June 26, 1945. G. C. PAXTON ET AL 2,378,948

CRATE HEAD MAKER

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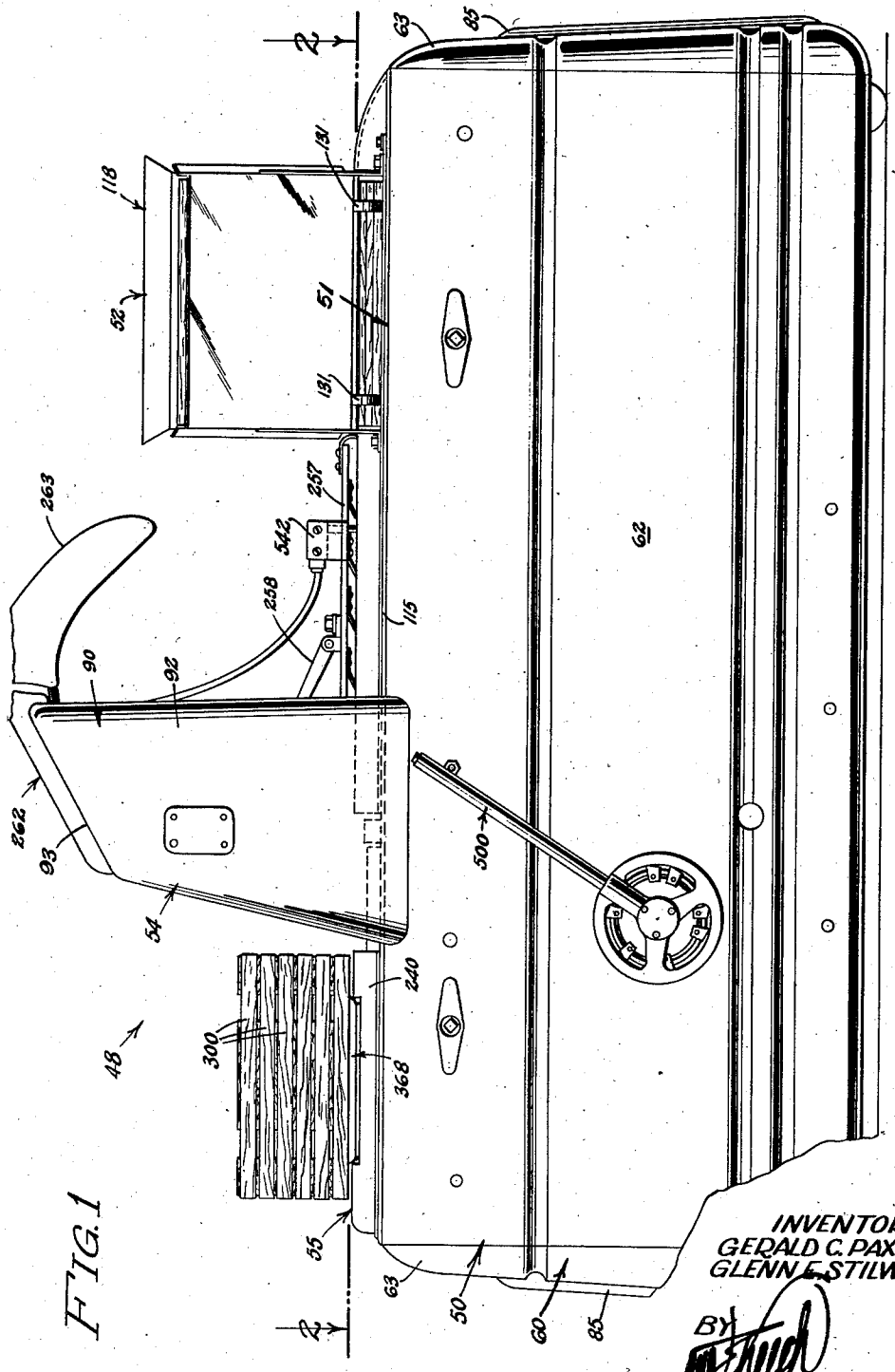


FIG. 1

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CRATE HEAD MAKER

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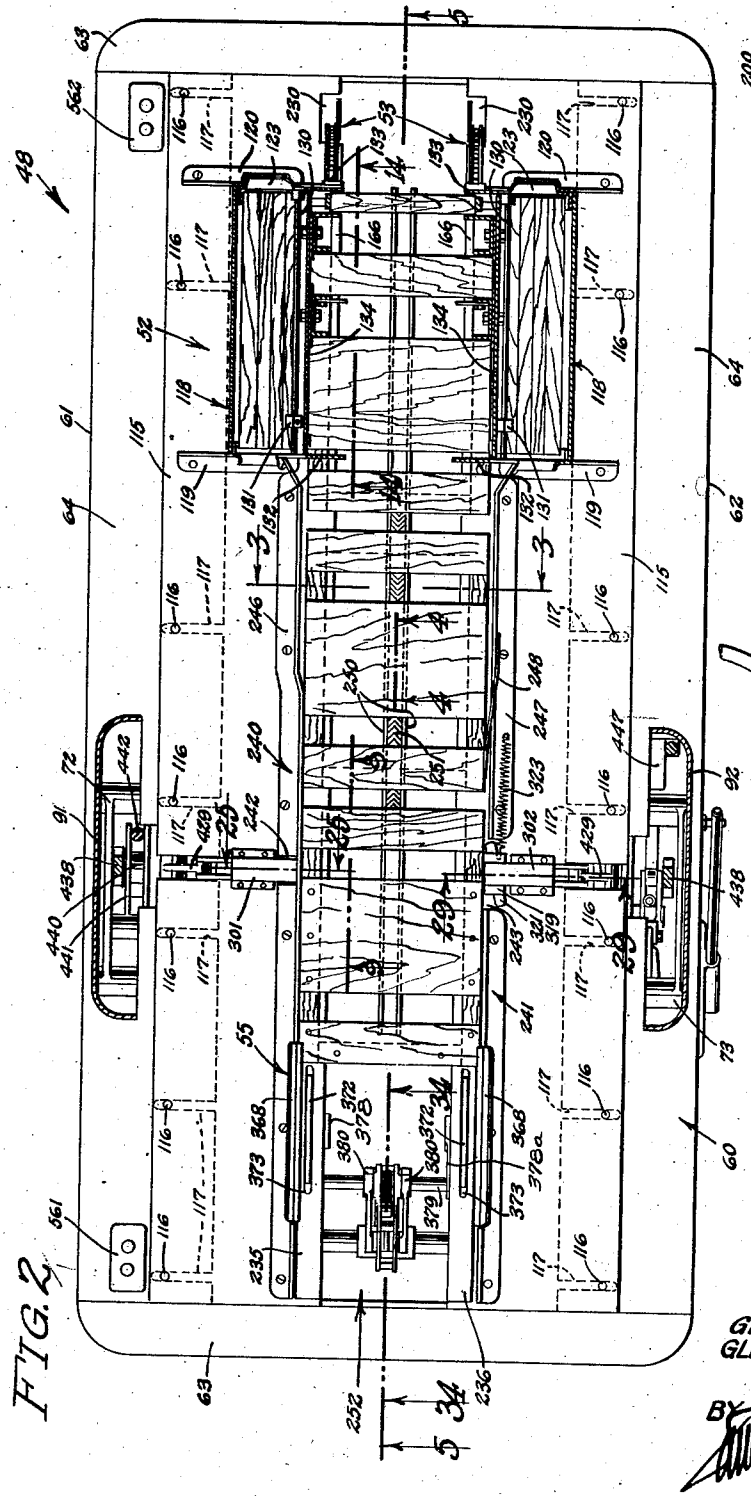


FIG. 2.

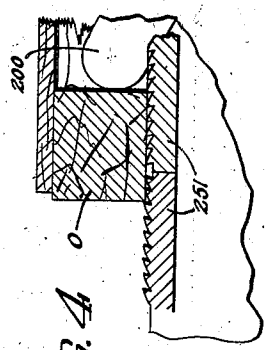


FIG. 4

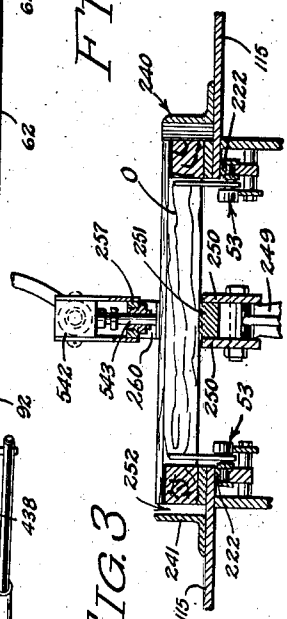


FIG. 3

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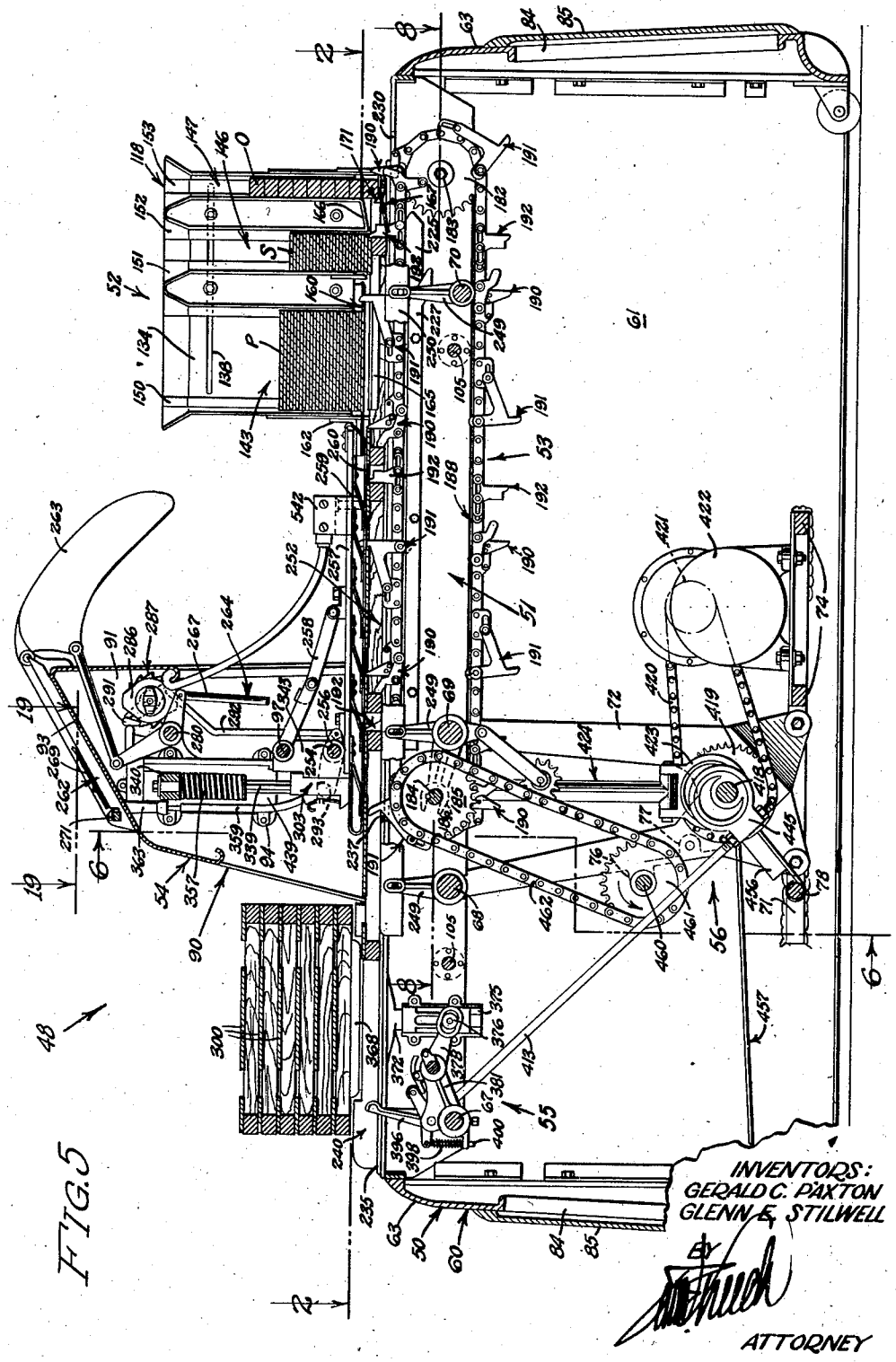


FIG. 5

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CRATE HEAD MAKER

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FIG. 6

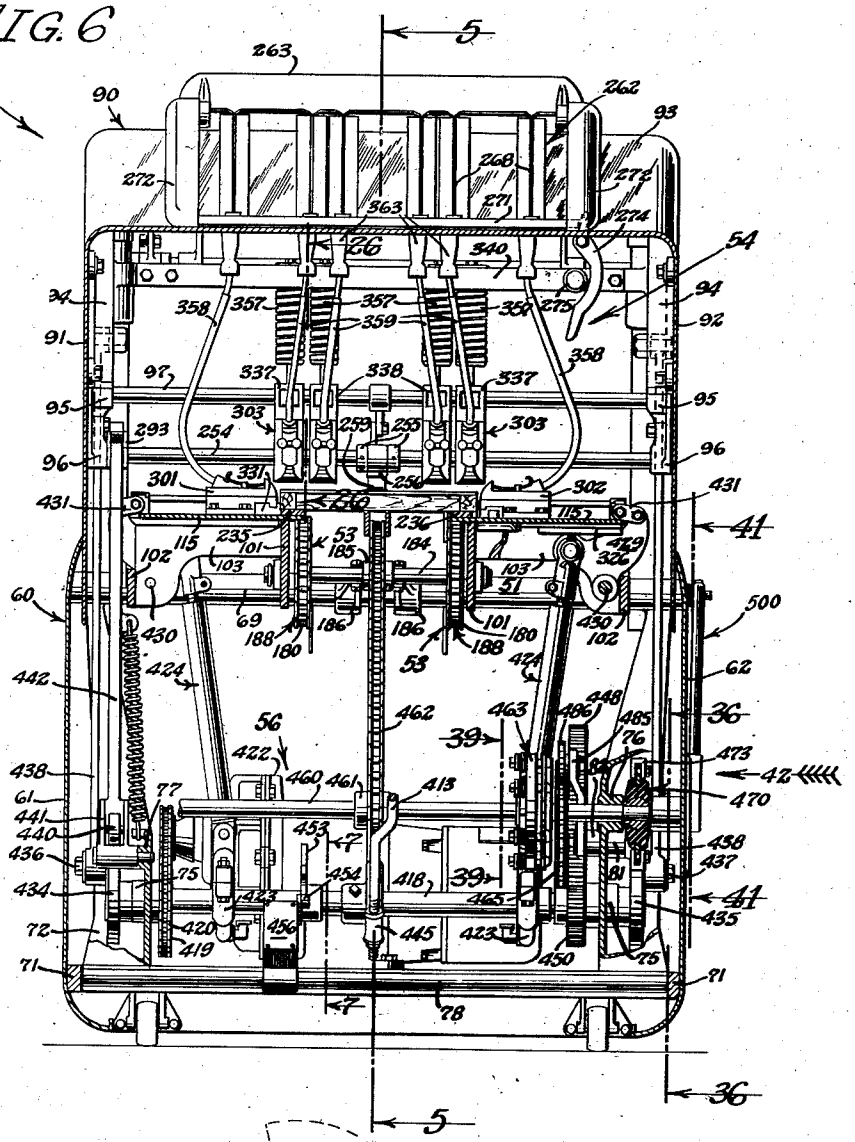
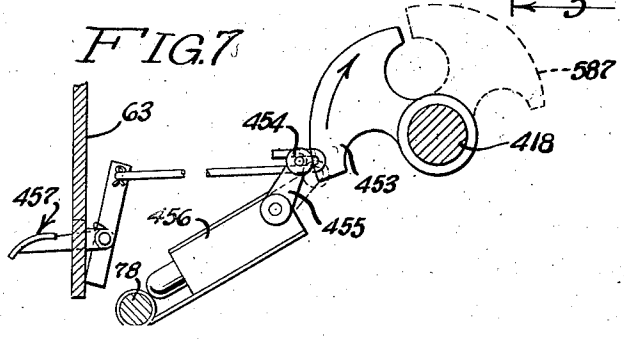


