# United States Patent [19]

**Peters et al.**

[11] **3,869,036**

[45] **Mar. 4, 1975**


[54] **I BEAM NESTING AND STACKING METHOD AND APPARATUS**


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[73] Assignee: **Trus Joist Corporation,** Boise, Idaho



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[21] Appl. No.: **352,879**

[52] **U.S. Cl.** ..... **198/35,** 100/2, 214/6.5

[51] **Int. Cl.** ..... **B65g 57/16**

[58] **Field of Search** ..... 198/35, 34; 214/6.5, 7, 214/10.5 R; 100/2, 7; 206/386, 526, 527; 29/155 R



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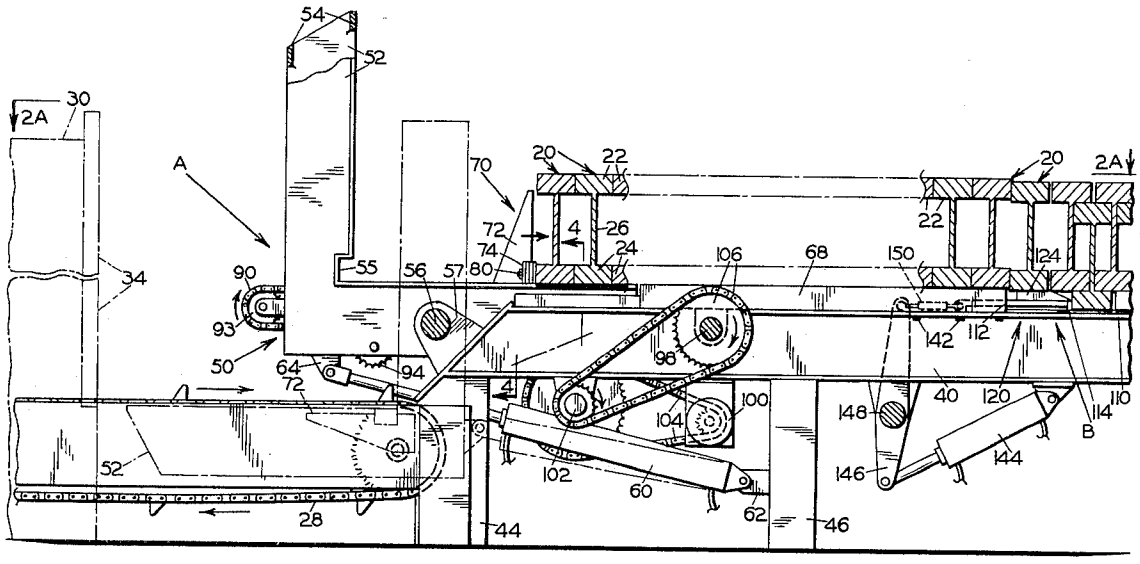
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*Assistant Examiner*—Richard K. Thomson
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[57] **ABSTRACT**

I beams are nested and stacked in horizontal bundles preliminary to transporting and storing them by arranging a selected number of I beams in side by side substantially aligned relation to each other. The I beams then are advanced laterally while shifting the leading I beam edgewise until its chords lie in a different plane than do the chords of the immediate following I beam. The two I beams then are telescoped together. The following I beams are similarly nested to provide an I beam assembly which may be tied into a bundle.


