follower on each tongue, said cams having their sides adjacent said central zone straight and parallel with said facing sides of said tracks.

12. A machine according to claim 11, wherein the said means to turn the said links around the said tracks includes a driven sprocket engaging the links of one of said sets of links.

13. A machine according to claim 11, wherein said links comprise rollers riding said tracks, the said rollers being co-axial with the pivotal connections between said links.

14. A machine according to claim 11, wherein springs urge the said tongues with their cam followers into engagement with said cams.

15. A machine according to claim 11, wherein the said tracks have at least their four remote quadrant areas of their rounded ends reduced to a curvature radius greater than half the spacing of opposite sides of said tracks.

16. A machine according to claim 11, wherein the said tracks have the remote sides thereof curved.

17. A machine according to claim 11, wherein a space is provided in said links at the pivotal connections between links, the tongues of one set of links extending into said space, and anvils being provided in said links on either side of said space, said anvils engaging diagonal portions of a web being formed to ensure straight diagonal sections between apices of the formed web to increase the compression and tension resistance of the web.

18. A machine for fabricating automatically a light weight truss having a pair of chords of strip material and a wire web welded to the said chords, the said machine comprising a pair of cold forming units each including a plurality of pairs of rollers between which the said chords are shaped from continuous strips of material, the said cold forming units being located on either side of the centre line of the machine, a web bender on said centre line of the machine, the said web bender comprising meshing tongues adapted to bend the said wire web from a continuous wire into a series of V shapes in the plane of the said pair of chords, means to slide the said tongues into and out of meshing engagement with the said wire web, a guide for said bent web, rollers to guide said chords into juxtaposed relation with the said web after it leaves the said guide, a drive for said web bender and said cold forming units, the said drive continuously moving the said pair of chords through the machine, a pair of resistance welding means located beyond the said web bender and guide, a carriage on which the said pair of welding means are mounted, means to advance the said carriage, transmission means connecting said drive unit with said advancing means, said transmission means including a clutch,

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means driven by said drive unit to connect and disconnect said clutch alternately to synchronize the advance of said carriage with the operation of said web bender and said cold forming units, means actuable by the said carriage when it is advanced to actuate the said welding means to weld a pair of opposing V bends of the wire web to adjacent chords, and means urging said carriage in return direction and taking effect when the said clutch is disconnected to complete a welding cycle.

19. A machine for fabricating automatically a light weight truss having a pair of chords of strip material and a wire web welded to said chords, the said machine comprising a pair of cold forming units including a plurality of pairs of rollers between which the said chords are shaped from a continuous strip, the said cold forming units being located on either side of the centre line of the machine, a web bender on said centre line of the machine and comprising meshing slidable tongues individually movable to bend the said wire web into a continuous series of V shapes in the plane of said pair of chords, a centering guide for the formed web, rollers to guide the said chords into juxtaposed relation with the apices of the said V shaped formed web, drive means for said web bender and for said forming units, the said drive means continuously moving the said pair of chords through the said machine, a pair of resistance welding means located beyond the said web bender, the said welding means welding the apices of

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said V shaped web to the said pair of chords, a carriage on which the said welding means are mounted, means associated with the said drive means to advance the said carriage in synchronism with the said cold forming units and with the said web bender, means actuable by said carriage when it is advanced to actuate the said welding means, means to disconnect the said advancing means from said drive when the welding operation on a pair of opposing apices of the bent web to the adjacent chords is completed, and means to return the said carriage when the said carriage is disconnected from the drive means for the start of another welding cycle.

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