FIG. 7



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CRATE HEAD MAKER

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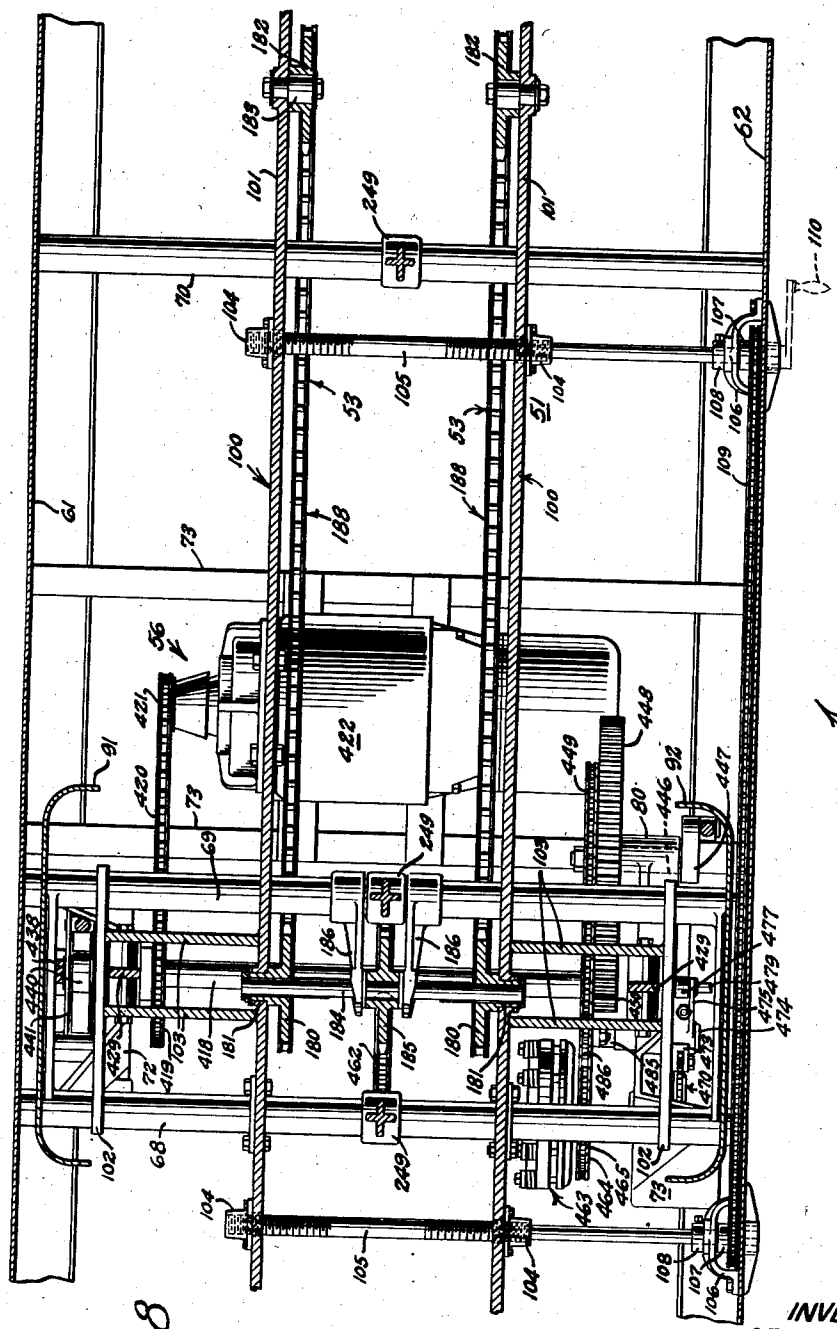


FIG. 8

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CRATE HEAD MAKER

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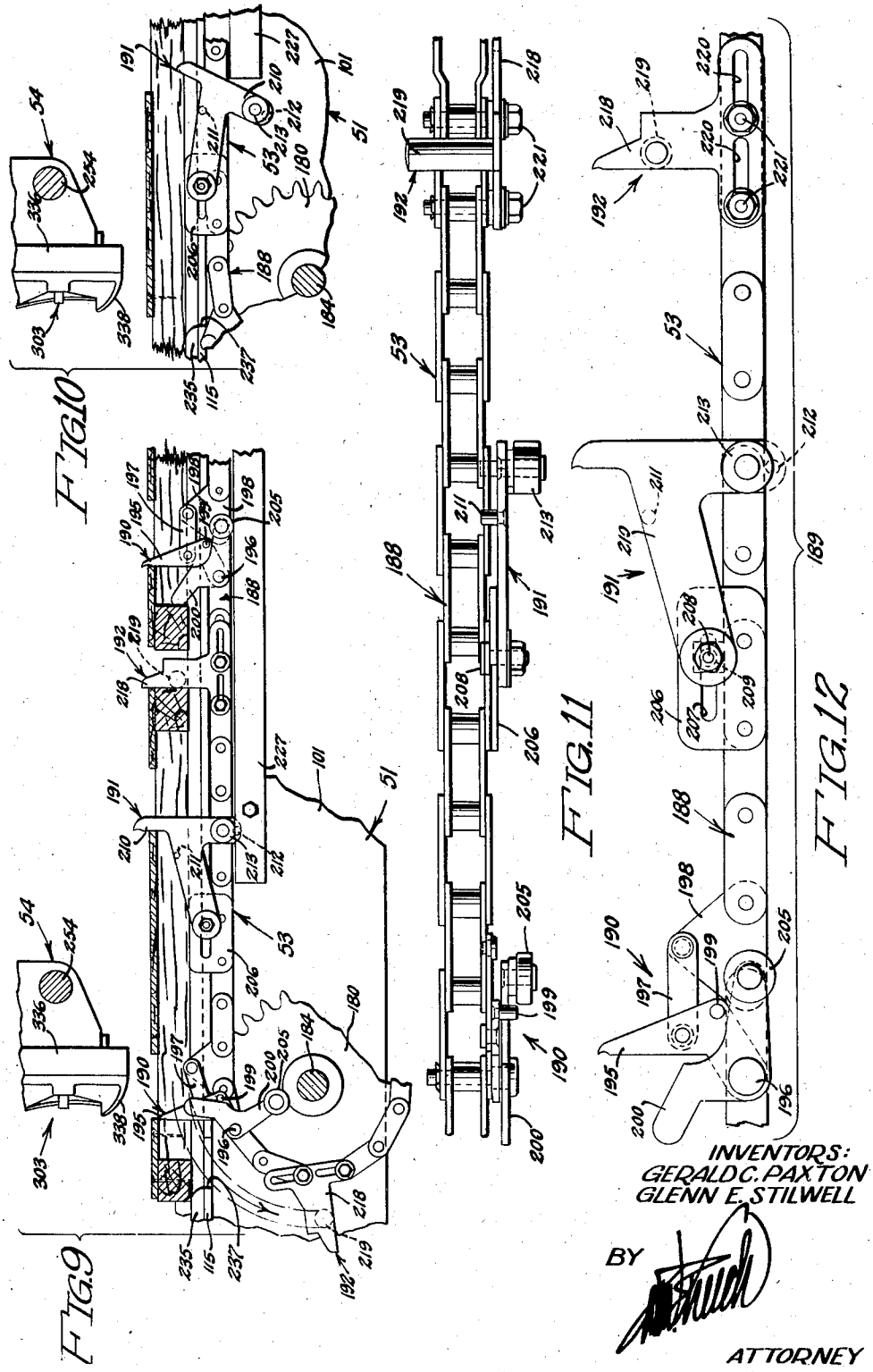


FIG. 10

FIG. 9

FIG. 11

FIG. 12

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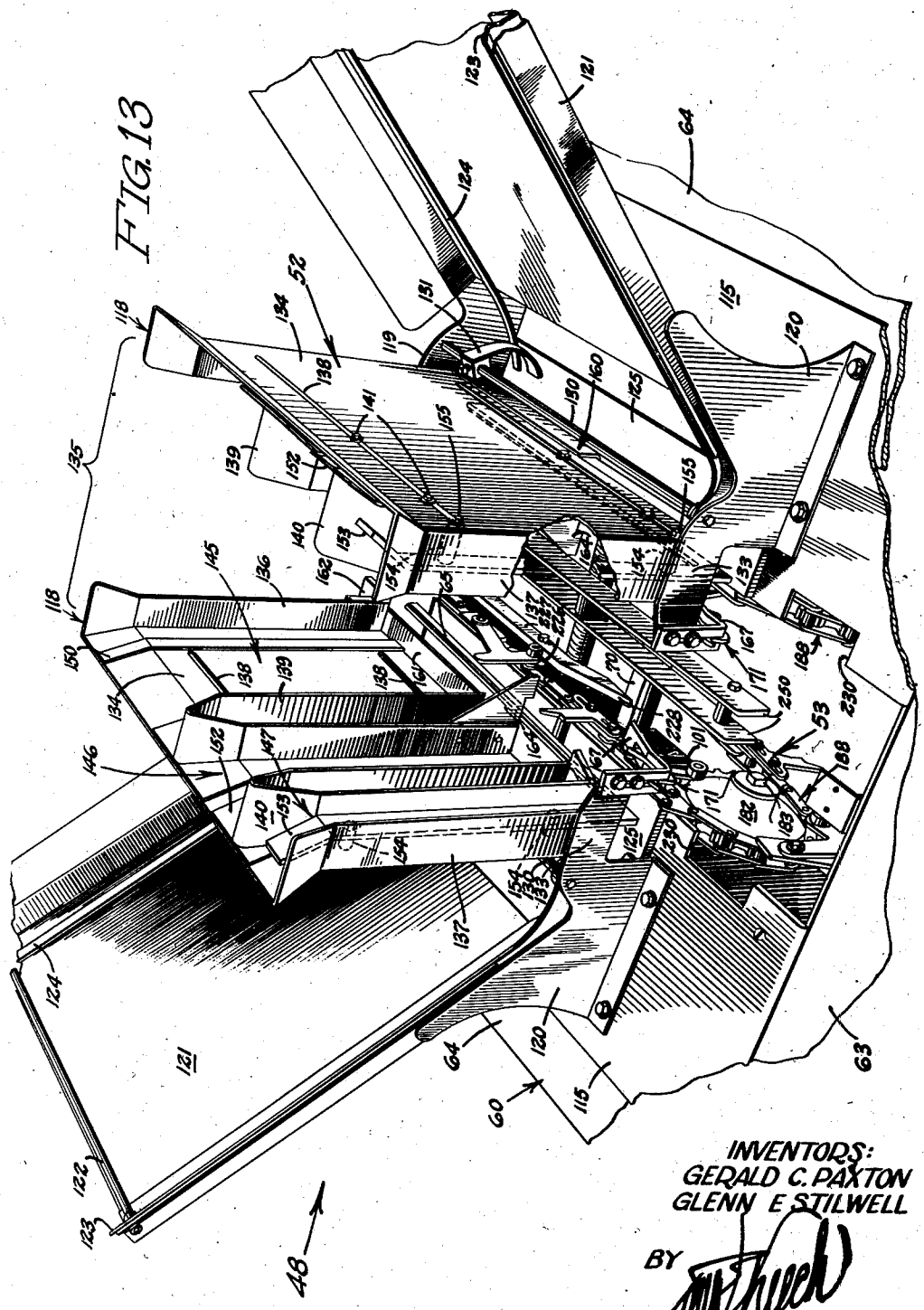
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CRATE HEAD MAKER

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FIG. 13



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CRATE HEAD MAKER

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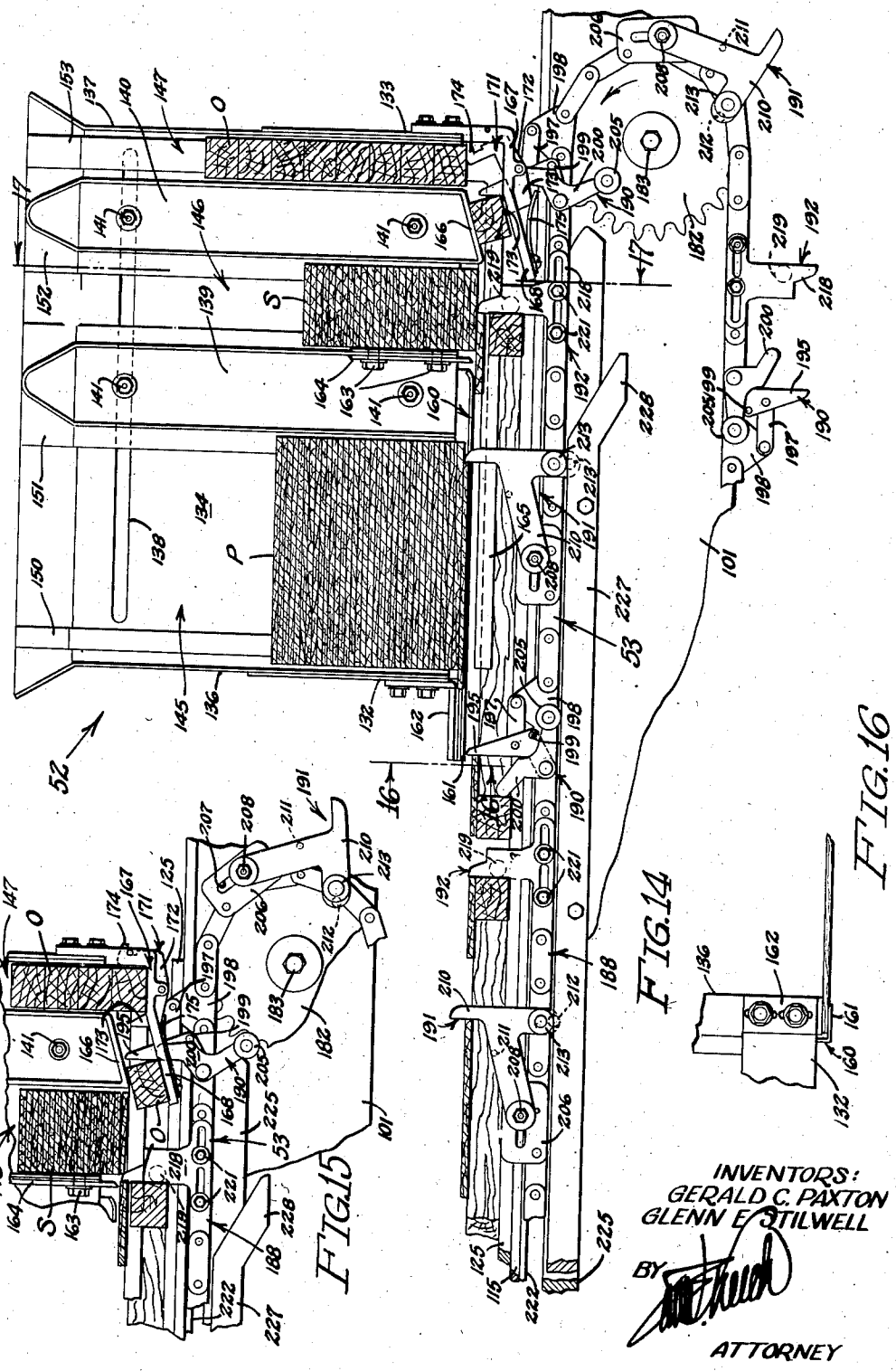


FIG. 14

FIG. 15

FIG. 16

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CRATE HEAD MAKER

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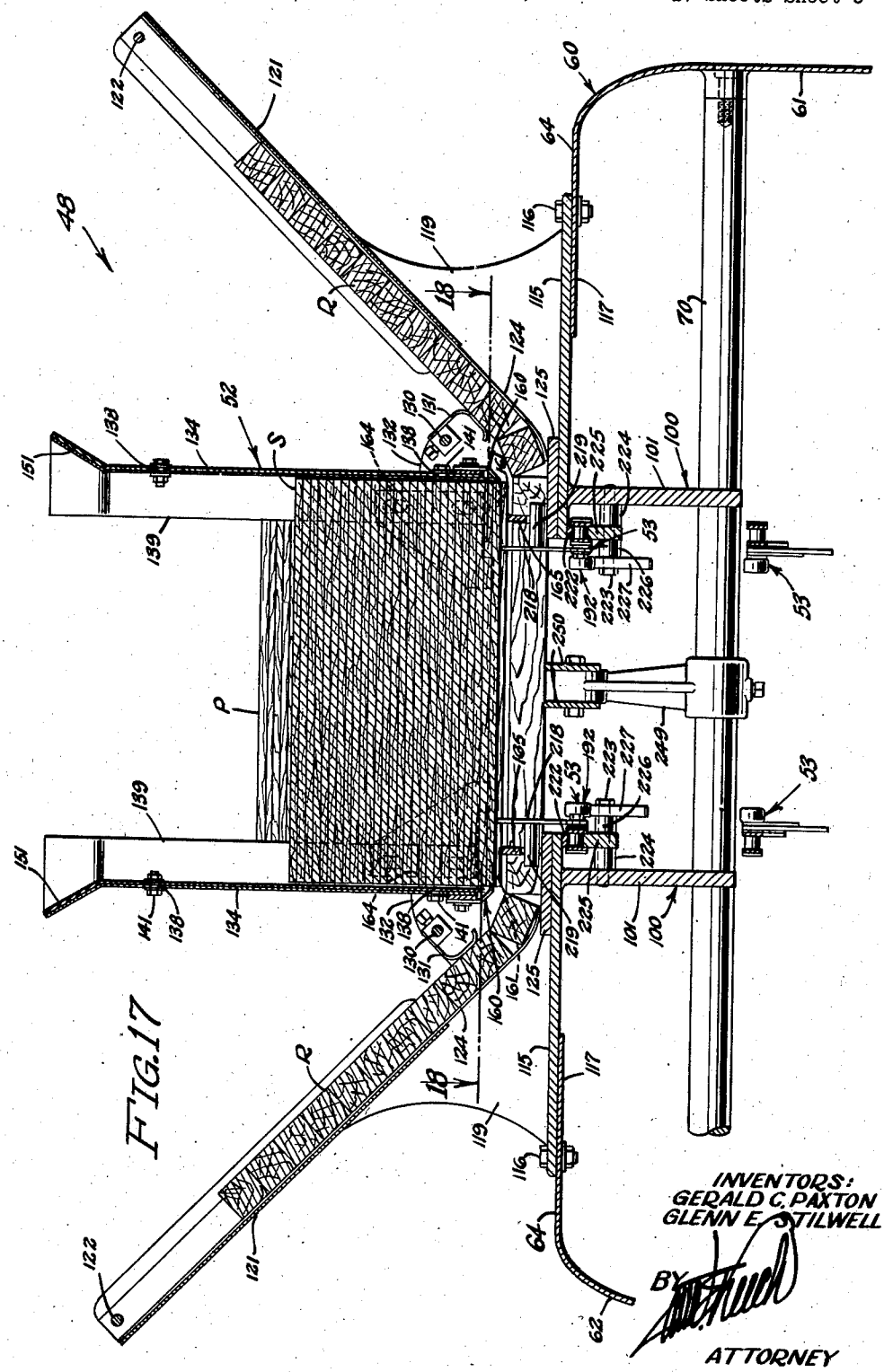