**21 Claims, 19 Drawing Figures**



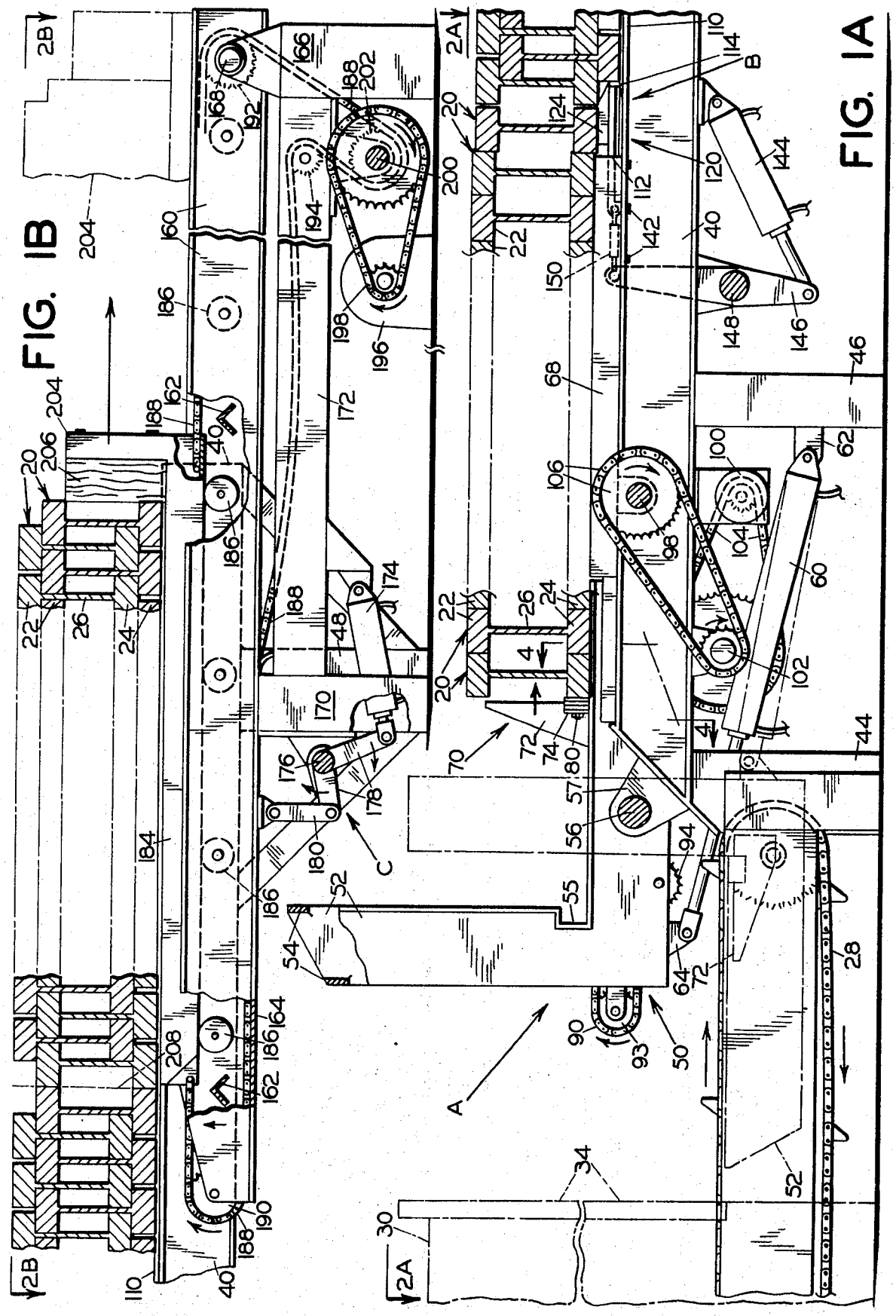


FIG. 1A

FIG. 1B

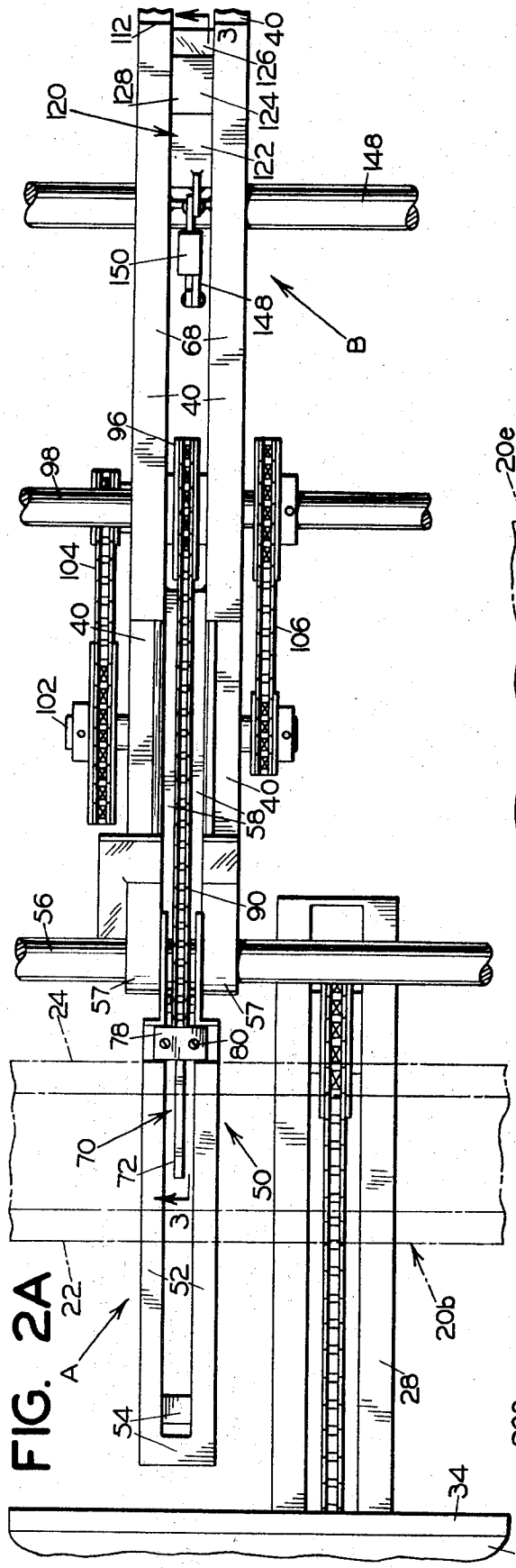


FIG. 2A

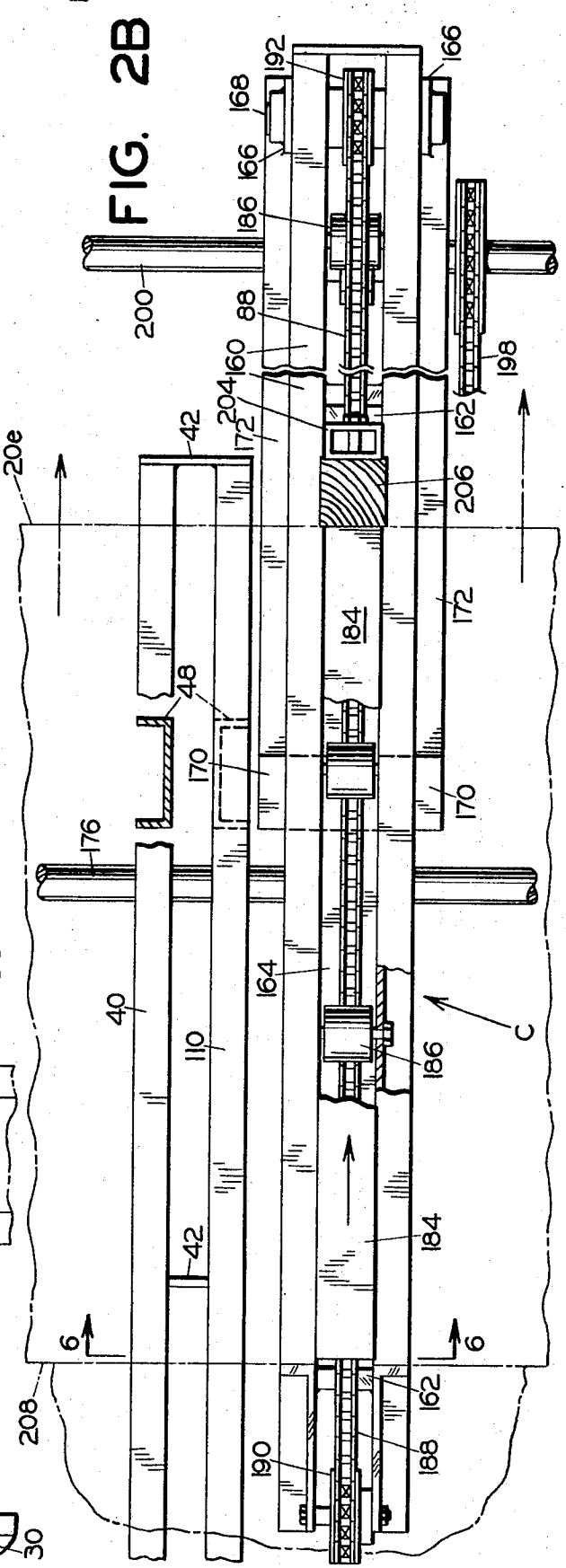


FIG. 2B

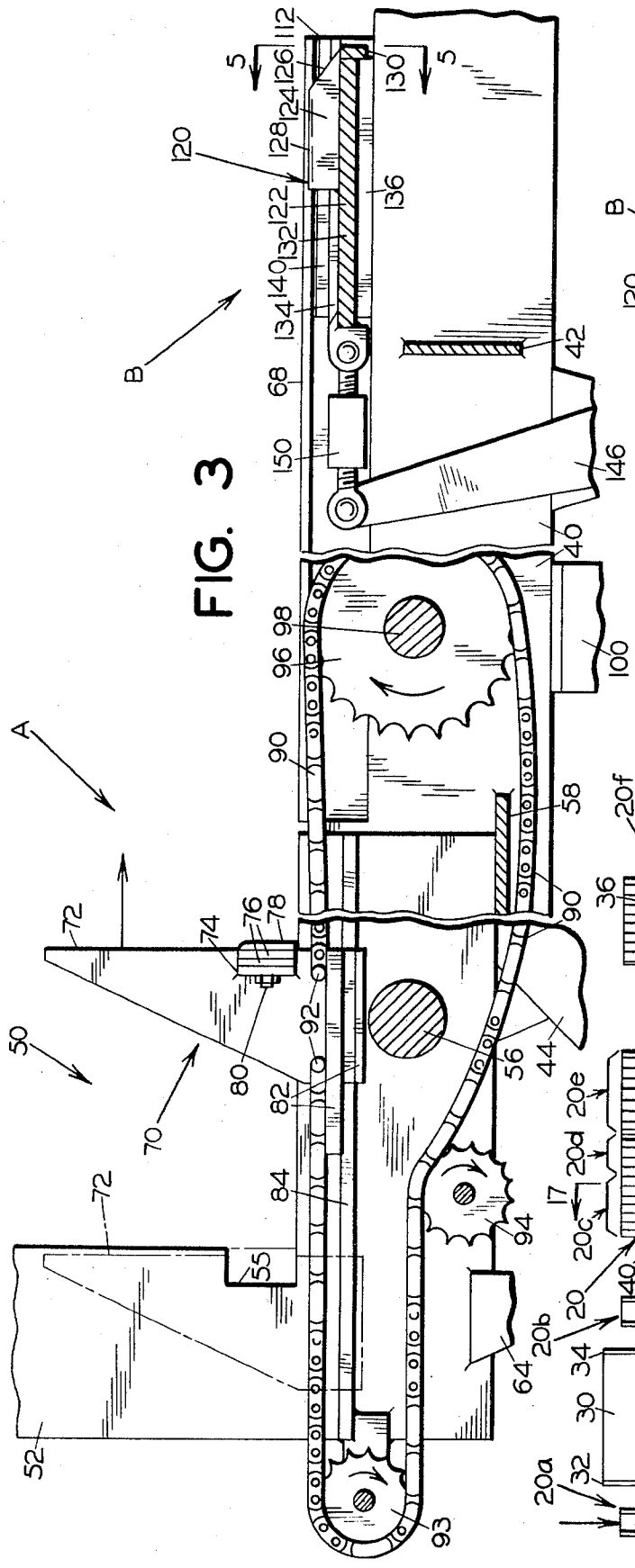


FIG. 3

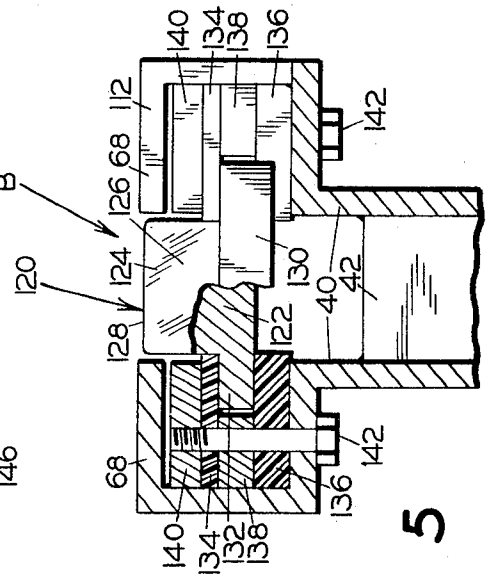


FIG. 5

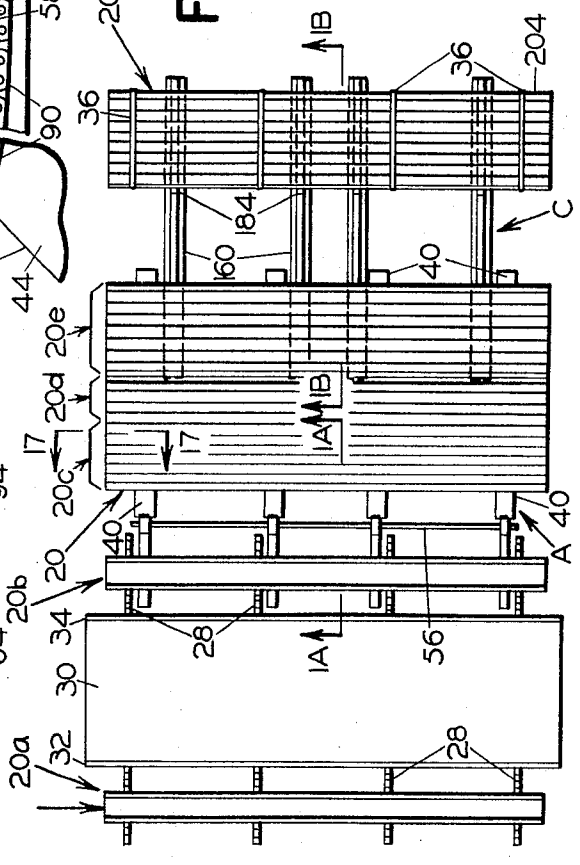


FIG. 7

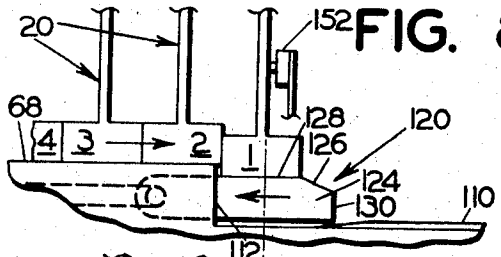



FIG. 8

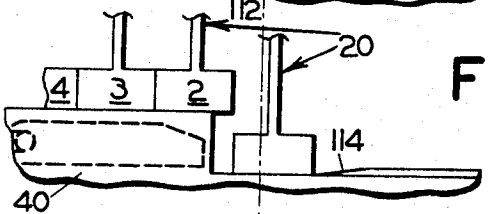