FIG. 17

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CRATE HEAD MAKER

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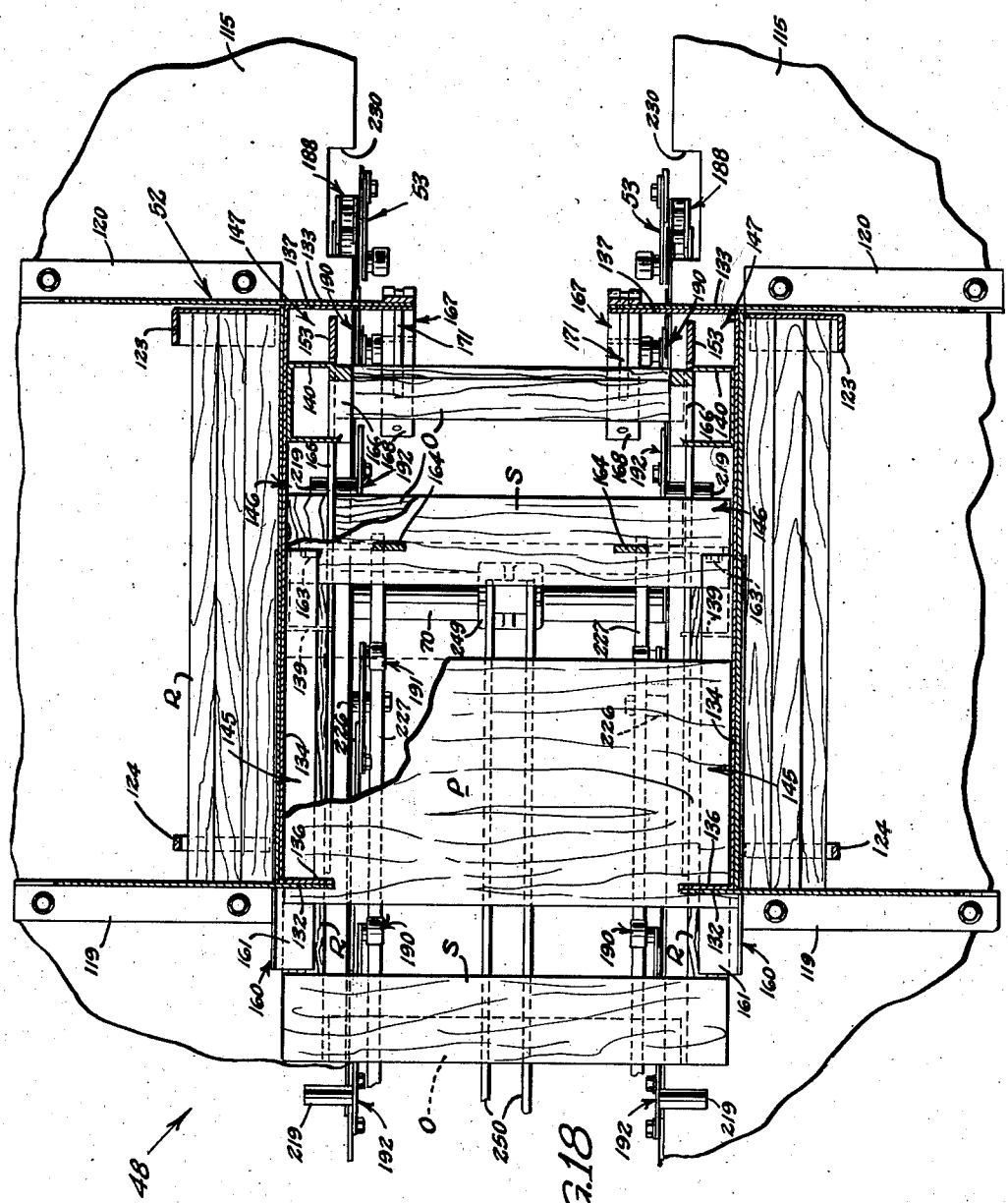


FIG. 18

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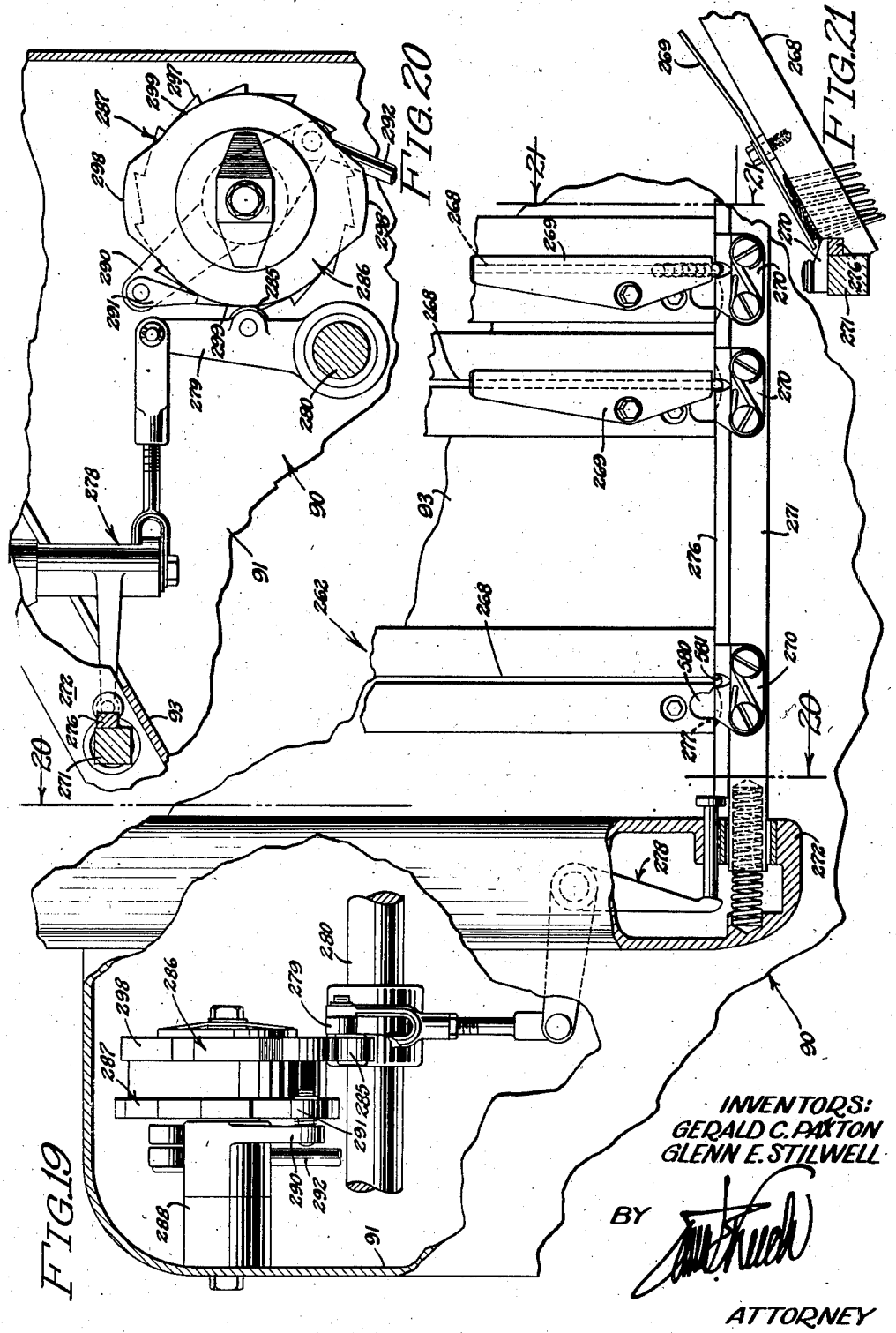
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CRATE HEAD MAKER

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CRATE HEAD MAKER

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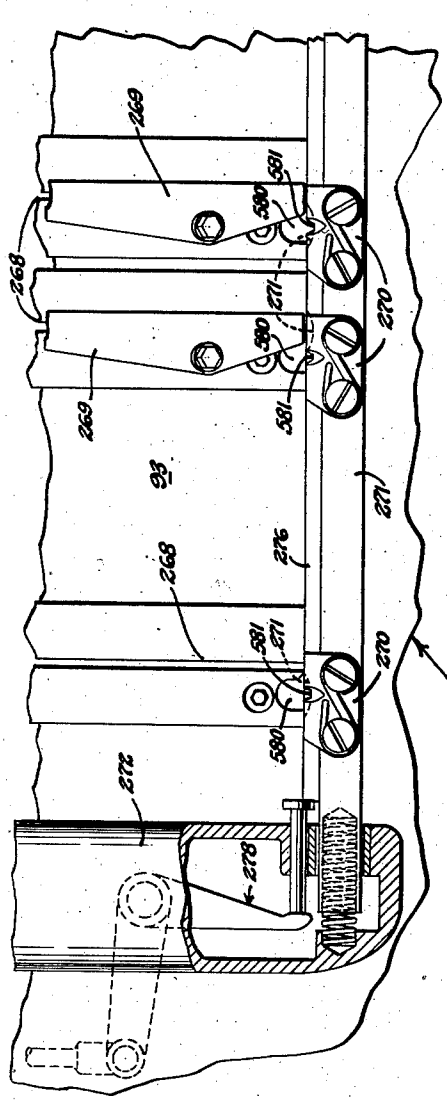


FIG. 22

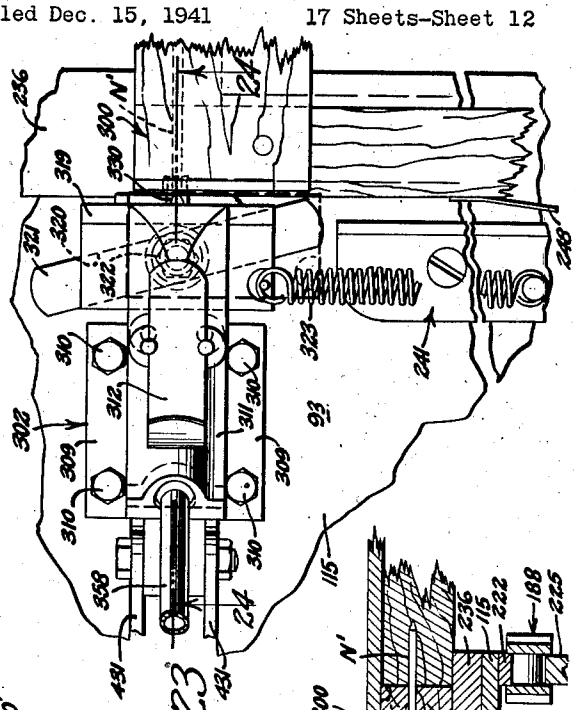


FIG. 23

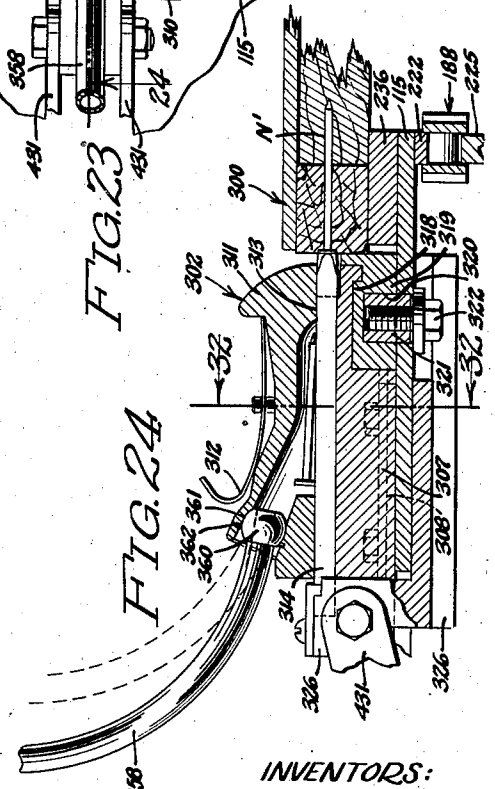


FIG. 24

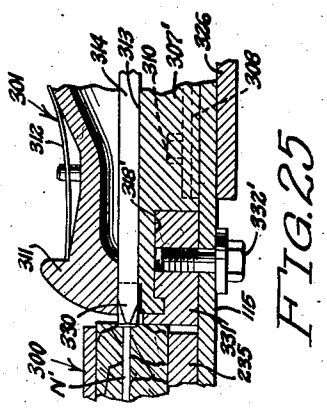


FIG. 25

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CRATE HEAD MAKER

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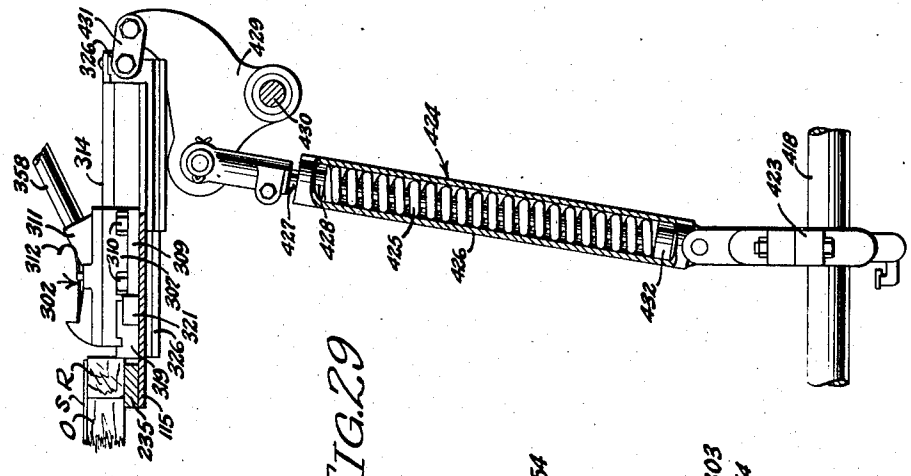


FIG. 29

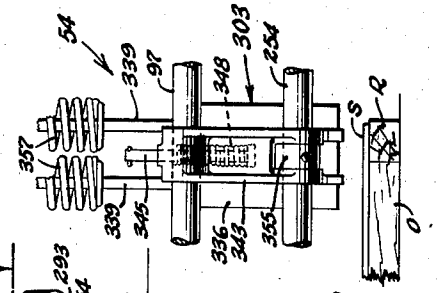


FIG. 28

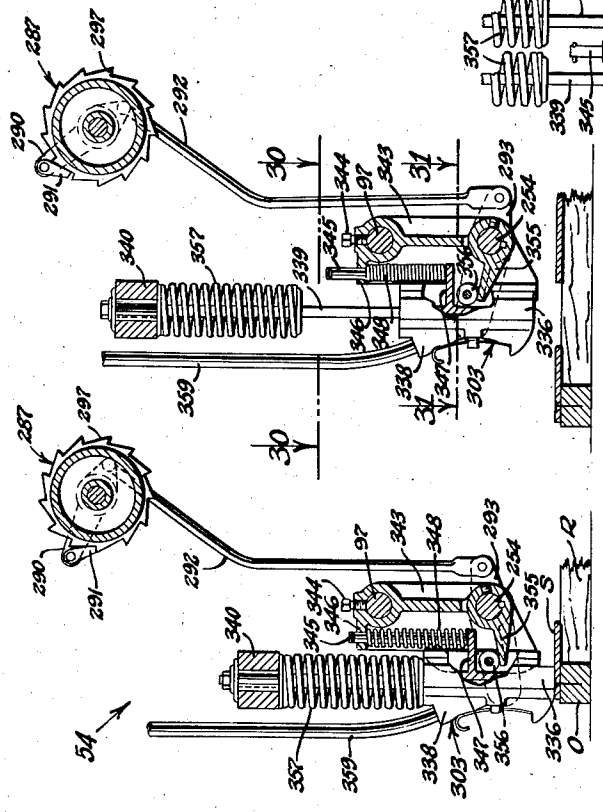


FIG. 27

FIG. 26

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CRATE HEAD MAKER

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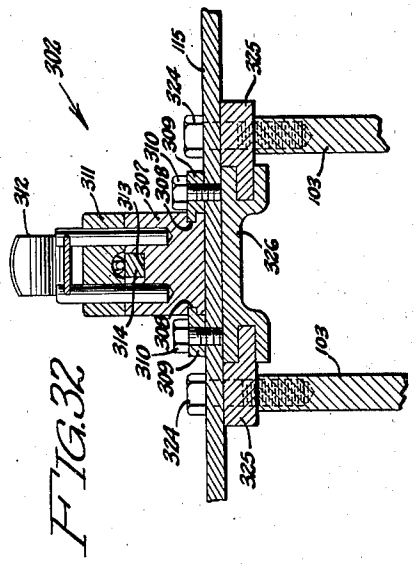


FIG. 32

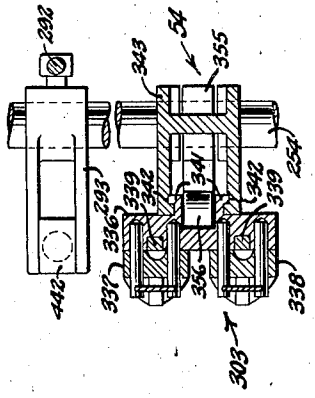


FIG. 31

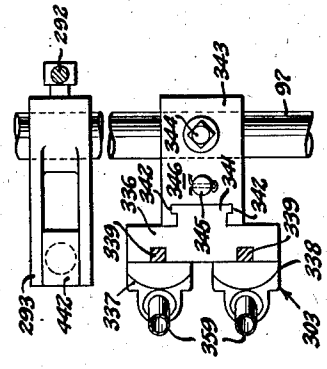


FIG. 30

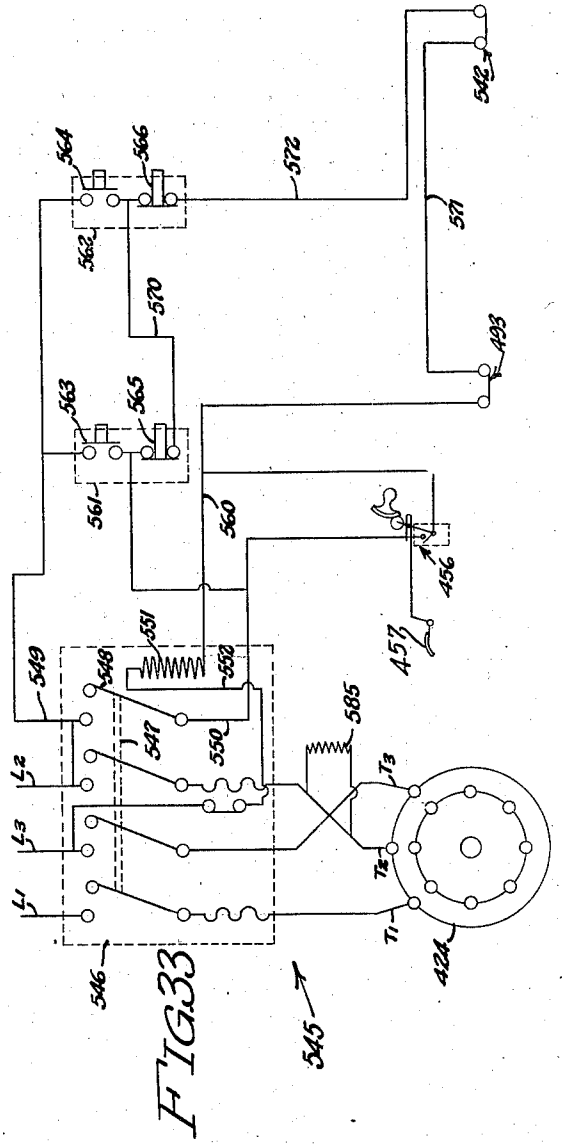


FIG. 33

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CRATE HEAD MAKER

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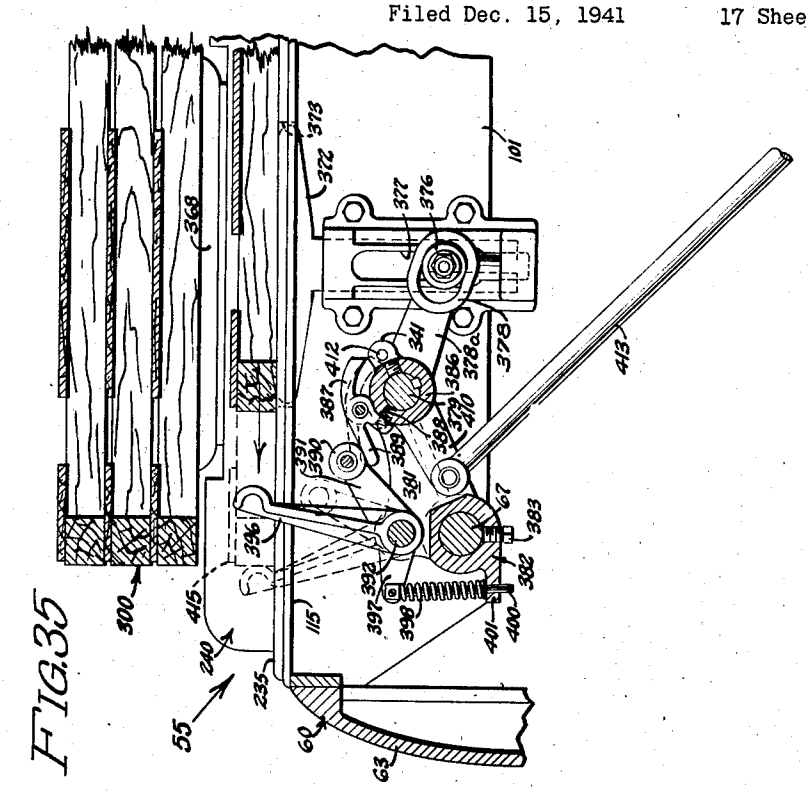


FIG. 35

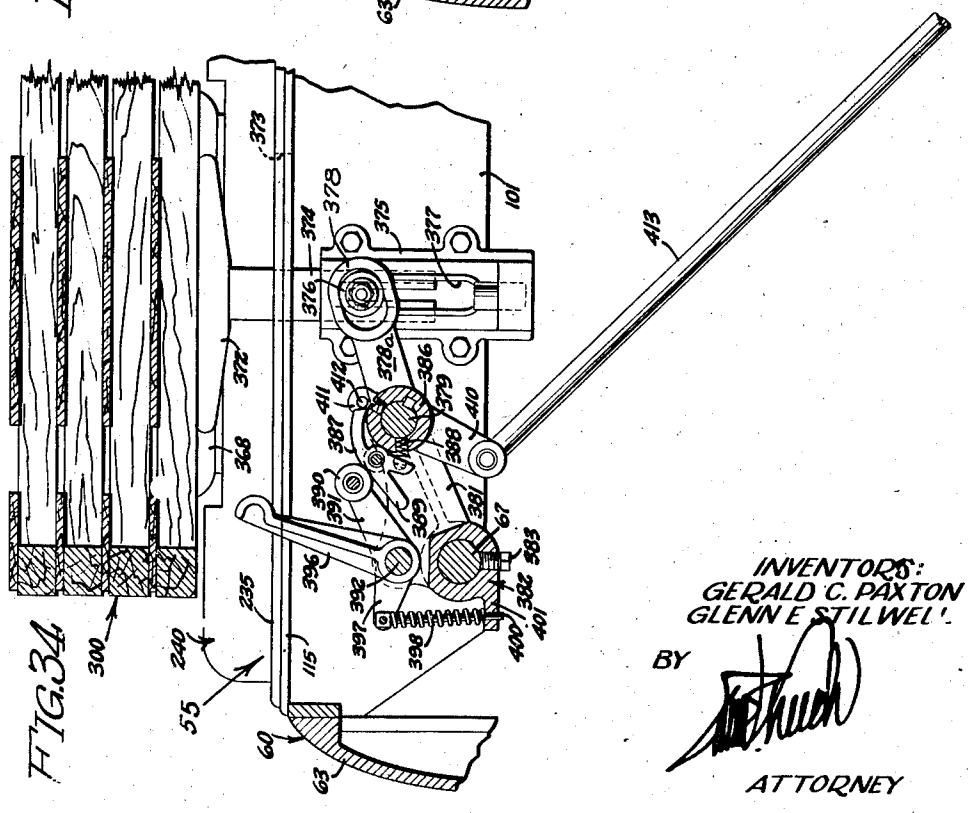


FIG. 34

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CRATE HEAD MAKER

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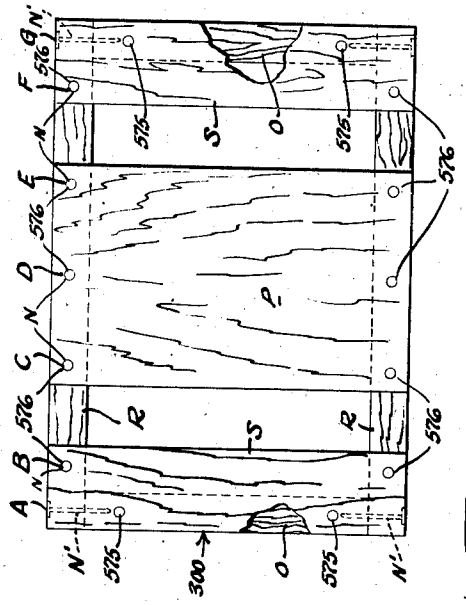


FIG. 38

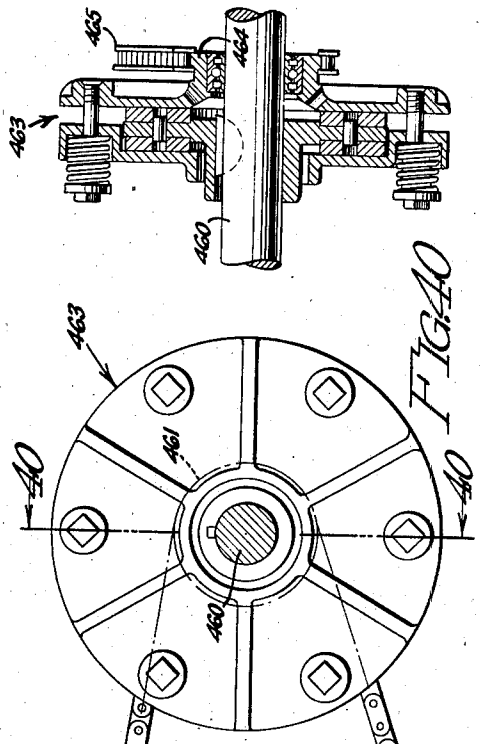


FIG. 40

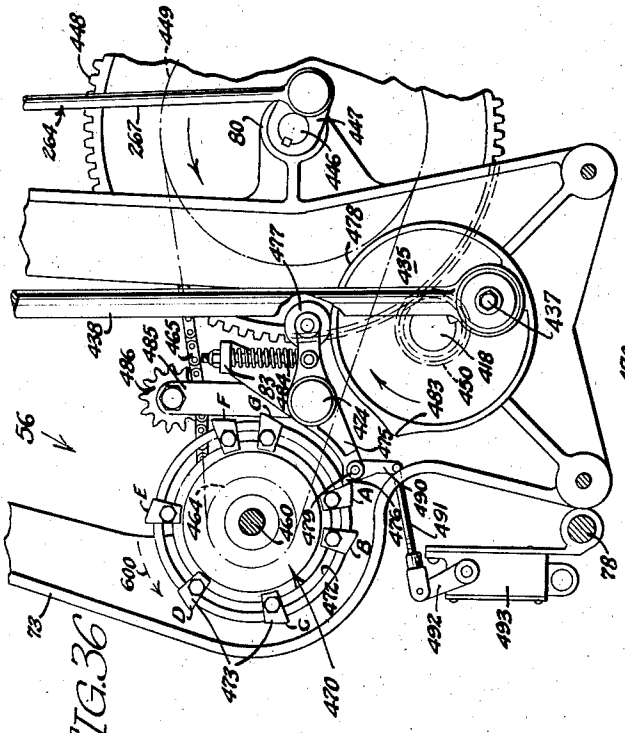


FIG. 36

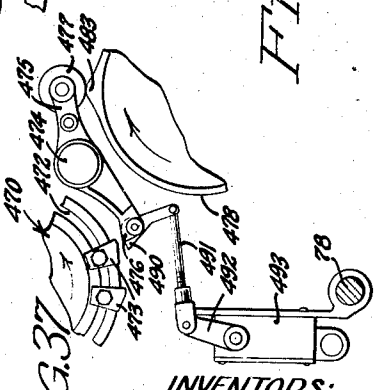


FIG. 37

FIG. 39

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CRATE HEAD MAKER

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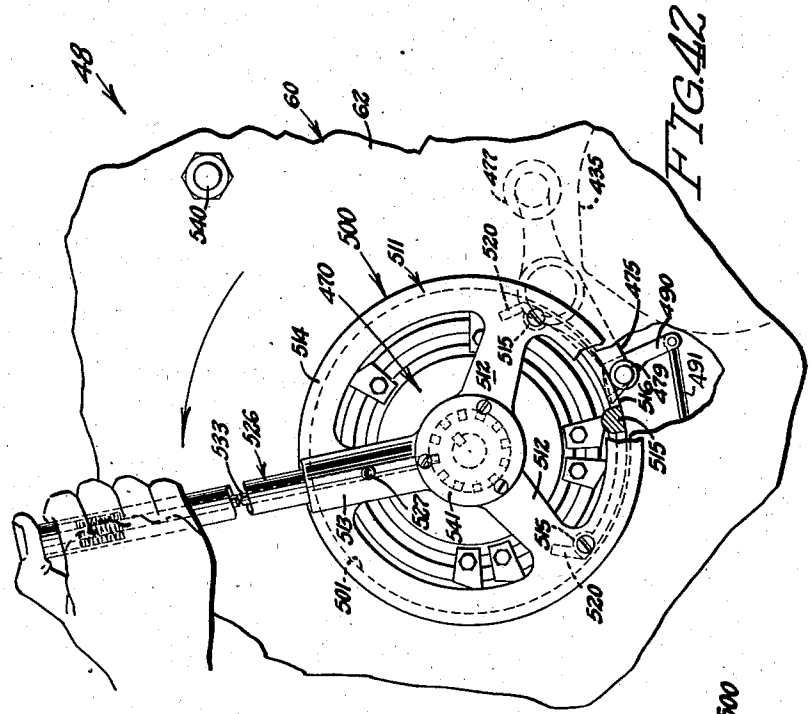


FIG. 42

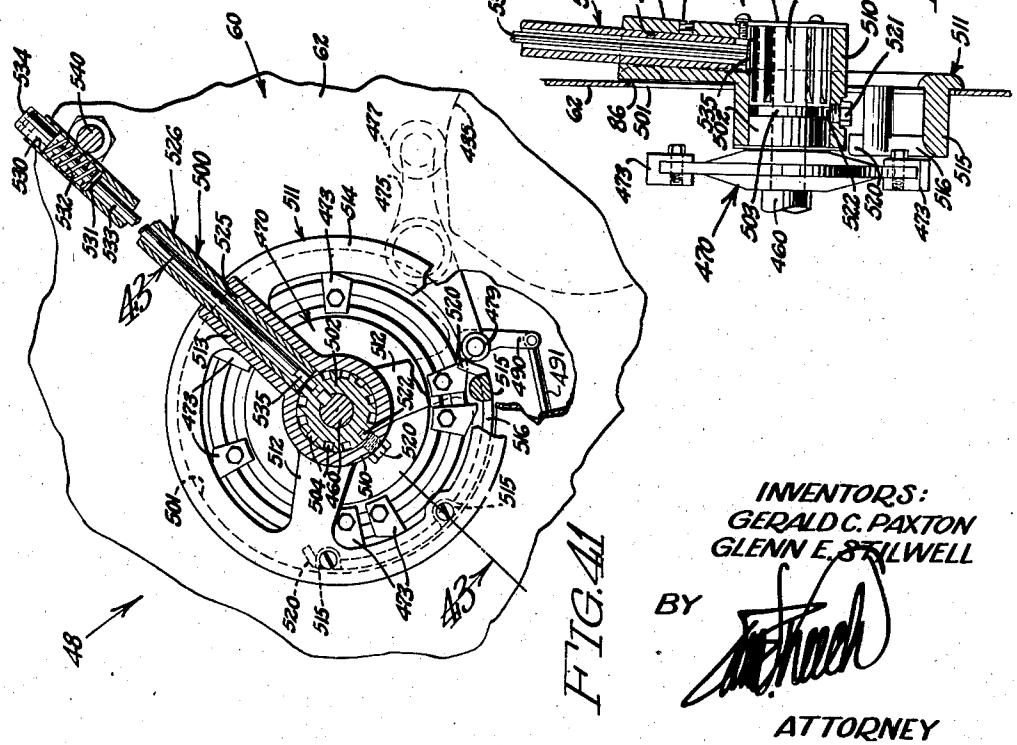


FIG. 43

FIG. 41

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Patented June 26, 1945 2,378,948

UNITED STATES PATENT OFFICE

2,378,948

CRATE HEAD MAKER

Gerald C. Paxton and Glenn E. Stilwell, Riverside, Calif., assignors to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Application December 15, 1941, Serial No. 423,052

31 Claims. (Cl. 1—8.1)

This invention relates to nailing machines and has particular utility in the manufacture of crate heads.

It is an object of the invention to provide a novel crate head maker which is relatively low in first cost and economical in operation.

The objects of this invention also embrace the provision in a nailing machine of a novel shook magazine and feed mechanism; a novel work stacking mechanism; a novel nail chuck mechanism; a novel control mechanism for feeding the work intermittently from one position to another; a novel means for adjusting such a control mechanism for rendering the same flexible as to the feeding intervals which can be produced; and a novel means for manually setting or timing said feed control mechanism.

It is a further object of the invention to provide a novel crate head maker which is adjustable to permit the production of crate heads of various sizes on the same machine.

The manner of accomplishing the foregoing objects, as well as further objects and advantages will be made manifest in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of a preferred embodiment of the invention.

Fig. 2 is a longitudinal horizontal sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary cross sectional view taken on the line 3—3 of Fig. 2 and illustrating an emergency control switch of the invention.

Fig. 4 is a fragmentary enlarged view taken on the line 4—4 of Fig. 2 and illustrating the shook retarding file track of the invention.