FIG. 9

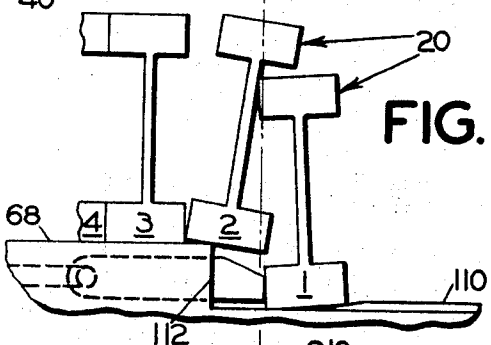



FIG. 10

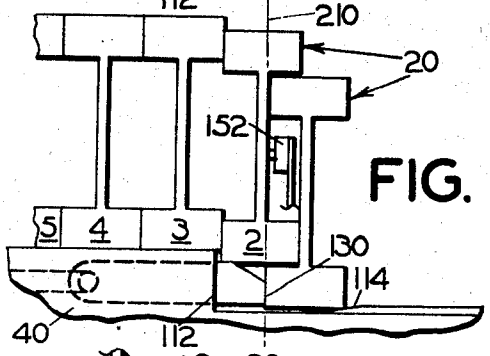



FIG. 11

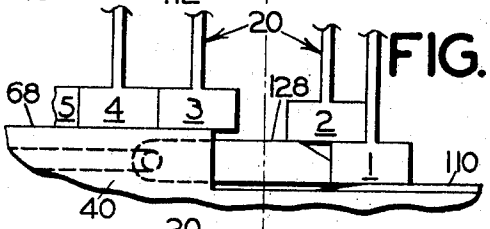



FIG. 12

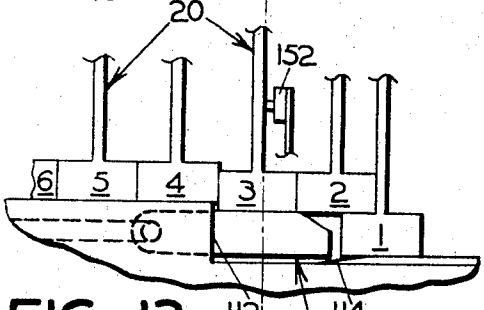



FIG. 13

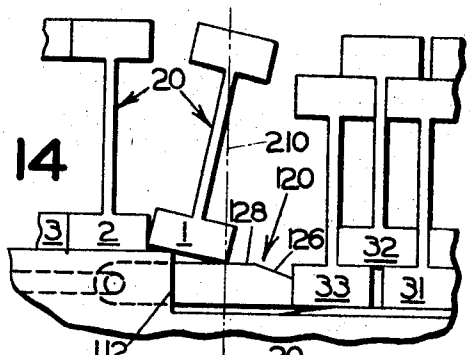



FIG. 14

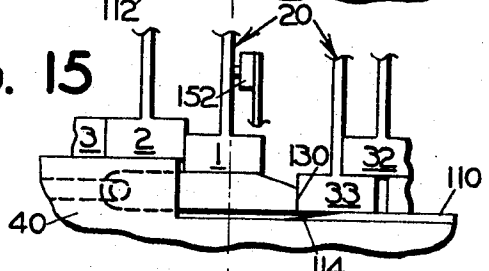



FIG. 15

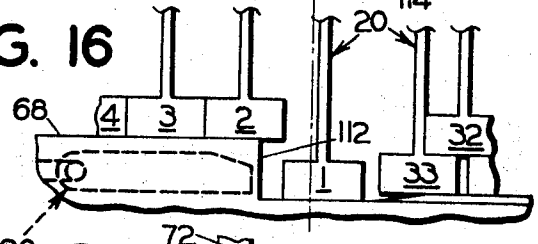



FIG. 16

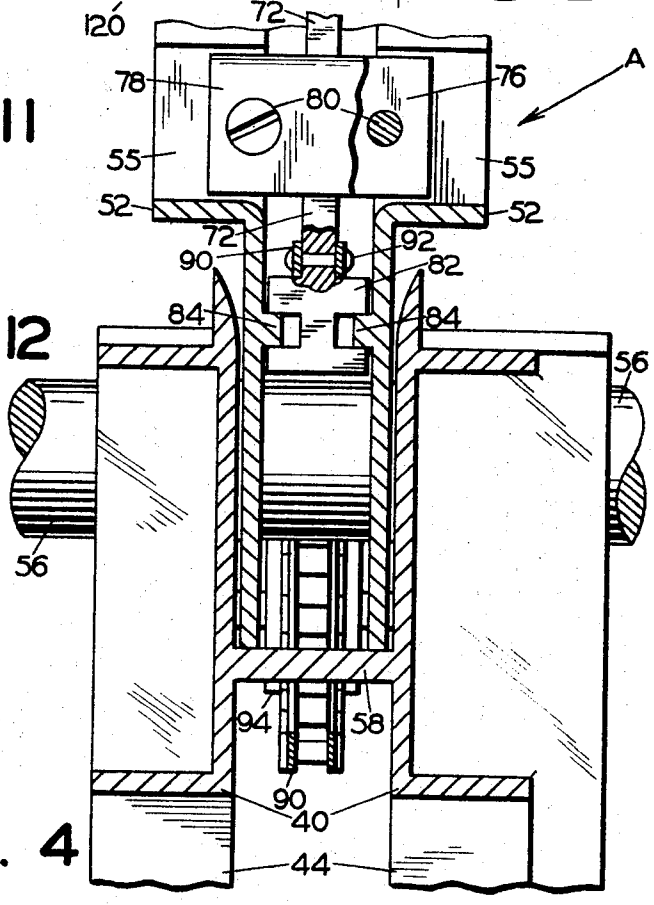



FIG. 4