Fig. 5 is a longitudinal vertical section taken on the line 5—5 of Figs. 2 and 6.

Fig. 6 is a transverse sectional view taken on the line 6—6 of Fig. 5.

Fig. 7 is a diagrammatic sectional view taken on the line 7—7 of Fig. 6, and illustrating the manual safety switch release of my invention.

Fig. 8 is a diagrammatic fragmentary enlarged horizontal sectional view taken on the line 8—8 of Fig. 5.

Fig. 9 is an enlarged detailed sectional view taken on the line 9—9 of Fig. 2 and illustrating the manner in which the first pair of picks operating on a crate head drop out of contact with the forward slat of this crate head after their function has been performed.

Fig. 10 is a view similar to Fig. 9 illustrating the same circumstance in the operation of a second pair of picks on the panel of the crate head.

Fig. 11 is an enlarged plan view of one of the chains and pick devices attached thereto which is employed in the work assembling conveyor of my invention.

Fig. 12 is a side elevational view of Fig. 11.

Fig. 13 is a perspective view of the shook magazine of my invention and showing its relation to the work assembling conveyor.

Fig. 14 is an enlarged longitudinal sectional view taken on the line 14—14 of Fig. 2 and illustrates an initial step in the picking of shook from the magazine of the invention by the work assembling conveyor thereof.

Fig. 15 is a fragmentary view similar to Fig. 14 and illustrates a further step in the operation, the beginning of which is shown in Fig. 14.

Fig. 16 is a fragmentary detailed view taken on the line 16—16 of Fig. 14 and shows how panels are supported in the panel hopper.

Fig. 17 is an enlarged transverse sectional view view of the magazine of the invention taken on the line 17—17 of Fig. 14.

Fig. 18 is a horizontal fragmentary sectional view taken on the line 18—18 of Fig. 17.

Fig. 19 is an enlarged fragmentary view taken on the line 19—19 of Fig. 5 and illustrating the nail feed mechanism of my invention.

Fig. 20 is a sectional view taken on the line 20—20 of Fig. 19.

Fig. 21 is a view taken on the line 21—21 of Fig. 19.

Fig. 22 is a view similar to Fig. 19 and illustrating the nail picking mechanism of the invention in a different phase of its operation as when nails have just been picked.

Fig. 23 is an enlarged plan view of the compensating spiker chuck of my invention.

Fig. 24 is a vertical sectional view taken on the line 24—24 of Fig. 23.

Fig. 25 is a vertical sectional view taken in the same plane as Fig. 24 but illustrating the non-compensating spiker chuck of my invention.

Fig. 26 is an enlarged vertical sectional view taken on the line 26—26 of Fig. 6 and illustrating one of the double vertical nailing chucks of the invention positioned as when driving one or more nails.

Fig. 27 is a view similar to Fig. 26 illustrating said double chuck when raised in relaxed or non-nailing position.

Fig. 28 is a rear elevational view of the double chuck aforesaid.

Fig. 29 is a vertical sectional view taken on the line 29—29 of Fig. 2 and illustrates the mech-

anism for operating one of the spiker nailing mechanisms of the invention.

Fig. 30 is a horizontal cross sectional view taken on the line 30—30 of Fig. 27.

Fig. 31 is a horizontal cross sectional view taken on the line 31—31 of Fig. 27.

Fig. 32 is a cross sectional view taken on the line 32—32 of Fig. 24.

Fig. 33 is a wiring diagram of the electrical circuit of the nailing machine of my invention.

Fig. 34 is an enlarged vertical sectional view taken on the line 34—34 of Fig. 2, and illustrating the work stacker of the invention and showing said stacker in work stacking position.

Fig. 35 is a view similar to Fig. 34 showing the stacker in retracted or work-receiving position.

Fig. 36 is an enlarged fragmentary detailed view taken on the line 36—36 of Fig. 6 and illustrating the power transmission of the invention as when the work assembling conveyor thereof is halted for an interval between successive intermittent movements thereof.

Fig. 37 is a fragmentary view of a portion of Fig. 36 and illustrates the situation when the work assembling conveyor is moving between successive stops.

Fig. 38 is a plan view of a crate head which the machine shown in the drawings is adapted to move.

Fig. 39 is an enlarged view of the slip clutch of the conveyor drive of my invention and is taken on the line 39—39 of Fig. 6.

Fig. 40 is a cross sectional view of said clutch taken on the line 40—40 of Fig. 39.

Fig. 41 is an enlarged sectional view taken on the line 41—41 of Fig. 6 and illustrating the manual timing mechanism for timing the intermittent work assembly conveyor drive mechanism of the invention.

Fig. 42 is an enlarged side elevational view taken in the direction of the arrow 42 in Fig. 6 and illustrates the manner in which the timing mechanism aforesaid is manually controlled.

Fig. 43 is a fragmentary sectional view taken on the line 43—43 of Fig. 41 and illustrates the means for manually, though temporarily, connecting said adjustment means operatively with intermittent drive mechanism for the assembly conveyor.

Referring specifically to the drawings, the preferred embodiment of the invention there illustrated is a crate head maker 48 (see Figs. 1, 5 and 6) which is a nailing machine and which includes a frame 50, an integrating adjustable base 51, a magazine 52, a work feeding conveyor 53, a nailing mechanism 54, a stacking mechanism 55 and a power drive mechanism 56 for actuating and controlling the operation of the aforesaid feeding, nailing and stacking mechanisms. Portions of the magazine 52, the conveyor 53, the nailing mechanism 54 and the stacking mechanism 55 are mounted on the integrating adjustable base 51, the spaced relation of these portions of these mechanisms being controlled by adjustment of this base so as to condition the entire machine to operate upon work having a particular dimension, this dimension of the work being that which is disposed transversely of the path of travel of the work through the machine.

Frame 50

The main element of the frame of the machine is a cast shell 60 (see Figs. 1, 2, 5, 6 and 8) which include side walls 61 and 62 and end walls 63. The upper edges of the side walls 61 and 62 turn inwardly to provide horizontal border decks 64 (see Fig. 17). These walls are also rigidly connected by transverse frame shafts 67, 68, 69, 70 (see Figs. 5, 6 and 8).

The frame 50 includes reinforcing bars 71 which are provided on inner faces of the sides 61 and 62 near their lower edges. Supported on these bars and on the frame shafts 68 and 69 are bearing spiders 72 and 73. The bars 71 are connected by motor support channels 74 (see Figs. 5, 6 and 8). The bearing spiders 72 and 73 have main crank shaft bearings 75 and conveyor drive shaft bearings 76 (see Figs. 5 and 6). The frame bars 71 are also connected by a fixed shaft 78. The spider 72 has a pin receptacle 77. The spider 73 (see Figs. 6, 8 and 36) has a jack shaft bearing 80 (see Figs. 8 and 36) a pawl pin bearing 81 (see Fig. 6), an idler arm stud 82 and a spring rod ear 83 (see Fig. 36).

The end walls 63 have door holes 84 (see Fig. 5) which are preferably provided with doors 85 to completely enclose the mechanism inside the shell 60, but provide ready access thereto whenever this is necessary. The side wall 62 is provided with an opening 86 which is concentric with the conveyor drive shaft bearings (see Fig. 43) the purpose of this opening to be made clear hereinafter.

The frame 50 also includes an arch-like tower 90 (see Figs. 1, 5 and 6) having side standards 91 and 92 which are rigidly fixed on the side walls 61 and 62 and are connected at their upper ends by a sloping bridge 93. The standards 91 and 92 have slideway and bearing brackets 94, these brackets having bearings 95 and 96. Also included in the frame is a shaft 97 which is rigidly fixed on the bearings 95.

Integrating adjustable base 51

This base includes two foundation members 100, each of these including a heavy metal beam 101, these beams being parallel and spaced from each other (see Figs. 5, 6 and 8) and being notched so that their lower edges receive and rest on the rigid frame shafts 67, 68, 69 and 70. Thus these beams are slidable laterally relative to each other on the frame 51. Parallel with and disposed outwardly from each of these beams are bars 102 which slidably rest on the shafts 68 and 69 and are rigidly connected to this beam by bars 103.

The members 100 are provided with right and left-hand threaded nuts 104 (see Fig. 8) into which shafts 105 are screwed. These shafts extend through suitable openings in the wall 62 and through brackets 106 provided on these walls, these shafts being held against axial movement relative to said brackets by sprockets 107 and collars 108 fixed on these shafts. Trained about the sprockets 107 is a chain 109 which causes the rotation of either of these shafts to rotate the other in synchronism therewith. The ends of these shafts are squared and are adapted to be rotated as by the application of a crank 110 thereto.

The upper edges of the beams 101 (see Fig. 17) are on the same level as the upper faces of the horizontal border decks 64. Lying on these decks and these beams, and welded to the latter, are a pair of deck plates 115 which extend throughout the length of the machine. The outer edges of the plates 115 are held in snug sliding relation with the horizontal border decks 64 by bolts 116 which extend downwardly through slots 117 in these decks (see Fig. 2).

Magazine 52

This magazine is best shown in Figs. 13, 14, 15, 17 and 18. It includes two magazine sections **118** which are substantial duplicates of each other, each of which is mounted on one of the deck plates **115**. Each section **118** includes front and rear brackets **119** and **120**, which support a rail hopper **121** extending upwardly outwardly therefrom at an angle of about 45°. The hopper **121** has a rod **122** extending across its upper edge and which is mounted on an adjustable rail flusher **123** which lies on the rear side of the hopper and is capable of being shifted to adapt the hopper **121** for rails of different lengths. The hopper **121** has guide strips **124**, the lower ends of which are curved upwardly (see Figs. 13 and 17) so as to deliver rails onto the top of magazine track plates **125**, the inner edges of which are flushed with the inner edges of the deck plates **115**.

Extending between each pair of brackets **119** and **120** is a rod **130** which carries a spring guide **131** which guides the rails R onto the curved portion of the guide strips **124**. Provided on the brackets **119** and **120** are inwardly extending arms **132** and **133** (see Fig. 13). Disposed just inside of and secured to each pair of these arms, and extending upwardly therefrom, is an end wall **134** of a multiple post slat and panel hopper **135**. Each of the walls **134** has front and rear flanges **136** and **137** and has horizontal slots **138**.

The space within the post slat and panel hopper **135** is adjustably divided by vertical guide members **139** and **140** which are secured to the hopper end walls **134** by bolts **141** extending through the slots **138**. A panel hopper **145** is thus provided between the two walls **134**, the two flanges **136** and the two vertical guide members **139**.

A slat hopper **146** is likewise formed between the vertical members **139** and **140** and a post hopper **147** is provided between the members **140** and the rear end wall flanges **137**. When the shook is placed in the hoppers **145**, **146** and **147** the ends of the shook are guided by guides **150**, **151**, **152** and **153**. Of these the guides **150** are secured to the magazine end walls **134**. The guides **151** and **152** are provided on the vertical members **139** and **140** respectively and the guides **153** are fixed on the ends of spacers **154** which are secured to the end walls **134** by bolts **155** passing through the slots **138**. The reason for the guides **153** being on spacers **154** is that the posts O for which the hopper **147** is provided are considerably shorter than the slats and panels for which the hoppers **146** and **145** are provided.

Secured to the outer face of each wall **134** adjacent its lower edge and opposite the hopper **145** is a sheet angle member **160** (see Figs. 13 and 17) which provides an inwardly extending shelf **161** on these shelves supporting opposite ends of a load of panels P which may be placed in the hopper **145**. The lower ends of the front hopper end wall flanges **136** and the adjacent portions of the bracket arms **132** are disposed above the shelves **161**, the latter extending forwardly thereunder. Adjustable panel retaining gauges **162** are secured to the arms **132** and are substantially coextensive in length with the forward ends of the shelves **161** (see Figs. 14 and 16).

Adjustably secured on the vertical members **139** (see Figs. 13 and 14) by cap screws **163**, are slat retention members **164** which extend a substantial distance inwardly into the multiple hopper **135** and lie just in advance of the slat hopper **146**. Secured to the lower ends of guides **153** and extending forwardly beneath the slat and panel hoppers **146** and **145**, are yieldable slat supporting guide arms **165** (see Figs. 14 and 17).

The bottom ends of the vertical guide members **140** are provided with inclined guides **166**. Disposed inwardly somewhat from these guides, and supported on bracket arms **133** (see Figs. 13, 14 and 15), are post supports **167** having inclined portions **168** which are parallel with guides **166** and each of which is provided with an escapement mechanism **171**. This mechanism includes a rocker lever **172** having end fingers **173** and **174**. This rocker is normally held in the position in which it is shown in Fig. 15, by a spring **175**, but is capable of being rocked into the position in which it is shown in Fig. 14 by the feeding of post O forwardly from the bottom hopper **147**. Each wall **134** and associated flanges etc. described hereinabove comprises one half of the hopper **135** and may, therefore, be referred to as a "hopper half." This hopper comprises the main portion of the magazine **52** in that it feeds the posts, slats and panels downwardly into the path of the conveyor **53**.

Work feeding conveyor 53

This conveyor operates to feed shook from the magazine **52** and assemble this in proper relation so that when this is nailed together it will produce a crate head. This conveyor (see Figs. 5 and 8) includes a pair of drive sprockets **180** having sleeve hubs **181** which are suitably journalled in beams **101**. It also includes driven sprockets **182** which are rotatably mounted on studs **183** fixed on the beams **101** at the rear end of the magazine **52**.

Extending through the sleeve hubs **181** and having splined connection therewith is a drive shaft **184**. Fixed centrally on this shaft is a driven sprocket **185**, end play of the shaft being prevented by yokes **186** mounted on the frame shaft **69** and disposed close to opposite faces of the sprocket **185**. Trained about the sprockets **180** and **182** are conveyor chains **188** (see Figs. 5, 8, 9, 10, 11 and 12). In Fig. 8 these chains are diagrammatically shown. In the normal functioning of the machine **50**, these chains travel intermittently about the sprockets **180** and **182**, these chains being comprised of a number of shook picking units **189** (see Figs. 11 and 12), each of these units including a front post and slat picking device **190**, a panel picking device **191** and a rear slat and post picking device **192**. Half of each of these devices is provided on the inner face of one of the chains **188** and the corresponding other half is provided on the inner face of the other chain **188** directly opposite the first half of this device.

Each of these halves of each device **190** includes a pick **195** which is pivotally mounted on a chain pin **196** and is connected by a link **197** to a high link plate **198**. The pick **195** is provided with a pin **199** which limits the rotation of a front post positioned **200** which is also pivotally mounted on the pin **196**. The positioner **200** has a roller **205**, the purpose of which will be made manifest hereinafter.

Each half of each device **191** includes a plate **206** which is fixed on one of the link plates of the chain **188** and has a slot **207** which receives a bolt **208** and rigidly positions a spacer **209** in this slot. Pivotally mounted on this spacer is a panel pick **210**, this pick having stop pins **211** and **212** and a roller **213**. The pins **211** and **212**

limit the swinging of the pick 210 about the spacer 209 by their engagement with adjacent chain links (see Fig. 11).

Each half of each picking device 192 includes a rear post and slat pick 218, having a rail feeding pin 219, this pick being provided with slots 220 by which the pick is adjustably secured in place to an adjacent link of the chain by bolt-headed chain pins 221.

Welded to the under faces of the deck plates 115, at their inner edges (see Fig. 17) are chain guide strips 222. Supported on the beams 101 by bolts 223 and spaced outwardly from said beams by spacers 224 are chain tracks 225 which cooperate with the strips 222 to trap and closely guide the upper flights of the chains 188. Also mounted on the bolts 223 and spaced from the rails 225 by sleeves 226 are cam rails 227.

Provided in inner edges of the deck plates 115, near the rear thereof (see Figs. 2, 5 and 13) are notches 230 through which the rail feeding pins 219 travel upwardly when the machine is operating.

Mounted on the deck plates 115 flush with the inner edges of these, and extending from the magazine 52 to the opposite ends of these plates, are anvil tracks 235 and 236 (see Fig. 2) these having notches 237 close to the shaft 184 (see Fig. 9), these notches extending downwardly through the deck plates 115 and providing passage for the rail feeding pins 219 as these drop downwardly when passing around the shaft 184. Also mounted on the deck plates 115 just outwardly from the anvil tracks 235 and 236 are angle iron guide walls 240 and 241, these having open spaces 242 and 243 (see Fig. 2) for a purpose to be made clear hereinafter.

The ends of the angle iron guide walls 240 and 241 adjacent the magazine 52 are flared as shown in Fig. 2 and angle iron wall 240 has a portion 246 which jogs outwardly from the balance of the wall 240 formed therein. The wall 241 is entirely broken at the space 243 and the portion 247 thereof lying between the space 243 and the magazine 52 is spaced farther away from the wall 240 than the balance of the wall 241 is spaced. Mounted on the wall portion 247 is a shook guiding leaf spring 248 which guides the work into contact with the wall 240.

Mounted on the upper ends of arms 249 (see Fig. 5), provided on frame shafts 68, 69 and 70, are a pair of plates 250 which serve to clamp and support a post retarding file 251 (see Figs. 3 and 4) which engages posts O when these are traveling along the work runway 252 formed by the anvil tracks 235 and 236 and walls 240 and 241, the purpose of this being made clear hereinafter.

Journalled in the bearings 96 (see Figs. 5 and 6), is a shaft 254 having collars 255. Mounted on this shaft between these collars is the hub 256 of a work depressing bar 257, this being optionally held in a downward position by a toggle link 258 connecting this bar to the frame shaft 97 (see Fig. 5). The bar 257 has a series of light springs 259 and a long leaf spring 260 which the springs 259 press against, and which in turn engages the work traveling along the runway 252 so as to hold this work together in a proper assembled relation while this work is being fed from the magazine 52 to the nailing mechanism 54.

Nailing mechanism 54

This mechanism includes a nail stripper 262 provided on sloping bridge 93, this stripper including a nail hopper 263 which is oscillated through linkage 264 actuated by a pitman 267 (see Figs. 5 and 36) in a manner well known in the art and is thus caused to deliver nails to runways 268 included in the stripper. These runways have guards 269 (see Figs. 19 and 21) which prevent the nails from jumping out of the runways 268, causing them to be fed in proper order to nail pickers 270 provided on a picker bar 271. The latter is slidably mounted in a picker housing 272 which is provided on the bridge 93 and is actuated by a cam 274 (see Fig. 6) responsive to the vertical reciprocation of a roller 275 each time the nailing mechanism functions, this all being in a manner well known in the art, and as will be pointed out hereinafter. Slidably mounted adjacent the picker bar 271 is a selector bar 276, this bar having shallow nail passages 277 provided therein in a manner so that when the bar 276 is in one position nails will be prevented from being fed from certain of the runways 268 while allowing nails to feed from the balance of the runways and vice versa.

This selector bar 276 is actuated through linkage 278 (see Fig. 19) connected to an arm 279 mounted on a shaft 280 which is journalled in the brackets 94 and having a roller 285, which bears against a cam 286 formed integrally with a ratchet wheel 287 and pivotally mounted on a stud 288 fixed on the inner face of the standard 91. Also pivoted on the stud 288 is an arm 290 carrying a ratchet dog 291 which actuates the ratchet wheel 287 and is in turn operated by a rod 292. The latter arm connects to a short arm 293 on the shaft 254. The shaft 254 is rocked in a manner to be explained hereinafter, during the operation of the machine, this rocking motion being transmitted to the ratchet wheel 287 to cause the intermittent rotation of the cam 286.

The ratchet wheel 287 has 14 teeth 297 and the means for operating the dog 291 are so arranged that for each reciprocation of this dog the ratchet wheel 287 and cam 286 are rotated a single tooth. The cam 286 has two high portions 298 which are separated by low portions 299. The high portions 298 are such that each of these is disposed opposite the roller 285 during two nailing operations of the nailing mechanism 54 and each of the low portions 299 is disposed opposite the roller 285 during five nailing operations of the nailing mechanism 54. The machine 50 is adapted to manufacture crate heads 300 (see Fig. 38). Each head requires seven nailing operations, the nails driven during the first and last of these operations being differently disposed than those being driven in the intermediate five nailing operations. During the last nailing operation on each crate head and the first nailing operation of the next crate head one of the high portions 298 of the cam 286 is disposed opposite the roller 285, and during the five similar nailing operations in each crate head one of the low cam portions 299 is disposed opposite the roller 295. The significance of this will be explained in detail hereinafter.

The nailing mechanism 54 (Fig. 6) also includes a pair of spiker chucks 301 and 302 and two double chucks 303.

The construction of spiker chucks 301 and 302 is largely similar and for convenience the structure of 302 will be described first. This is a compensating chuck in that it automatically adapts itself to work passing between this chuck and the wall 240 so as to maintain itself pressed against the work on the opposite side thereof from this wall. This chuck is located in the space 243 in

the wall 241 and has a base 307, (see Figs. 23, 24 and 32) this base having longitudinal channels 308 into which guide lands 309 extend, the latter being secured to the plate 115 by screws 310. This chuck has a cap 311 held on by a spring 312, this cap covering up a nail driver runway 313 provided in the base 307 in which a nail driver 314 is slidably disposed.

The details of construction of the base 307 and cap 311, not herein described, are substantially identical to those of the nail chuck shown in the U. S. Letters Patent to Paxton, No. 2,240,516, issued May 6, 1941.

The base 307 has a transverse slideway 318 into which fits a compensating slide block 319. The block 319 has obliquely formed therein a channel 320 which slidably fits over a bar 321, the latter being rigidly secured to the adjacent deck plate 115 by a cap screw 322. Connected at one end to the block 319 and at the other end to the base of the wall 247 is a contractile spring 323 which constantly pulls the block 319 toward the direction from which the work is fed from the magazine 52 toward the nailing mechanism, this pull tending to slide the block 319 toward the spring along the bar 321 and thus slide the chuck base 307 between the lands 309 until the inward movement of this chuck base is halted by the block 319 engaging the work (as shown in Figs. 23 and 24).

Rigidly held in place by bolts between the upper edges of the bars 103 and the adjacent deck plates 115 are guide members 325. Slidable between the members 325 is a nail driver cross head 326 to which the nail driver 314 is secured. As shown in Fig. 24, the cross head 326 is right up against the chuck base 307 when the nail driving end 330 of the driver 314 has driven a spike N' flush with the surface of the work engaged by the compensating slide block 319.

The chuck 301 is located in the space 242 in the wall 240. Reference will be made to those elements of this chuck which are similar to corresponding parts of the spiker chuck 302 by using the reference numerals applied to the latter with prime attached. The features in which chuck 301 differs from 302 are as follows (see Fig. 25): The stationary block 331, which is similarly shaped to the slide block 319, is secured to the adjacent deck plate 115 by a bolt 332, this block fitting the transverse slideway 318' of the chuck 301 so as to rigidly fix the body 307' of this chuck on the adjacent deck plate 115.

The double chucks 303 are of similar construction and are mounted on the shafts 97 and 254 (see Figs. 5, 6, 26, 27, 28, 30 and 31). Each of these chucks has a base 336 on which are provided two individual chucks 337 and 338 which are substantially identical in construction and mode of operation to the chucks shown in the aforesaid U. S. Letters Patent to Paxton. These chucks have drivers 339, the upper ends of which are secured to a cross head bar 340. For purposes of identification, the individual chucks 337 will be considered as those disposed toward the outside of the machine and the chucks 338 as those disposed toward the inside of the machine.

The chuck base 336 has gibs 341 which slide vertically in a suitable slideway 342 provided in a stationary chuck body 343, the latter having suitable apertures through which the shafts 97 and 254 extend, this body being secured to the first of these by a set screw 344. Coiled about a rod 245 and disposed between a web 346 formed on the body 343 and a ledge 347 formed on the chuck base 336 is an expansion spring 348, this tending to hold the double chuck 303 downwardly. Fixed on the shaft 254 is an arm 355 which engages a roller 356 on the base 336 so as to lift the chuck 303 upwardly when the shaft 254 is rotated (as shown in Fig. 27).

Positioned about the drivers 339 of the chucks 303 are heavy coiled springs 357, the purpose of which will be made clear hereinafter.

Spikes or large size nails are adapted to be fed from the nail stripper 265 to the chucks 301 and 302 through telescopic metal tubes 358 and smaller size nails to double chucks 303 through telescopic metal tubes 359. Fig. 24 shows a connection between the lower end of one of the tubes 358 with the chuck 302, this being typical of the connection of all of these nailing tubes with all of the chucks. Here it is seen that the lower end of the nail tube has a ball formation 360 thereon which snaps in place in a socket 361 formed in the chuck to receive the same and is retained in this socket against accidental removal by a spring ring 362 which is trapped in a suitable recess provided in the socket 361. This type of construction is provided at the connection of each of the telescopic tubes 358 and 359 with the spiker chucks 301, the nail chucks 337 and 338, and with the nail funnel 363 of the nail stripper 265. This permits these tubes to be quickly removed and replaced incidental to cleaning out any nail jams which may develop therein.

Stacking mechanism 55

This mechanism includes a pair of head supports 368 (see Fig. 2) which are mounted on the walls 240 and 241 and spring pressed inwardly so that these supports must be pressed outwardly in order for a crate head to be elevated therebetween. These supports then yieldably return inward to support this crate head. T head elevators 372 are adapted to be shifted vertically in slots 373 provided in the anvil tracks 235 and 236 and in the deck plates 115 therebeneath. The shanks 374 are vertically guided in guide blocks 375 fixed on the inner faces of beams 101 (see Figs. 34 and 35). Each shank has a roller 376 which extends through a slot 377 in one of the blocks 375 and is received in an eye 378 of an arm 378a which is splined on a shaft 379. This shaft journals in bearings 380 (see Fig. 2) provided on arms 381 which extend inwardly from the bracket 382 which is fixed centrally on shaft 67 by a set screw 383. Fixed on the shaft 379 in between the arms 381 is a collar 386, this collar having pivotally mounted thereon a dog 387 which is normally held by a spring 388 in the position in which it is shown in Fig. 34. This dog has a tail 389 which when the arms 378 are rocked downwardly (see Fig. 35) is extended upwardly in the path of a roller 390 provided on the end of an arm 391 on a short shaft 392, the opposite ends of which are supported on the arms 381 of the bracket 382. Integral with the arms 391 is a control finger 396 and a short arm 397, all three of these arms being yieldably urged about the shaft 392 and inwardly of the machine by an expansion spring 398 which is coiled about a rod 400 which is pivotally connected to the arm 397 and extends downwardly through an aperture in a lug 401 provided on the bracket 382.

Pivoted freely on the shaft 379 on opposite sides of the collar 386 are a pair of arms 410, these arms having ears 411 between which is supported a pin 412. Disposed between and pivotally connected with the arms 410 is a link 413. As will be

pointed out and hereinafter described, in the operation of the machine 48, the link 413 reciprocates between the position in which it is shown in Fig. 35 and the position in which it is shown in Fig. 34 with each nailing operation of the machine. When no crate head has been delivered along the anvil tracks 235 and 236 into the position shown by dotted lines 415 (see Fig. 35), the arms 391 and 397 are rocked forwardly, as shown in full lines in this figure so that the roller 390 engages the latch tail 389 and lifts the latch 387 outwardly out of the path of the pin 412.

While the stacker mechanism 55 is in this condition, the link 413 may reciprocate any number of times without having any effect upon the stacker. When a crate head enters the stacking mechanism 55, so as to move into the dotted line position 415, it shifts the control finger 396 ahead of it thus releasing the pressure of roller 390 on the latch tail 389, allowing the latch 387 to drop into the path of the pin 412 so that on the next reciprocation of the link 413 the pin 412 engages the latch 387, and arms 378 are swung upwardly to elevate the T elevators 372, the crate head resting on anvil tracks 235, and also any heads supported by the head supports 368. As the elevators return downwardly the spring head supports 368 of the stacker catch and support the crate head just elevated and any others resting on top of this.

Power drive mechanism

This mechanism includes a main drive shaft 418 (see Figs. 5 and 6) which is journalled in bearings 75 on the bearing spiders 72 and 73. This shaft has a sprocket 419 which is driven by a chain 420 from a pinion 421 on a geared motor 422, the latter being mounted on the motor support channels 74 (see Figs. 5 and 8).

While the machine 48 is being operated the shaft 418 rotates continuously.

The shaft has eccentrics 423 (see Figs. 6 and 29) to which are connected extensible links 424 each of which contains a heavy coil spring 425 disposed within a tube 426, having a rod 427 which extends through a head 428 provided in the upper end of the tube 426, and is pivotally connected to a rocker 429 pivotally mounted on a shaft 430 fixed between the bars 103. These rockers are connected by links 431 to the spiker chuck cross heads 326 and 326'.

The lower end of each rod 427 has a head 432 so that when rotation of the shaft 418 pulls down on that rod and rocks one of the rockers 431 so as to drive a spike from one of the chucks (such as the chuck 302) and the cross head 326 comes into contact with this chuck before the eccentric 423 operating this chuck reaches its lowermost position in the shaft 418, the spring 425 is compressed so as to compensate for the position of the chuck 302 which, as previously explained, automatically adjusts itself to the work being spiked.

The shaft 418 (Figs. 6 and 36) also has crank cams 434 and 435 provided on its opposite ends, these having crank pins 436 and 437 connecting with pitmans 438 which reach upwardly and are pivotally connected to slide gibs 439 which are vertically slidable in the slide brackets 94 and which carry the aforementioned nail driving cross head 340. It is thus seen that with each rotation of the shaft 418, the cross head 340 is reciprocated vertically.

Riding on crank cam 434 is a roller 440 on an arm 441 which is pivotally mounted on the frame spider 72. Pivotally connected to the free ends of arm 441 and arm 293 on shaft 254 is a link 442. Through this mechanism the cam 434 lowers chucks 303 onto the work and then lifts these chucks, as seen in Fig. 6, during each nailing operation.

The shaft 418 also has an eccentric 445 to which the link 413 is connected so as to reciprocate this link and thereby operate the stacker 55 in the manner pointed out hereinabove.

Journalled in the bearing 80 in the bearing spider 73 (see Figs. 6 and 9) is a shaft 446 on the outer end of which is carried a short arm 447 to which is pivotally connected the lower end of the pitman 267. Mounted on the other end of this shaft is a master gear 448 having a sprocket 449. This gear wheel is driven by a pinion 450 provided on the shaft 418. Also provided on the shaft 418 is a safety switch cam 453 (see Fig. 7) which is adapted to engage a roller 454 on an arm 455 of a switch 456 fixed on the frame shaft 78. Contact of the cam 453 with the roller 454 opens the switch. Pedal mechanism 457 is provided whereby the switch 456 may be manually held open.

The drive mechanism also includes a shaft 460 (see Figs. 5, 6, 36, 41, 42 and 43) this shaft being journalled in two bearings 76, one of which is provided on each of the spiders 72 and 73. This shaft has a sprocket 461 (see Figs. 5 and 6) which is connected by a chain 462 to the sprocket 185 of the feeding conveyor 53.

Shaft 460 also has a friction clutch 463, this being provided with a sprocket 464 (see Fig. 40) which is connected by a chain 465 to the sprocket 449 on the gear wheel 448 (see Figs. 8 and 36). The chain 465 thus rotates the shaft 460 through the friction clutch 463, this clutch however being adapted to slip when the shaft 460 is held against rotation. A means for causing this slippage and thus controlling the rotation of shaft 460 (see Figs. 6 and 36) and the resulting operation of the conveyor 53 includes a stop disc 470 having a rubber hub 471 and mounted on the shaft 460. This disc has an annular channel 472 (see Fig. 36) in which are adjustably fixed stops 473. The machine 48 being set up for the manufacturing of the crate head 300 in which there are seven nailing operations, there are thus seen to be seven of these stops 473 on the stop disc 470.

Mounted on a pawl pin 474 is a pawl lever 475 having a stop pawl 476 provided on one end thereof and on the opposite end a roller 477 which rolls on a cam track 478 provided on the adjacent crank disc 439. The pawl 476 has mounted thereon a roller 479. The track 478 is mainly circular but has a high portion 483. Mounted between the ear 83 and the lever 475 is a spring 484 which holds the roller 477 into contact with the cam track 478.

Mounted on the idler arm stud 82 (see Figs. 6 and 36) is an arm 485 having an idler sprocket 486 which meshes with the chain 465 to maintain this in taut condition.

The stop pawl 476 is bifurcated and pivotally receives therein a switch lever 490 which is connected by a link 491 to an arm 492 of a switch 493 mounted on the frame shaft 78 (see Figs 36 and 37). The arm 492 of switch 493 is spring pressed into the position in which it is shown in Fig. 37, this causing the lever 490 to extend outwardly from the stopping face of the stop pawl 476 so that when this pawl is positioned in the way of one of the stops 473 and is engaged thereby (as shown in Fig. 36) the lever 490 is swung

about its pivotal mounting so as to move the switch arm 492 into the position in which it is shown in Fig. 36. The switch 493 is normally open (see Fig. 37) and closed when operated (see Fig. 36).

To facilitate the timing of the feeding conveyor 53 an adjusting device 500 (see Figs. 41, 42 and 43) is provided. This is mounted in a hole 501 formed in the side wall 62 of the frame substantially concentric with the shaft 460 and includes a heavy sleeve 502 which fits over and is keyed to one end of the shaft 460. The sleeve 502 has an annular retaining channel 503 and a series of longitudinal slots 504 milled in the periphery thereof.

Rotatably mounted on the sleeve 502 is the hub 510 of a cam supporting spider 511, this spider having legs 512 and 513 and a rim 514 joining the outer ends of the arms. Extending inwardly from the rim 514 are studs 515 which are joined by an arcuate cam 516, this being concentric with the shaft 460 except for beveled end portions 520. The spider hub 510 is held on the sleeve 502 by a screw 521, having a pin 522 extending into the annular groove 503.

The spider leg 513 has a bore 525 which slidably receives a tubular handle 526, this being retained in place by a set screw 527. The handle 526 has a counter bore 530 at its outer end containing a washer 531 and a spring 532. Extending through the handle 526 is a rod 533, this rod having a cylindrical plunger 534 at its outer end which extends into the counter bore 530 and presses the spring 532 against the washer 531. The inner end of the rod 533 has a lug 535 which retains the rod 533 in the handle 526 and is adapted to be inserted into one of the grooves 504 by manual depression of the plunger 534.

Provided on the side wall 62 and extending outwardly therefrom is a stop 540 to limit the freedom of the handle 526 to swing about the sleeve 502. The outer open end of the spider hub 510 is preferably covered as by a plate 541.

Mounted on the work depressing bar 257 (see Figs. 3 and 5) is a shock responsive switch 542, having an operating rod 543 which extends downwardly against the long leaf spring 260. When this leaf spring is pressed upwardly by the presence of shook disposed therebeneath, (as shown in Figs. 3 and 5) switch 542 is closed. In the event of no shook being disposed beneath the spring 260 opposite the switch 542, however, the rod 243 will be allowed to drop downwardly thereby opening this switch.