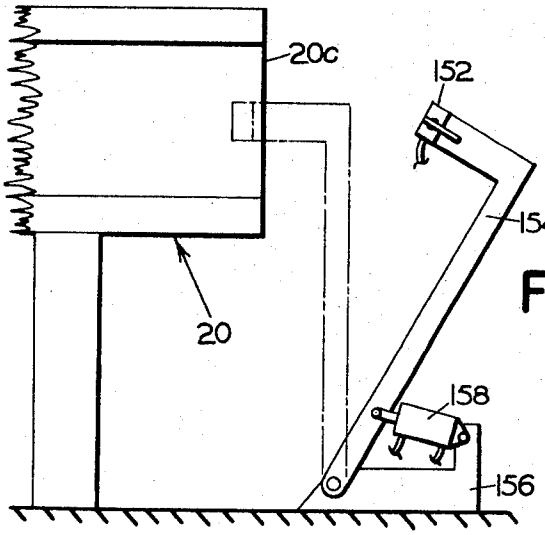

20c
152
154
20
158
156

FIG. 17

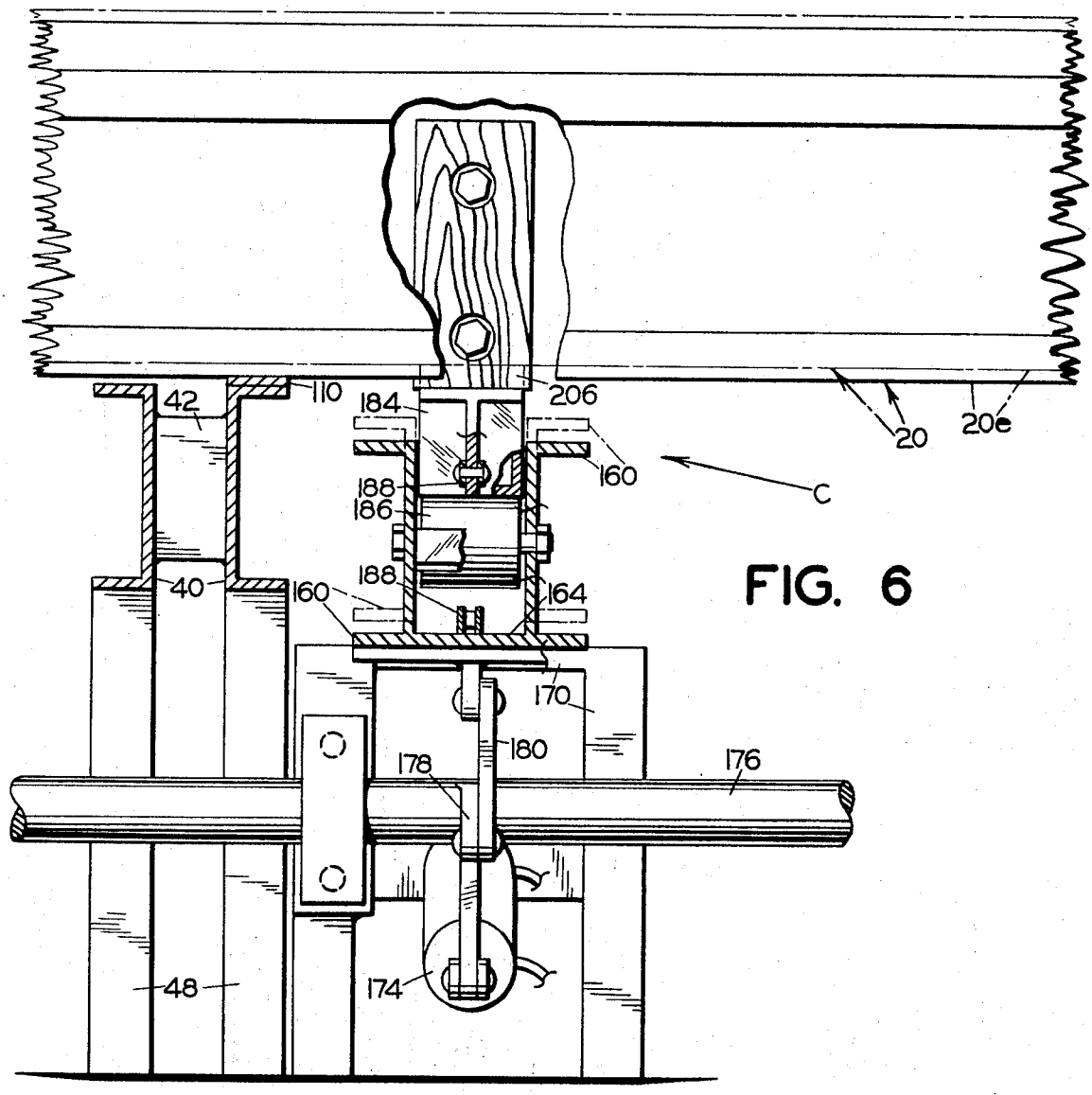

42
110
184
206
20
20e
160
C
188
186
40
188
160
164
170
180
178
176
48
174

FIG. 6

# I BEAM NESTING AND STACKING METHOD AND APPARATUS

## BACKGROUND OF THE INVENTION

This invention relates to method and apparatus for nesting and stacking I beams, particularly wooden I beams, so that they may be transported and stored with facility.

With the advent of automated machinery for producing wooden I beams of great length, i.e., of the order of 80 feet or more, it has become important to develop an automated method for nesting the beams with their chords in lapped relation so that they may be moved about and stored with convenience and economy. This is a matter of considerable difficulty in view of the great length of the beams and their substantial weight.

It accordingly is the general object of the present invention to provide method and apparatus for nesting and stacking structural I beams in bundles of a convenient size for transportation and storage.

It is a further object of the present invention to provide method and apparatus for nesting structural I beams as they are produced on the large scale in a commercial production line at a nesting rate which is commensurate with the production rate, without damaging the I beams, and using a minimum of operating personnel.

Still a further object of the present invention is the provision of apparatus for nesting and bundling on an automated basis structural I beams which are of such great length and weight that they may be nested and bundled manually only with great difficulty and with potential hazard to the handlers.

## GENERAL STATEMENT OF THE INVENTION

The foregoing and other objects of the invention are accomplished by the provision of a method for nesting I beams which basically comprises first arranging a plurality of I beams in side by side substantially aligned relation to each other. The I beams then are advanced laterally. As they are advanced, the leading or first I beam is shifted edgewise until its component chords lie in a different plane than do the chords of the immediately following or second I beam. Next the second I beam is advanced relative to the leading I beam until the leading portions of its chords lap the trailing portions of the chords of the leading I beam. The next succeeding or third I beam then is advanced laterally relative to the second I beam in the plane of the first I beam until the leading portions of its chords lap the trailing portions of the chords of the second I beam. This sequence is repeated until the selected number of I beams have been telescoped together and nested in an aggregate assembly having a convenient size for bundling.

## DESCRIPTION OF THE DRAWINGS

FIGS. **1***a* and **1***b* are views in side elevation of the hereindescribed I beam nesting apparatus, partly broken away to show interior construction, FIG. **1***b* being a continuation of FIG. **1***a*, taken along lines **1***a*,**1***a* and **1***b*,**1***b*, respectively of FIG. **7.**

FIGS. **2***a* and **2***b* are plan views of the apparatus, partly in section and partly broken away, FIG. **2***b* being a continuation of FIG. **2***a*, looking in the direction of the arrows of lines **2***a*,**2***a* and **2***b*, **2***b*, respectively, of FIGS. **1***a* and **1***b*.



FIG. **3** is an enlarged view in side elevation taken along line **3—3** of FIG. **2***a* and illustrating particularly an I beam infeed and rotating conveyer subassembly.

FIG. **4** is an enlarged, detailed, transverse sectional view of the same subassembly, taken along line **4—4** of FIG. **1***a*.

FIG. **5** is an enlarged, detail, transverse fragmentary sectional view taken along line **5—5** of FIG. **3.**

FIG. **6** is a detailed transverse sectional view taken along line **6—6** of FIG. **2***b*.

FIG. **7** is a diagrammatic plan view of the operating layout including the hereindescribed I beam nesting and stacking apparatus as a component.

FIGS. **8–16** inclusive are sequential diagrammatic views illustrating the manner of operation of the hereindescribed apparatus and

FIG. **17** is a view in side elevation taken along line **17—17** of FIG. **7** and illustrating a sensing unit which is a part of the control for the apparatus.

## DESCRIPTION OF A SPECIFIC EMBODIMENT

### The General Plan

The general plan of a plant installation which includes the hereindescribed I beam nesting and stacking apparatus is illustrated in FIG. **7.**

The apparatus is designed to nest and stack a predetermined number of I beams indicated generally throughout the drawings at **20** (see especially FIG. **1***a*). As noted above, the I beams normally comprise wooden I beams of great length, for example 40–100 feet in length, and of substantial weight and strength. Each I beam comprises an upper chord **22,** a lower chord **24** and a connecting web **26.**

Such I beams presently are the subject matter of automated apparatus for their manufacture. In this procedure the opposite side margins of plywood webs are inserted into glue moistened grooves in the opposed side faces of a pair of traveling chords. The chords and webs then are assembled into I beams which leave the machine in a self sustaining condition, but one in which the glue has not been fully cured. The final step in the manufacturing procedure is to pass the I beams through an oven at a rate predetermined to set the glue.

As the finished I beams leave the forming machine, they are stacked flatwise with their respective chords bearing against each other in a stack of predetermined height. In the illustrative example the vertical stack **20***a* contains eleven I beams, all with their glue content incompletely cured.

The stack is placed on a conveyor **28** which feeds it laterally into an oven indicated schematically at **30.** The oven is fitted with doors **32, 34** at its entrance and exit respectively. The I beams are moved into the oven on conveyer **28** and remain there a sufficient length of time to cure the glue. The vertical stack **20***b* contains eleven cured I beams. It is conveyed away from the oven and transferred to the hereindescribed nesting apparatus.

The nesting operation is continuous, the I beams passing through the nesting apparatus laterally and in sequence. They are nested in groups containing a sufficient number of component I beams to provide a finished bundle of desired size. In the example, the bundle contains **33** I beams and accordingly is composed of three of stacks **20***b*.

The progression of the I beams through the apparatus is illustrated in FIG. **7.** A turned horizontal stack con-

tains eleven I beams. Unnested I beams, seven of them, are indicated at **20***c*. Nested I beams, four of them, are indicated at **20***d*. A completely nested group of **33** I beams is indicated at **20***e*.

The nested group in its aggregated condition is discharged from the apparatus, wrapped with ties, which normally comprise stout metal straps, and the resulting bundle **20***f* transferred by crane to railroad car, truck or storage.

The apparatus of the invention basically comprises three major subassemblies.

The first is a rotating infeed conveyer subassembly, indicated generally at A, which receives each vertical stack **20***b* from oven **30,** rotates it 90° to the condition of a horizontal stack, and feeds the I beams on edge into the nesting unit of the assembly.

The second is the nesting subassembly, indicated generally at B. This has for its function telescoping the adjacent I beams laterally with the chords of alternate ones in a first plane and the chords of the intermediate ones in a second plane, thus compacting the I beams so that they are more easily handled and require less space.

The third subassembly, indicated generally at C, is the off-bearing conveyer. It has for its function transferring the nested I beams to a bundling and loading station where they are tied together and carried away by the crane.

Considering these in order:

The Rotating Infeed Subassembly

As noted above, the rotating infeed conveyer subassembly has for its function receiving from oven **30** a vertical stack of I beams **20***b* arranged flatwise face to face, rotating it through 90°, thereby converting it to a horizontal stack wherein the I beams are placed on edge, and transferring the I beams in continuous flow to the nesting subassembly. Its construction and manner of operation are indicated particularly in FIGS. **1***a*, **2***a*, **3** and **4.**

The rotating infeed conveyer subassembly A is mounted on a common frame with the nesting subassembly B. These frames are multiple, laterally across the machine, as seen in FIG. **7.** There are four in the illustrated embodiment. However, this number can be varied as desired depending upon such factors as the length and weight of the I beams being processed.

Each supporting frame comprises a pair of longitudinally extending, laterally spaced, parallel channel members **40** tied together by tie plates **42.** The resulting composite longitudinal frame member is supported on a plurality of spaced posts **44, 46, 48.**

At the upstream end of the frame there is mounted a cradle member indicated generally at **50.** It has for its functions receiving a vertical stack **20***b* of the I beams, rotating it through 90° and thereby converting it to a horizontal stack, and transferring the horizontal stack to the downstream processing units.