The power drive mechanism 56 also includes an electric system 545 (see Fig. 33). As will be noted, this system supplies electricity from main conductors L1, L2 and L3 to terminals T1, T2 and T3 of the electric motor 424 of the machine 48. The connection is effected through a magnetic switch 546 having a switch bar 547 which, besides making the connection aforesaid, has an auxiliary switch arm 548 which is adapted, when the switch 546 is closed, to form a connection between conductor 549 leading from L2 and a conductor 550. The switch 546 is actuated by a solenoid 551, one terminal of which is connected by a conductor 552 to L3, the other terminal being connected by a conductor 560 to switch 456, and to one terminal of switch 493. At opposite ends of the machine 48 are mounted switch boxes 561 and 562 in which are provided start switches 563 and 564 and stop switches 565 and 566.

The conductor 550 connects to one terminal of the switch 456 and to adjacent terminals of the start and stop switches 563 and 565. The other terminal of the switch 565 is connected by a conductor 570 to adjacent terminals of the start and stop switches 564 and 566. The other terminals of switches 563 and 564 connect to the conductor 549.

The switch 493 is connected to the switch 542 by a conductor 571, while the switch 542 is connected to the switch 566 by a terminal 572.

Operation

The machine 48 is adapted to be adjusted to manufacture any one of a large number of different styles of crate heads and the like. It can manufacture only one of these styles of crate heads however at a time and must be adjusted and timed to make that particular style of crate head before the operations commence.

As illustrated in the drawings, machine 48 is adjusted and timed to manufacture the crate head 300 shown in Fig. 38. This crate head is seen to include two rails R, two end posts O, two end slats S and a central panel P. The parts of the crate head 300 are held together by spikes N' and smaller nails N. The positions of the spikes N' in the structure are shown in dotted lines in Fig. 38, these spikes all being driven from the chucks 301 and 302 so as to nail opposite ends of the rails R to the posts O. As before stated, there are seven nailing operations in making each of the crate heads 300, the spikes N' being driven only in the first and last of these nailing operations.

Two pairs of nails N, which shall be identified by the numeral 575, are driven downwardly through the forward slat S, into the forward post O and through the rearmost slat S into the rearmost post O during each of the first and last nailing operations in the manufacture of each crate head. These nails are driven from individual chucks 338 of the double chucks 303. Nails N, identified by the numerals 576, are driven from the individual chucks 337 which are the outer individual chucks of the double chucks 303 during each of the five nailing operations occurring in between the first and last of the nailing operations involved in the making of each crate head. The manner in which this selective driving of nails is accomplished by selectively feeding the nails to the chucks will be made clear hereinafter. Before taking up the manner of feeding the crate head parts, the timing of their delivery to the nailing mechanism will be described.

The parts from which each crate head 300 is to be fabricated are removed from the magazine 52 by the work feeding conveyor 53 and are conveyed to the nailing mechanism 54 assembled in the proper relation with each other to be nailed together. These parts thus assembled, whether nailed together or not, will be referred to hereinafter as "the work" and this is fed intermittently through the nailing mechanism, the conveyor 53 halting with the work for a brief interval to permit each of the seven nailing operations aforesaid to be performed on the work.

The halting of the conveyor 53 and the work carried thereby in each of these nailing positions, is effected by the successive engagement of the stops 473 on the stop disc 470 with the stop pawl 476 (see Figs. 36 and 37). To indicate the relationship between the positioning of these stops on the stop disc and the relative positions of the work in which the seven nailing operations are performed on each crate head 300, these stops are lettered from A to G and the positions of

the seven nailing operations are similarly lettered in Fig. 38 so as to indicate which nailing operation the work is positioned for by each of these stops.

The starting of the machine had best now be described so that the operation of the stops 473 may be pointed out. To begin with, the magazine 52 is furnished with supplies of the various crate head parts (as clearly shown in Figs. 2, 5, 14, 17 and 18). The motor 424 is now energized by momentarily closing one of the start switches 563 or 564, the solenoid switch 548 keeping the solenoid 551 energized and the switch 546 closed until the circuit of the solenoid 551 is broken, the manner in which this may be done being described hereinafter.

The motor 422 constantly rotates the main drive shaft 418, this shaft operating through its eccentrics 423 and crank pins 436 and 437 to cause the nailing mechanism 54 to perform a complete nailing operation during each revolution of the shaft 418. Through the pinion 450 on the shaft 418 (see Fig. 36) the gear 448, the chain 465 and the sprocket 461, the shaft 460 is rotated in the opposite direction from the shaft 418 and in turn rotates the driven sprocket 185 (see Fig. 5) of the conveyor 53 so as to cause the upper flights of the conveyor chains 188 to travel from the magazine 52 toward the nailing mechanism 54. In this travel of these chains each pair of shook picking units 189 (see Fig. 12) of these chains, when passing beneath the magazine 52, operates as follows (see Figs. 9, 10, 11, 12, 14 and 15):

As previously pointed out, the chains 188 are comprised of shook picking units 189, each of which includes a set of picking devices 190, 191 and 192, one-half of each of which is located on the inside face of one of the chains 188 and the corresponding other half of this device being located on the inside face of the other chain 188, so that each of these units, when passing under the magazine 52, will pick therefrom a complete set of parts to form a crate head 300 and assemble these in proper relation to be nailed together to manufacture such a crate head. When one of these picking units 189 starts upwardly around the sprockets 182 (see Fig. 14) the picks 195 of this unit engage a post O resting on the post supports 167 and carry this post forwardly between the guides 166 and the inclined portions 168 of the post supports 167. In this movement this post engages the forward end fingers 173 of the rocker levers 172 so as to rotate these levers and swing the rear end fingers 174 inwardly under the next post O disposed thereabove in the magazine 147 (as shown in Fig. 14). This prevents the next post from descending to the bottom of the hopper until the post engaged by the picks 195 is entirely out of the way. After this first post has been shifted forwardly by these picks 195, past the rocker lever fingers 173, these rocker levers are returned by the springs 175 to a normal position (as shown in Fig. 15). As the picks 195 continue in their travel, the upper ends of these picks are just the proper height to engage and carry forwardly the lowermost slat S in the magazine 146, in the same manner that picks 218 are shown as picking a slat therefrom in Fig. 14. Although the foremost post and slat, at the time they are first picked by the picks 195, have their rearmost edges in vertical alignment, it is desirable that this post be disposed with its forward face substantially flush with the forward edge of this slat. The front post positioners 200 perform the function of repositioning relative to this slat and this takes place when the rollers 205 of these positioners contact ramps 228 of the tracks 227 and rotate the positioners 200 into the position in which the positioner above the cam rail 227 is shown in Fig. 14.

The next pair of picks to arrive under the magazine 52 are the picks 210, but when they so arrive they hang downwardly in lower position with the pins 211 thereof resting on the chains 188 so that these picks pass under the post hopper 147 and slat hopper 146. However, when the rollers 213 of the picks 210 engage the ramps 228 of cam rails 227, the picks 210 are swung upwardly to bring their upper ends into proper relation with the lowermost panel P in the panel hopper 145 (as shown in Fig. 14) so as to eject this panel from the hopper and propel it forwardly in the proper plan relation with the first post and slat picked by this picking unit 189.

The picks 218 are of the same height as the picks 195 and pick a post from the post hopper and a slat from the slat hopper in a similar manner as already described for the picks 195. At the same time the final slat and post are picked by the picks 218, the rail picking pins 219 pick the lowermost pair of rails R (see Figs. 14 and 17) from the rail hoppers 121. The shook picking unit 189, the operation of which is being described, have now picked a complete set of parts for forming a crate head 300 and these are all disposed in the proper plan relation for assembly, by nailing, to form a crate head. It is necessary for this shook picking unit 189 to continue to travel until the panel P engaged by the picks 210 of this unit is ejected from between the guides 162 and the panel supporting shelves 161, and for the rearmost slat S to be propelled forwardly from between the shelves 161 and the yieldable slat supporting arms 165 in order for these parts to be free to drop downwardly so that all of the parts picked are in proper relation for assembly. From here on there is no change in the relation between the parts thus picked, these parts being held together during their travel between the magazine 52 and the nailing mechanism 54 by downward pressure of the springs 259 and 260 thereagainst (see Figs. 3, 5 and 6) and the retarding friction applied to the bottom faces of the posts O by the post retarding file 251 (see Figs. 2, 3 and 4). As the conveyor 53 feeds the work toward the nailing mechanism 54 the work is brought into engagement with the spring 248 (see Fig. 2) which shifts the opposite edges of the work into sliding contact with the guide wall 240.

It is now to be noted that immediately after one shook picking unit 189 has finished picking a set of shook, assembling this in proper relation to form a crate head, the next shook picking unit 189 of the chains 188 proceeds to pick another similar set of shook from the magazine 52 in the same manner as above described.

It is also to be noted that the conveyor 53, when functioning in this manner, does not travel continuously but instead travels intermittently. This intermittent travel of the conveyor 53 is for the purpose of stopping each assembled group of crate head parts seven times, each stop being to permit the performance of one of the seven nailing operations, which is necessary to assemble these parts to produce a crate head. The manner in which this intermittent movement is accomplished will now be described.

As before noted, each nailing operation is accomplished by a single revolution of the main

drive shaft 418 and this shaft is rotated by the motor 422 continually and at a uniform rate throughout the operation of the machine. Power is constantly transmitted from the shaft 418 to the shaft 460 through the friction clutch 463 (see Figs. 36 and 40) this tending to rotate the shaft 460 in the direction of the broken arrow 600 (see Fig. 36). Whenever the stop pawl 476 is positioned as shown in Fig. 36, the shaft 460 is permitted to rotate only until one of the stops 473 comes into engagement with this pawl, as shown in this figure, where stop A is in engagement with this pawl. The pawl 476 is positioned in the path of the stops 473 as long as the roller 477 is on the low portion of the track 478 of the crank cam 435. With each revolution of the shaft 418, however, the high portion 483 of this track passes under the roller 477 which swings the pawl 476 downwardly (as shown in Fig. 37).

The withdrawal of the pawl 476 from the path of a stop 473 lodged thereagainst is only momentary and the pawl is returned immediately so that the shaft 460 is only permitted to rotate a distance sufficient to bring the next stop against this pawl. Thus for each rotation of the shaft 418, the shaft 460 is only permitted to rotate through the angle subtended by the leading faces of a certain pair of adjacent stops 473. As before pointed out, the stops 473 are adjusted in their positions about the stop disc 470 before the machine is started in operation so that the movement transmitted to the shaft 460, preparatory to the performance of each nailing operation, accomplishes the travel of the conveyor 53 such as will shift the work, on which the nailing mechanism is operating, a proper distance to cause the nails driven in the next following operation to be properly located in the work.

Fig. 36 shows the elements of the power drive mechanism 56 as these are related at the moment when the first nailing operation is being performed in the manufacture of a crate head and when the nails have just been completely driven into the work. These nails include the first pair of spikes N' and the first pair of nails 575. All of the chucks 303 are at the moment of operation, here illustrated, lowered into contact with the work by the roller 440 (see Fig. 6) descending onto a low portion of the crank cam 434, thereby rotating the shaft 254 (as shown in Fig. 26).

As the pitmen 438 pass over their lowermost dead center and start to rise, the roller 440 rises onto a high portion of the crank cam 434 so as to rotate the shaft 254 (as shown in Fig. 27) so as to lift the chucks 303 from the work. Closely following this action, the high portion 483 (Fig. 36) of the cam track 478 rides under the roller 477 so as to momentarily deflect the pawl 476 downwardly, thereby permitting the shaft 460 to be rotated by the friction clutch 463 until the next stop B comes into contact with the pawl 476 which in the meantime has been returned upwardly when the roller 477 returns into contact with the low portion of the cam track 476. This partial rotation of the shaft 460 is sufficient to operate the conveyor 53 to shift the work to bring the operating plane B into alignment with the nailing mechanism so that in the next nailing operation a pair of nails 576 is driven into the work in plane B. In the same manner the remaining five nailing operations are performed, the spacing of the nails on the work being determined by the spacing of the stops 473 on the stop disc 470. Rotation of the shaft 460 between the position in which the stop G is engaging the stop pawl 476, and the position in which the stop A engages this pawl, causes the travel of the conveyor 53 between the position in which the nailing mechanism performs the last nailing operation of the manufacture of a crate head 300 and the proper position of the conveyor for the nailing mechanism to perform the first nailing operation on the next succeeding group of crate head parts carried on the conveyor 53.

The manufacture of the second crate head proceeds in the same manner as described for the first and so on, each crate head after its manufacture has been completed in the seventh nailing operation of a given series being impelled along the anvil tracks 235 and 236 into the stacker 55. When a finished crate head, positioned ahead of the next crate head being manufactured in the machine, engages the control finger 396 of the stacker 55, this causes the elevator 372 in the immediately following revolution of the shaft 418 to elevate this finished crate head upwardly into the stack resting on the supporting latches 368 of the stacker.

As previously pointed out, while all the chucks in the nailing mechanism go through the motions of driving nails in each of the seven nailing operations in the manufacture of a crate head, individual chucks 338 and spiker chucks 301 and 302 drive nails during only the first and seventh of these nailing operations and individual chucks 337 drive nails only during the second, third, fourth, fifth and sixth of these nailing operations. This mode of operation is effected by selective feeding of nails to the chucks, the selection being accomplished by the selector bar 276 and its actuating mechanism and particularly the cam 286 (see Figs. 19 and 20). As before stated, the feeding of nails to certain chucks during each rotation of the main drive shaft 418 is accomplished by the engagement of the roller 275 with the cam 274 (see Fig. 6) which reciprocates the picker bar 271 between the position in which it is shown in Fig. 19 to the position in which it is shown in Fig. 22, and back again. Movement of the picker bar 271 from the position in which it is shown in Fig. 19 to the position in which it is shown in Fig. 22 takes place during the downward movement of the cross bar 340, carrying the roller 275, and the return movement of the bar 271 is accomplished by the upward return of the cross bar 340. This reciprocation of the picker bar 271 causes each nail pick 270 mounted thereon to convey a nail received from its runway 268 to an opening 580 disposed opposite the notch 581 of this nail pick at the end of the first shift of its reciprocation. This transfer of a nail by a pick 270 during any picking operation is only possible if the nail passage 277 in the bar 276 adjacent this pick is disposed so as to overlap both the adjacent nail runway 268 and opening 580.

It is to be noted in Figs. 19 and 22 that from the position in which the control bar 276 is there shown, certain of the passages 277 in this bar are disposed so as to allow nails to be delivered from adjacent runways 268 while other of these passages are not so disposed and the bar 276 obstructs the passage of a nail from the runways 268 next to these other passages. There are six nail runways 268, one for each of the chucks in the nailing mechanism. The position in which the bar 276 is shown in Figs. 19 and 22 permits the picking of nails from those runways from which nails picked are delivered to the chucks 377 but prevents the picking of nails from those run-

ways which feed nails to the chucks 301, 302 and 338.

When the cam 286 turns, however, so that the roller 285 passes from the low cam portion 299 to one of the high cam portions 298, the control bar 276 is shifted to a different position from that shown in Figs. 19 and 22, the passages 277 being then so disposed as to permit the delivery of nails from the nail runways 268 from which nails are picked for the chucks 301, 302 and 338 and to prevent the passage of nails from the runways 268 from which nails are picked for the chucks 337. Actuation of the ratchet wheel 287 on which the cam 286 is formed is accomplished by reciprocation of the rod 292 with each nailing operation. This is effected as clearly shown in Figs. 26 and 27, by the rocking of the shaft 254 and the arm 293 fixed thereon, to which the rod 292 is pivotally attached. The rocking of the shaft 254 during each nailing operation is effected by the link 442 (see Fig. 6) which connects at its upper end to an opposite extension of the arm 293 from that which connects to the rod 292 and its lower end is pivoted on the arm 441, the roller 440 of which rests on the crank cam 434 and transmits a vertical reciprocal motion from this cam to the link 442. It is to be noted that the ratchet drive for the cam 286 requires seven revolutions of the main drive shaft 418, which causes seven nailing operations, in order to give the cam 286 one-half a revolution. At the beginning and end of each such one-half revolution, the roller 285 is disposed on one of the high cam portions 298 and this is timed so as to occur during the first and seventh nailing operations on each crate head 300 manufactured in the machine. During the other five nailing operations the roller 285 comes to rest on one of the low cam portions 299. The shifting of the control bar 276, which results from this, is arranged in accordance with the mode of operation just described to supply nails to the chucks 301, 302 and 338 during the first and seventh nailing operations in the manufacture of each crate head, and only during these nailing operations, and to supply nails to the individual chucks 337 during the second, third, fourth, fifth and sixth nailing operations, and only during these nailing operations.

When for any reason it is desired to manually operate the work feeding conveyor 53, so as to time the same or to clear any jams which may have occurred therein, or for any other reason, the operator may take hold of the handle 526 and swing the same away from its normal position where it rests against one of the stops 540 (as shown in Fig. 42). This brings one of the beveled ends 520 of the arcuate cam 516 against the roller 479 which is mounted on the dog 476 so as to shift this dog out of the path of the stops 473. The shaft 418 may now be rotated by depression of the plunger 534 in the end of the handle so as to insert the lug 535 into one of the grooves 504 in the sleeve 502 on this shaft and rock the spider 511 only far enough at one time so that the roller 479 will still remain in engagement with the cam 516. Naturally this adjustment could not be made while the machine is running, and is solely for use while it is stopped.