In the illustrated form, cradle member **50** comprises an L-shaped unit consisting of two parallel, spaced angled plates **52** interconnected by tie plates **54** and formed in two segments lying at substantially right angles to each other.

The outer segment, with reference to the machine direction, has a notch **55** the purpose of which will appear hereinafter.

The inner segment is fixed to a substantial drive shaft **56** mounted in bearings **57.** This shaft may extend completely across the machine, driving all of the cooperating cradle assemblies.

The inner segment is supported in its I beam transferring position by a support plate **58** which bridges the companion channel beams comprising longitudinal frame members **40.** Plate **58** also serves as a stop which precisely locates the inner segment in the desired operating position of I beam transfer.

Drive means is provided for shifting cradle member **50** between its two angular positions, FIG. **1***a*. Since all of the component cooperating units of the machine may be tied together, a single drive suffices.

As illustrated in FIG. **1***a*, the reciprocating drive comprises a fluid operated cylinder, preferably an hydraulic cylinder **60.** The base of the cylinder is pivotally connected to a bracket **62** mounted on support post **46.** The piston rod of the cylinder is pivotally coupled to a bracket **64** suitably located on the underside of the angular cradle member.

Reciprocation of the cylinder results in shifting the angular cradle member through 90°, i.e., between the ghosted line receiving position and the solid line transferring positions of FIG. **1***a*. This in turn results in shifting the position of the I beams from a vertically stacked face to face arrangment to a horizontally stacked edge to edge arrangement, as is also apparent in that figure.

Suitable conveying means is associated with cradle members **50.** This member of the assembly serves the function of driving the I beams in their edge-abutting relationship continuously in the machine direction. The construction of the conveying system employed is shown particularly in FIGS. **3** and **4.**

In its horizontal position, upper surface of the inner segment of angular cradle member **50** merges and is coplanar with the upper surface of a pair of skid bars or tracks **68** mounted on the upper surface of the longitudinal frame member. It is the function of the conveyer associated with the cradle member to slide the I beams in a continuous drive off the cradle member and along skid bars **68.**

For this purpose there is provided a drive trolley indicated generally at **70,** FIGS. **3** and **4.** The trolley comprises a vertical support plate **72** having a height substantially equal to the height of the I beams which it pushes, and a triangular outline in side elevation to develop the desired strength.

Its front face is notched and receives a pad assembly comprising a transverse mounting plate **74** welded across the leading edge of support plate **72,** a plurality of spacers **76,** and a face plate **78** of bearing material designed to bear against and drive the horizontal stack of I beams. All of these members are held together by means of bolts **80.**

The trolley is supported by an H-slide **82** which is integral with the bottom edge of support plate **72.** The slide engages a track **84** which is integral with the inner faces of the component plates of cradle member **50.**

A suitable drive is provided for reciprocating drive trolley **70** between a retracted position wherein it is received within the outer segment of cradle member **50,** with pad **78** nesting in notch **55** of the outer cradle segment, i.e., the dashed line position of FIG. **3,** and an advanced position wherein it drives the I beams off the inner segment of the cradle member, i.e., the full line position of FIG. **3.**

To accomplish this function, a drive must be provided which can adjust to the angular movement of cra-

dle member **50** as it swings between its two positions.

Accordingly, there is provided a reciprocating endless chain drive including an endless chain **90** the ends of which are pegged to drive trolley **70** by means of posts **92.** The chain is supported on an outer idler sprocket **93,** a central idler sprocket **94,** and a drive sprocket **96.** The latter is keyed to a substantial shaft **98** which may be continuous through all of the multiple conveying units of the machine to drive them from a single power source.

The power source is indicated in FIG. **1***a*. It comprises a motor **100** which drives a cross shaft **102** by means of a chain and sprocket assembly **104.** Shaft **102** in turn drives drive shaft **98** and associated sprocket **96** via chain and sprocket assembly **106.**

Motor **100** is a reversing motor which accordingly reciprocates I beam drive trolley **70** between controlled limits of advancement and retraction.

In the operation of the drive trolley, it continuously advances the horizontal stack of I beams in the machine direction to the next processing unit. This is the I beam nesting subassembly.

The I Beam Nesting Subassembly

The I beam nesting subassembly has for its function shifting the vertical position of alternate ones of the I beams to a uniform second plane and then telescoping all of the I beams together so that they lie in nested horizontal relation to each other. This makes a stable, compact assembly suitable for bundling and future handling.

The I beam nesting subassembly B, FIGS. **1***a*, **2***a*, **3** and **5,** includes first conveyer means and second conveyer means, the latter being aligned with the first and operating as an extension of it. However, it is located on a different plane. The height differential between the planes of the two is somewhat more than the thickness of the component bottom chords of the I beams being processed.

The first conveyer means employed in the I beam nesting subassembly comprises a combination of skid bars **68** supported on longitudinal frame members **40** and I beam drive trolley **70** which skids the stack of unnested I beams in edge-abutting relation along the length of the skid bars. The second conveyer means comprises skid bars **110** which also are supported on longitudinal frame members **40.** These serve as extensions of skid bars **68,** but in a different plane.

At the junction between skid bars **68** and skid bars **110** there is present an angular break or step **112** over which the I beams must pass. At the infeed ends of skid bars **110** there is an upwardly inclined ramp **114.** Both of these component parts of the nesting subassembly serve to tilt the moving I beams in such a manner as to facilitate their nesting, as will be described.

The drive for the I beams in nested condition as they traverse skid bars **110** comprises a ram indicated generally at **120.** This component of the subassembly is mounted between longitudinal frames **40** below the plane of skid bars **68** but above the plane of skid bars **110.** It works in the feed direction and serves three important functions.

First, it serves as a stepwise drive, driving the I beams incrementally along the length of skid bars **110.** Second, it serves as an underlying support for the I beams individually as they traverse the step present between skid bars **68** and skid bars **110.** Third, it serves as a tilting component of the assembly which assists in tilting the I beams to facilitate their nesting.

The construction of ram **120** is shown particularly in FIGS. **3** and **5.**

It comprises a longitudinally arranged base plate **122** which mounts a pad **124.** The pad is provided with an inwardly beveled leading clearance surface **126.** Pad **124** also has a horizontal bearing surface **128** which serves as an underlying support surface for the I beams as they are transferred from one to the other of the two skid bars.

The leading end of base plate **122** mounts a vertical bearing plate **130** which bears against the side edges of the lower chords of the I beams and pushes them along the skid bars.

Ram **120** is mounted for sliding movement by means of a pair of lateral extensions **132** on each side which serve as slides. The slides work in tracks housed by skid bars **68,** FIG. **5.**

Each track comprises upper and lower track plates **134, 136** made of a low friction material such as Nylon. The track plates are separated by a spacing plate **138.** The components of the assembly are clamped together in operational relation by means of a clamp plate **140** and clamp bolt **142.**

Suitable drive means is connected to ram **120** for adjusting it between three positions: The fully extended position of FIG. **1***a*, the fully retracted position of FIG. **3,** and an intermediate position of FIG. **10** in which it is part way extended.

The drive comprises a fluid operated cylinder, specifically an hydraulic cylinder **144.** The base of the cylinder is pivotally mounted to the underside of frame **40.** Its piston is pivotally connected to the lower end of a lever **146** which is rigid to a substantial drive shaft **148.** The shaft also is mounted to the underside of frame **40.** As in the case of the drives of the other subassemblies, drive shaft **148** may extend across the entire width of the machine thereby making it possible to serve several of the nesting subassemblies from a single cylinder **144.**

The upper end of lever **146** is coupled pivotally through an adjusting turn buckle **150** to the rearward end of base plate **122** of the ram. Accordingly, by adjusting cylinder **132** between its three positions, the position of the ram can correspondingly be adjusted to its three operational positions.

Suitable control means are provided for controlling the operation of ram **120** and drive trolley **70** as required to coordinate these units for accomplishing the desired nesting and stacking of the I beams. The control system is not described in detail, comprising as it does conventional control units. However, one of the key control components is illustrated in FIG. **17.**

This control component comprises a limit switch **152** which is positioned at the nesting station and serves to coordinate the advancing and retracting motions of ram **120** with the continuous drive of trolley **70.**

The limit switch is in an electric circuit with the actuating element for cylinder **144.** It is supported on a vertical, angular bar **154.** This bar is several feet long and is mounted on a base plate **156.**

A double acting, fluid operated cylinder **158** oscillates the bar in a timed sequence between an advanced dashed line position and a retracted full line position. In the advanced position its sensing element contacts one of I beams **20** if the latter is in a processing position. Switch **152** then energizes the circuit controlling

cylinder **144,** as will be described more fully hereinafter.

The Offbearing Conveyor Subassembly

When a sufficient number of I beams have been nested together, they are separated from the train of I beams accumulating on skid bars **110** and transferred to a downstream station for bundling preliminary to transporting them to storage or the job site. The offbearing conveyer used for effectuating this transfer is illustrated in FIGS. **1***b*, **2***b*, and **6.**

The offbearing conveyer subassembly C basically comprises a tilt conveyer arranged parallel to and lapping the conveyer systems heretofore described. It rests in retracted position while a nested stack of I beams accumulates on skid bars **110.** When a stack of the desired size has accumulated, the tilt conveyer tilts upwardly into operative position and conveys the stack away.

The tilt conveyer subassembly is mounted on a frame comprising a pair of channel members **160** arranged side by side, parallel to each other and interconnected by tie plates **162** as well as by a base plate **164.**

The downstream end of the frame is supported pivotally on posts **166** by means of a pivot pin **168.**

The frame is supported intermediate its ends on intermediate support posts **170** tied to posts **166** and braced by means of longitudinal frame braces **172.**

The drive for the offbearing conveyer, which adjusts it vertically between the full line retracted position of FIG. **6,** wherein the frame rests on posts **170,** and the dashed line position, wherein it engages the nested I beams, comprises a fluid operated cylinder **174.**

The base of the cylinder is pivotally connected to a bracket depending from longitudinal brace **172.** The piston rod of the cylinder drives a rock shaft **176** by means of bell crank lever **178** which is rigid to the rock shaft. As in the case of the drives of the other subassemblies, rock shaft **176** may extend the entire width of the machine and drive all of the offbearing conveyer frames. A link **180** connects the ends of lever **178** with a suitably positioned bracket on the underside of channel members **160.**

The latter members mount a carriage which in the elevated position of the frame contacts the nested I beams and conveys them in the downstream feed direction. It comprises an elongated box bar **184** positioned between the frames and having a flat upper surface designed to bear against the underside of the I beams.

The lower surface of the bar engages a plurality of longitudinally spaced rollers **186** rotatably mounted between channel members **160** and below the bar, in longitudinally spaced relation.

The drive for the carriage comprises a reversible chain **188** having its ends pinned to the opposite ends of the carriage.

Drive chain **188** is supported at the upstream end on sprocket **190**; at the downstream end, by sprocket **192.** Its lower stretch is supported and guided by an idler sprocket **194** as well as by base plate **164** of the frame.

The drive for the chain comprises a reversible motor **196** connected by chain and sprocket assembly **198** to a drive shaft **200.** This drive shaft, too, may extend the entire width of the machine and service several units. It mounts a sprocket **202** which meshes with chain **188,** thereby driving the carriage reversibly between its retracted full line position of FIG. **1***b* and its advanced dashed line position of the same figure.

Positioning means are present on carriage **184** for positioning the nested stack of I beams precisely thereon, thereby determining the exact number of nested I beams loaded onto the carriage.

As indicated particularly in FIGS. **1***b* and **6,** the positioning means comprise a vertical plate **204** to which is bolted a wooden bumper or abutment **206** against which the nested I beams are driven by the action of ram **120.** When the desired number of nested I beams has been located above the offbearing conveyer, cylinder **174** elevates the conveyer frame. This lifts carriage **184** into bearing engagement with the nested I beams, separating the selected number along the separation plane **208** of FIG. **1***b*.

Motor **196** drives the carriage in the outfeed direction to the dashed line position of FIG. **2***b*. As indicated in FIG. **7,** ties **36** then may be applied to the nested I beams, thereby bundling them preparatory to transferring them to another site.

## OPERATION

The operational sequence of the hereindescribed I beam nesting and stacking apparatus is as follows:

Referring first to FIG. **7,** a stack **20***a* of wooden I beams, assembled but without the glue having been completely cured, is advanced by means of conveyers **28** into a glue curing oven **30.** After the predetermined dwell time in the oven, the stack, still in the vertical position, is conveyed out of the oven by the same conveyer. The cured vertical stack **20***b* then is transferred to the rotating infeed conveyer A wherein the component angular cradle members **50** rotate the stack 90° in the feed direction, thereby converting it to a horizontally disposed stack **20***c* of I beams having their margins in edge-abutting relationship.

Drive trolley **70** then advances at a controlled and predetermined rate. It engages the trailing I beam and skids all the I beams along skid bars **68.** This feeds them into the nesting subassembly B, FIGS. **1***a* and **3.**

The function of the latter subassembly basically is to shift the vertical position of alternate I beams until the chords of the same are out of registration with the chords of the intermediate I beams, all the while advancing the trailing I beams laterally. This telescopes the I beams by lapping the leading and trailing portions of the chords, thereby nesting the I beams.

The sequence by which this is achieved may be explained best with reference to FIGS. **8** to **16** inclusive.

In interpreting these figures it is to be kept in mind that the chords in edge-abutting relation are driven continually along skid bars **68** by means of drive trolley **70** which bears against the trailing one of the I beams. The I beams eventually reach tilt plane or step **112** where they transfer to skid bars **110.** The I-beams in nested condition on skid bars **110** are driven intermittently by ram **120.** It is in the interval of transfer that the nesting of the I beams takes place.

The sequences are initiated by sensing unit **152** which is always at the action line **210,** but which is represented pictorially only at the intervals at which it functions.

FIG. **8** illustrates the starting condition of the nesting subassembly. Ram **120** is fully extended. The I beams are being pushed continually along skid bars **68** by drive trolley **70.** The leading I beam No. **1** has dropped onto the upper bearing surface of ram **120** and has energized sensor **152.** This causes the ram to retract fully,

FIG. 9, and I beam No. 1 to drop to the plane of the underlying second conveyor, in front of the ram.

Continuous progression of the trailing I beams causes I beam No. 2 to break over step or tilt plane 112 and accordingly to tilt in the outfeed direction. At the same time, or just before, ram 120 advances to its intermediate position of FIG. 10 and pushes the leading I beam No. 1 up ramp 114. This causes the I beam to tilt in the infeed direction.

Since the two I beams are on different planes, the consequence is to lap the leading portions of the chords of I beam No. 2 with the trailing portions of the chords of I beam No. 1.

Further progression of the I beams along skid bars 68 now drops tilted I beam No. 2 into a position where it is supported partly on the chords of I beam No. 1 and partly on the upper bearing surface of ram 120, i.e., the position of FIG. 11.