When through with using the adjustment device 500 in this manner, the handle is merely rocked into contact with the stop 540, against which it is shown in Fig. 41, this permitting the roller 479 to run off the cam 516, whereupon the dog 476 is returned by the spring 484 into the path of the stops 473.

In the manufacture of crate heads 300, as above described, the machine 48 of our invention operates quite rapidly and accurately but we have provided safety devices for halting the operation of the machine automatically in case there should be any jam in the conveyor 53 caused by the placing of faulty shook in the magazine 52 which is sometimes unavoidable. It is for this reason that the switch 456 as one group, and the switches 565 and 566, 542 and 493, connected in series as another group, are placed in parallel and then included in the circuit of the solenoid 551. This means that when the machine is running and the switch 456 is open all of the switches 493, 542, 565 and 566 must be kept closed in order for the machine to continue running which, by the same token, means that when the machine is running and any one of the switches 493, 542, 565, or 566 is open, the switch 456 must be closed at that time in order for the solenoid 551 to remain energized and the switch 546 closed, unless one of the start switches 563 or 564 should be held closed, and it is to be recalled that these are normally open.

When a jam occurs in the conveyor 53, rotation of the shaft 460 is generally halted by the jam, thus leaving the lever 490 uncontacted by one of the stops 473 so that the switch 493 remains open (as shown in Fig. 37). When this happens, the continuing rotation of the shaft 418 causes the cam 453 to engage the roller 454 of the switch 456 and opens this switch. Immediately when this takes place, at the same time that jam is holding the switch 493 open, the electric circuit of the solenoid 551 is broken and the main magnetic switch 546 of the motor 422 is thrown open and the motor stopped rapidly by the electric brake 585 with which this is equipped (see Fig. 33). This automatically prevents damaging the work by double nailing when the jamming of the conveyor suspends the proper feeding of the work.

If the operator should fail to keep the magazine 52 supplied with crate head parts while the machine is operating the spring 260 (see Fig. 5) would drop downwardly thus permitting the switch 542 to open. With this open, the opening of the switch 456 with the next revolution of the shaft 418 would stop the motor 422 in the same manner as when the switch 493 was left open. It is thus seen that we have provided a means for automatically stopping the machine whenever there is a jam in the machine, as well as when through inadvertence the magazine 52 is not kept supplied with crate head parts.

The electric system 545 is also adapted to permit the jogging of the machine at a time when the switch 456 is not held open by the cam 453 as when this cam is in the dotted line position 587 of Fig. 7. In such a situation the operator depresses the pedal 457, thus holding the roller 454 outwardly in a position similar to that in which it is disposed when engaged by the cam 453 thus holding this switch open. Then by holding one finger on one of the stop switches 565 or 566, so as to hold this open, and by intermittently closing one of the start switches 563 or 564, the operator is able to jog the machine to move the mechanism thereof slight distances and without the necessity of moving the machine through an entire cycle before it stops.

We claim:

1. In combination: a slat hopper; a post hop-

per; a pick conveyor passing first under said post hopper and then under said slat hopper; pick means on said conveyor for first picking a post from said post hopper and then picking a slat from said slat hopper and propelling the parts thus picked ahead of said pick means as the latter travels with said conveyor away from said hoppers; and means operated coordinately with said conveyor for shifting said post forwardly in the direction of travel of said conveyor away from said picking means to reposition said post with respect to said slat.

2. In combination: a slat hopper; a post hopper; a pick conveyor passing first under said post hopper and then under said slat hopper; pick means on said conveyor for first picking a post from said post hopper and then picking a slat from said slat hopper and propelling the parts thus picked away from said hoppers; means mounted on said conveyor adapted to engage said post and propel said post forwardly away from said pick means to reposition said post with respect to said slat and means responsive to the travel of said conveyor for actuating said post re-positioning means.

3. In combination: a post hopper; a slat hopper; a picking conveyor traveling beneath said post hopper and then beneath said slat hopper; downwardly inclined guide means for guiding the lowermost post in said post hopper into a position beneath the lowermost slat in said slat hopper; and picking means on said conveyor for first engaging and picking said lowermost post from said post hopper and then engaging said lowermost slat and picking the same from said slat hopper.

4. In combination: a post hopper; a slat hopper; a picking conveyor traveling beneath said post hopper and then beneath said slat hopper; picking means on said conveyor adapted to first engage the lowermost post in said post hopper and pick the same from said hopper and then engage the lowermost slat in said slat hopper and pick said slat from said slat hopper; downwardly inclined means for guiding said post, as it is propelled by said pick means from said post hopper, into a position beneath the lowermost slat in said slat hopper so that when said slat is picked from said slat hopper, said post will be disposed beneath said slat; and means for supporting the balance of the posts in said post hopper until said lowermost post has been transferred from the bottom of said post hopper to said inclined guide means.

5. In combination: hopper means for holding a supply of slats; rail hopper means positioned to feed rails transversely inwardly beneath the opposite ends of the slats in said slat hopper means; and a picking conveyor for feeding said rails and said slats from said hopper means and arranging these in the proper relation to be united.

6. In combination: a panel hopper; a slat hopper; a post hopper; a picking conveyor passing under said hoppers; rail hoppers positioned to feed rails transversely inwardly beneath said slat and panel hoppers; and picking means on said conveyor for picking panels, slats, posts and rails from said hoppers and arranging the same in proper relation to be united in the manufacture of a crate head.

7. In combination: a pair of guide tracks for guiding opposite side edges of work to be fed along a given path; a pair of endless conveyors, one of which is located adjacent each of said tracks; means on said conveyors for engaging and propelling work along said path; a pair of magazine hopper halves one of which is disposed adjacent each of said guide tracks, said hopper halves cooperating to form a magazine; a pair of bases on each of which is mounted the track, conveyor, and hopper half at one side of said path; means for causing relative movement between said bases to vary the width of said path and the spacing of said tracks, conveyors and hopper halves to accommodate work differing in transverse dimension, said magazine being adapted to feed certain work parts downwardly into operative relation with said conveyors; and a pair of secondary hoppers one of which is mounted on each of said bases for feeding other work parts inwardly beneath said first mentioned hoppers and into operative relation with said conveyors.

8. In combination: a pair of guide tracks for guiding opposite side edges of work to be fed along a given path; a pair of endless conveyors, one of which is located adjacent each of said tracks; means on said conveyors for engaging and propelling work along said path; a pair of magazine hopper halves one of which is disposed adjacent each of said guide tracks, said hopper halves cooperating to form a magazine for feeding work downwardly to said path; a pair of bases on each of which is mounted the track, conveyor, and hopper half at one side of said path; means for causing relative movement between said bases to vary the width of said path and the spacing of said tracks, conveyors and hopper halves to accommodate work differing in transverse dimension, said magazine being disposed above said path to provide side openings communicating with said path beneath said hopper halves; and means for feeding work parts inwardly through said openings in position to be engaged and fed along said path by said conveyors.

9. In combination: a pair of guide tracks for guiding opposite side edges of work to be fed along a given path; a pair of endless conveyors, one of which is located adjacent each of said tracks; means on said conveyors for engaging and propelling work along said path; a pair of magazine hopper halves one of which is disposed adjacent each of said guide tracks, said hopper halves cooperating to form a magazine for feeding work downwardly to said path; a pair of bases on each of which is mounted the track, conveyor, and hopper half at one side of said path; means for causing relative movement between said bases to vary the width of said path and the spacing of said tracks, conveyors and hopper halves to accommodate work differing in transverse dimension, said magazine being disposed above said path to provide side openings communicating with said path beneath said hopper halves; means for feeding work parts inwardly through said openings in position to be engaged and fed along said path by said conveyors; and guide arms disposed in said path opposite said openings to be engaged by work parts fed inwardly into said openings to properly position said work parts for engagement by said work propelling means.

10. In combination: a pair of guide tracks for guiding opposite side edges of work to be fed along a given path; a pair of endless conveyors, one of which is located adjacent each of said tracks; means on said conveyors for engaging and propelling work along said path; a pair of magazine hopper halves one of which is disposed adjacent each of said guide tracks, said hopper halves cooperating to form a magazine for feeding work downwardly to said path; a pair of bases

on each of which is mounted the track, conveyor, and hopper half at one side of said path; means for causing relative movement between said bases to vary the width of said path and the spacing of said tracks, conveyors and hopper halves to accommodate work differing in transverse dimension, said magazine being disposed above said path to provide side openings communicating with said path beneath said hopper halves; means for feeding work parts inwardly through said openings in position to be engaged and fed along said path by said conveyors; guide arms disposed in said path opposite side openings to be engaged by work parts fed inwardly into said openings to properly position said work parts for engagement by said work engaging means said guide arms also guiding work parts fed downwardly into said path from said magazine while said parts are being propelled by said conveyors along said path beneath said magazine.

11. In combination: a pair of guide tracks for guiding opposite side edges of work to be fed along a given path; a pair of endless conveyors one of which is located adjacent each of said tracks; means on said conveyors for engaging and propelling work along said path; a pair of magazine hopper halves one of which is disposed adjacent each of said guide tracks, said hopper halves cooperating to form a magazine adapted to feed certain work parts downwardly to said path, there being side openings into said path beneath said magazine; and means for feeding work parts inwardly through said openings in position to be engaged and fed along said path by said conveyors.

12. A combination as in claim 11, in which guide arms are disposed in said path opposite said openings to be engaged by work parts fed inwardly into said openings to properly position said work parts for engagement by said work propelling means.

13. A combination as in claim 11, in which guide arms are disposed in said path opposite said openings to be engaged by work parts fed inwardly into said openings to properly position said work parts for engagement by said work propelling means, said guide arms also guiding work parts fed downwardly to said path from said magazine while said parts are being propelled by said conveyors along said path beneath said magazine.

14. In combination: a pair of guide tracks for guiding opposite side edges of work to be fed along a given path; a magazine hopper disposed above said path for holding and presenting work parts to be delivered downwardly to said path, there being side openings beneath said magazine communicating with said path; means for delivering other work parts through said openings into said path; and feed conveyor means for engaging work parts presented to said path as aforesaid and for propelling said work parts along said path.

15. A combination as in claim 14 in which guide arms are disposed in said path and substantially parallel therewith opposite said openings to be engaged by work parts fed inwardly into said openings to properly position said work parts for engagement by said work propelling conveyor, said parts from said magazine being fed downwardly between said guide arms.

16. A combination as in claim 14 in which guide arms are disposed in said path and substantially parallel therewith opposite said openings to be engaged by work parts fed inwardly into said openings to properly position said work parts for engagement by said work propelling conveyor, said magazine containing parts differing in transverse dimension, one of said parts when delivered from said magazine passing between said guide arms and the other of said parts when delivered from said magazine resting on top of said guide arms.

17. In a mechanism for assembling rails, posts and slats in which said posts are disposed between said rails and said slats overlie said posts and rails preparatory to uniting said parts in an assembling machine, the combination of: means defining a path for said parts; a magazine disposed above said path for delivering said posts and slats downwardly to said path with said slats and posts disposed transversely of said path, there being side openings beneath said magazine giving access to said path; means for delivering said rails through said side openings into said path; conveyor means for stripping the lowermost post and slat from said magazine and propelling these along said path with the foremost rails fed inwardly through said openings; and a pair of guide arms between which said posts are fed when stripped from said magazine and along the top of which said slats are fed when stripped from said magazine, said guide arms serving as stops for said rails when fed inwardly through said openings.

18. A combination as in claim 17, in which guide means is provided alongside said path which shifts said rails inwardly against said posts and aligns said slats transversely with said rails and posts after said conveyor has propelled said posts, rails and slats beyond the ends of said guide arms.

19. A combination as in claim 17, in which said magazine also contains a supply of panels disposed above said arms in advance of said posts and slats; means for supporting said panels above and out of the path of said slats when the latter are being propelled along said guide arms; and means actuated by said conveyor for stripping the panels from said magazine for assembly with said posts, slats and rails.

20. In a mechanism for arranging rails, posts, and slats in which said posts are disposed between said rails and said slats overlie said posts and rails preparatory to uniting said parts in an assembling machine, the combination of: means defining a path for said parts; a magazine disposed above said path for delivering said posts and slats downwardly to said path with said slats and posts disposed transversely of said path; means for delivering said rails inwardly beneath said slats; conveyor means for engaging a set of said parts as thus fed into said path and propelling these along said path; and a pair of guide arms disposed beneath said slats, constituting inner stops for said rails when the latter are fed into said path, and also guiding said posts by admitting said posts broadside between said arms when said posts are fed into said path.

21. A combination as in claim 20 in which said guide arms support a column of slats in said magazine from the bottom of which column slats are stripped by said conveyor.

22. A combination as in claim 20 in which said magazine includes a slat hopper and a post hopper, said conveyor passing said post hopper before it passes said slat hopper, said guide arms extending from just below said post hopper and in the direction of said conveyor to lie beneath

said slat hopper and support a column of slats in said slat hopper.

23. A combination as in claim 20 in which guide tracks define said path and support said parts when delivered from said magazine, and in which said magazine includes a slat hopper containing a column of slats and said guide arms are disposed above and out of contact with said tracks and extend below said slat hopper to support said column of slats to permit slats to be stripped by said conveyor means from the bottom of said column and propelled along said guide arms.

24. A combination as in claim 20 in which guide tracks define said path and support said parts when delivered from said magazine, and in which said magazine includes a slat hopper containing a column of slats and said guide arms are disposed above and out of contact with said tracks and extend below said slat hopper to support said column of slats to permit slats to be stripped by said conveyor means from the bottom of said column and propelled along said guide arms, said conveyor means being disposed between said tracks and extending outwardly between said tracks and said guide arms to engage said rails.

25. A combination as in claim 20 in which said magazine has a post hopper and a slat hopper which said conveyor passes in the order named, and in which said post hopper has side guides from the lower ends of which said guide arms are supported, said guide arms extending forwardly therefrom to lie beneath said slat hopper and support a column of slats therein whereby said conveyor means strips slats successively from the bottom of said column.

26. A combination as in claim 20 in which said magazine has a post hopper and a slat hopper which said conveyor passes in the order named, and in which said post hopper has side guides from the lower ends of which said guide arms are supported, said guide arms extending forwardly therefrom to lie beneath said slat hopper and support a column of slats therein whereby said conveyor means strips slats successively from the bottom of said column; and means for guiding posts, stripped by said conveyor means from said post hopper, downwardly in said path into a position where said posts underlie said slats.

27. In combination: a slat hopper; a post hopper; a pick conveyor passing first under said post hopper and then under said slat hopper; pick means on said conveyor for first picking a post from said post hopper and then picking a slat from said slat hopper and propelling the parts thus picked ahead of said pick means as the latter travels with said conveyor away from said hoppers; and means operating in timed relation with said conveyor for repositioning said post with respect to said slat by causing relative movement between said post and said slat parallel with the direction of travel of said conveyor after said post and slat have been picked from said hoppers by said pick means as aforesaid.

28. In combination: a slat hopper; a post hopper; a conveyor passing first under said post hopper and then under said slat hopper; pick means on said conveyor for first picking a post from said post hopper and then picking a slat from said slat hopper and, by contact between said pick means and the parts thus picked, propelling the latter with said conveyor away from said hopper, said post when thus propelled lying beneath said slat and adjacent the rear edge thereof; and means causing relative movement between said post and said slat while these posts are being carried on said conveyor to reposition said post adjacent the front edge of said slat.

29. In combination: a slat hopper; a post hopper; a pick conveyor passing first under said post hopper and then under said slat hopper; a pair of pick means on said conveyor each of which picks a post from said post hopper and then a slat from said slat hopper and propels the parts thus picked ahead of said pick means as the latter travels with said conveyor away from said hoppers; each post when so picked being located beneath the slat associated therewith and adjacent the rear edge of the latter; and means causing relative movement between the post and slat picked by the first of said pick means so as to reposition said post adjacent the front edge of said slat.

30. A combination as in claim 29 in which means is provided for feeding rails broadside and transversely to the direction of travel of said conveyor to bring said rails beneath opposite ends of said slat and with the ends of said rails overlapping the ends of said posts; and means on said conveyor for picking up said rails and conveying the latter properly related as aforesaid to said slats and posts to a station for assemblying said slats, posts and rails.

31. In combination: a panel hopper; a slat hopper; a post hopper; a pick conveyor passing under said hoppers; said hoppers being parallel and disposed transversely with respect to the direction of travel of said conveyor; rail hoppers positioned to feed rails inwardly relative to said conveyor beneath said slat and panel hoppers with said rails disposed parallel with said conveyor; and picking means on said conveyor for picking panels, slats, posts and rails from said hoppers as said elements are presented to said conveyor.

GERALD C. PAXTON.
GLENN E. STILWELL.

CERTIFICATE OF CORRECTION.

Patent No. 2,378,948. June 26, 1945.

GERALD C. PAXTON, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 21, strike out the word "view"; page 3, second column, line 65, for "positioned" read --positioner--; page 6, first column, line 31, after "drive mechanism" insert the numeral "56"; and second column, line 12, for "Figs. 6 and 9" read --Figs. 6 and 8--; page 7, first column, line 12, for "one end" read --the end--; line 45, for "shock" read --shook--; page 11, first column, line 23, claim 2, after "slat" insert a semi-colon; and second column, line 16, claim 7, for "hoppers" read --hopper halves--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of December, A. D. 1945.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.