In this position of I beam No. 2, sensor 152 is actuated. This extends ram 120 to the fully extended position of FIG. 12. In this position, I beam No. 1 is fully supported on skid bars 110, I-beam No. 2 is supported partly on the chords of I beam No. 1 and partly on the bearing surface of ram 120; and I beam No. 3, being continually driven by drive trolley 70, is just about to break over step 112.

In the next stage of the operation I beam No. 3 is deposited on the upper bearing surface of ram 120 and is fully supported by the ram. It will be noted that its position is analogous to the position of I beam No. 1 in FIG. 8. In this position it activates sensor 152 which operates to retract ram 120 and the sequence of FIGS. 9–12 inclusive repeats.

This sequence repeats until the predetermined number of I beams (33 in the illustrative embodiment) have been nested together. This number is counted by positioning the nested I beams against abutment block 206 on offbearing carriage 184, FIG. 1b.

At this time a contact element, not illustrated, overrides the action of sensor 152. This causes the ram to be held in its extended position of FIG. 14. Drive trolley 72 then will deposit a new No. 1 I beam on top of the ram, as shown in FIG. 15. The ram then fully retracts, as shown in FIG. 16, dropping the No. 1 I beam to the top of the lower conveyer just ahead of skid bars 110.

The FIG. 16 position of the I beam corresponds to the FIG. 9 position. Accordingly the cycle repeats as previously described and illustrated in FIGS. 9–13 until an additional horizontal stack of 33 nested joists is deposited upon skid bars 110.

As each horizontal stack of nested I beams is completed, offbearing subassembly C is activated, FIGS. 1*b* and 2*b*. Accordingly, tilt conveyer 160 elevates and lifts the nested stack off the skid bars, separating it at the separation plane 208 of FIG. 1b. Carriage 184 then advances the stack to the dashed line position of FIG. 1*b*. This is the bundling station at which ties 36 are wrapped around the horizontal stack of nested I beams, preparing them for conveyance to storage or field application.

Having thus described the invention in preferred embodiments, we claim:

1. The method for nesting I beams comprising top and bottom chords and a connecting web, the method comprising:

a. arranging a plurality of I beams in side by side substantially aligned relation to each other,

b. advancing the I beams laterally,

c. shifting the first or leading I beam edgewise until its component chords lie on a different plane than do the chords of the second I beam,

d. advancing the second I beam laterally relative to the said first I beam until the leading portions of its chords lap the trailing portions of the chords of the first I beam, and

e. advancing laterally the third I beam relative to the second I beam in the plane of the first I beam until the leading portions of its chords lap the trailing portions of the chords of the second I beam, thereby arranging the I beams in nested relationship to each other.

2. The method of claim 1 wherein the I beams are advanced laterally in a substantially horizontal plane and shifted edgewise in a substantially vertical plane.

3. The method of claim 2 wherein the first I beam is shifted downwardly edgewise until its component chords lie on a lower plane than do the chords of the immediately following I beam.

4. The method of claim 1 including the step of tilting the first I beam sideways toward the second I beam in order to facilitate lapping the component chords thereof.

5. The method of claim 1 including the step of tilting the second I beam sideways toward the first I beam in order to facilitate the lapping of the component chords thereof.

6. The method of claim 1 including the steps of tilting the first I beam toward the second I beam and tilting the second I beam toward the first I beam in order to facilitate the lapping of the component chords thereof.

7. The method of claim 1 including the step of arranging the chords in edge-abutting relation to each other and pushing laterally on the trailing I beam for advancing all of the I beams simultaneously in a lateral direction.

8. The method of claim 1 including the step of tieing the nested I beams together into a bundle.

9. The method of nesting I beams comprising top and bottom chords and a connecting web, the method comprising:

a. arranging a plurality of I beams in side by side substantially aligned side edge-abutting relationship to each other,

b. advancing the I beams laterally by pushing laterally on the trailing I beam,

c. lowering the leading I beam edgewise until its component chords lie on a lower plane than do the chords of the immediately following I beam,

d. advancing the said immediately following I beam relative to the said leading I beam while tilting the two I beams toward each other until the leading portions of the chords of the immediately following I beam overlap the trailing portions of the chords of the leading I beam, and

e. advancing laterally the next succeeding I beam relative to the said immediately following I beam while in the plane of the leading I beam until the leading portions of its chords underlap the trailing portions of the chords of the said immediately following I beam, thereby arranging the I beams in nested relation to each other.

10. Apparatus for nesting I beams comprising top and bottom chords and a communicating web, the apparatus comprising:

a. conveyer means for laterally advancing a plurality of the I beams arranged in side by side substantially aligned relation to each other, and

b. I beam chord lapping means positioned for receiving the I beams from the conveyer means and shifting them edgewise and laterally for lapping the trailing edges of the chords of a given I beam with the leading edges of the chords of the next succeeding I beam thereby telescoping the chords together.

11. The apparatus of claim 10 including I beam tilting means for tilting one of an adjacent pair of I beams laterally toward the other for facilitating the lapping of their component chords.

12. Nesting apparatus for I beams having top and bottom chords and a connecting web, the nesting apparatus comprising:

a. first conveyer means for conveying laterally a plurality of the I beams in side by side relation to each other in a first vertical plane,

b. second conveyer means including reciprocating ram means arranged as an extension of the first conveyer means for receiving the I beams from the first conveyer means and conveying them laterally in a second vertical plane, and

c. step means positioned for traversal by the I beams as they transfer from the first to the second conveyer means,

d. the vertical separation of the two conveyer means being greater by a predetermined amount than the thickness of the I beam chords,

e. the ram means operable to advance the I beams laterally while positioning the bottom chords of alternate I beams on the second conveyer means and the bottom chords of the intermediate I beams on the bottom chords of the said alternate I beams, thereby telescoping the I beams and arranging them in nested relation to each other.

13. The apparatus of claim 12 wherein the ram means has an upper bearing support surface for supporting the I beams one at a time as they traverse the step means and transfer to the second conveyer means.

14. The apparatus of claim 12 wherein the ram means is provided with an upper bearing support surface for the I beams, the plane of said surface being below the plane of the first conveyer means by an amount predetermined to tilt a following I beam in the direction of a leading I beam as it transfers across the step means from the first to the second conveyer means.

15. The apparatus of claim 14 wherein the ram means has a downwardly tapered leading end to permit tilting of a following I beam toward a leading I beam as the following I beam transfers across the step means.

16. The apparatus of claim 12 including upwardly inclined ramp means on the second conveyer means a predetermined distance downstream from the first conveyer means for tilting a leading I beam in the direction of a trailing I beam as the leading I beam traverses the ramp means.

17. The apparatus of claim 12 wherein the first and second conveyer means comprise skid conveyers.

18. The apparatus of claim 12 wherein the chords on the first conveyer means are arranged in side edge-abutting relation to each other, wherein the first and second conveyer means comprises skid conveyer means, and wherein the first conveyer means includes pushing means for pushing the trailing one of the I beams on the first conveyer means and thereby advancing all the I beams along the same.

19. The apparatus of claim 12 including upstream from the first conveyer means and communicating therewith I beam rotating means positioned for receiving a vertical stack of I beams, and operable to rotate the stack to a horizontal position and deliver it to the first conveyer means.

20. The apparatus of claim 12 including offbearing conveyer means positioned for receiving nested I beams from the second conveyer means and conveying them to a downstream processing station.

21. The apparatus of claim 20 wherein the offbearing conveyer means comprises tilt conveyer means lapping the downstream end of the second conveyer means.

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