Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

NAIL DRIVING APPARATUS

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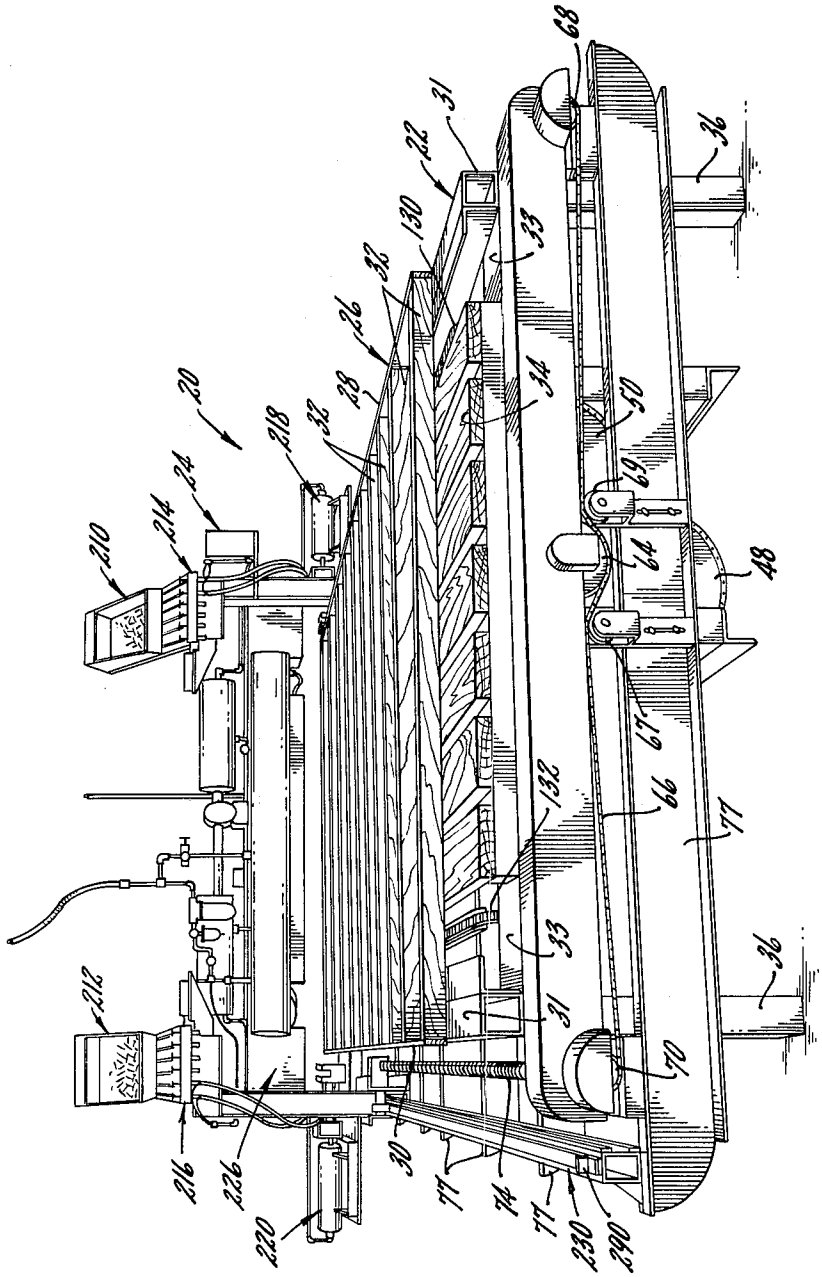


FIG. 1.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Groen & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

NAIL DRIVING APPARATUS

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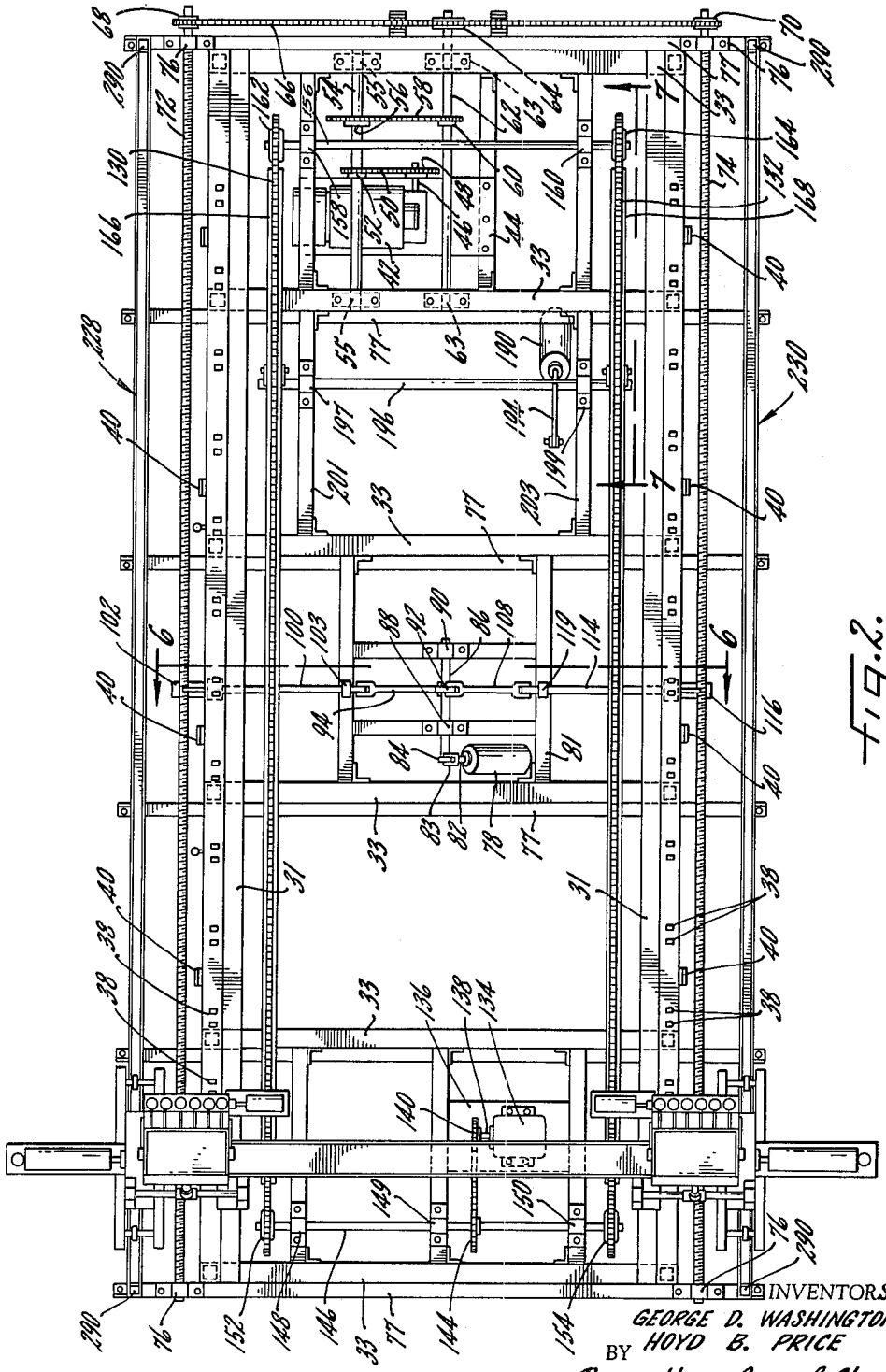


FIG. 2.

INVENTORS.
GEORGE D. WASHINGTON
BY HOYD B. PRICE
Byron, Hume, Groen & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

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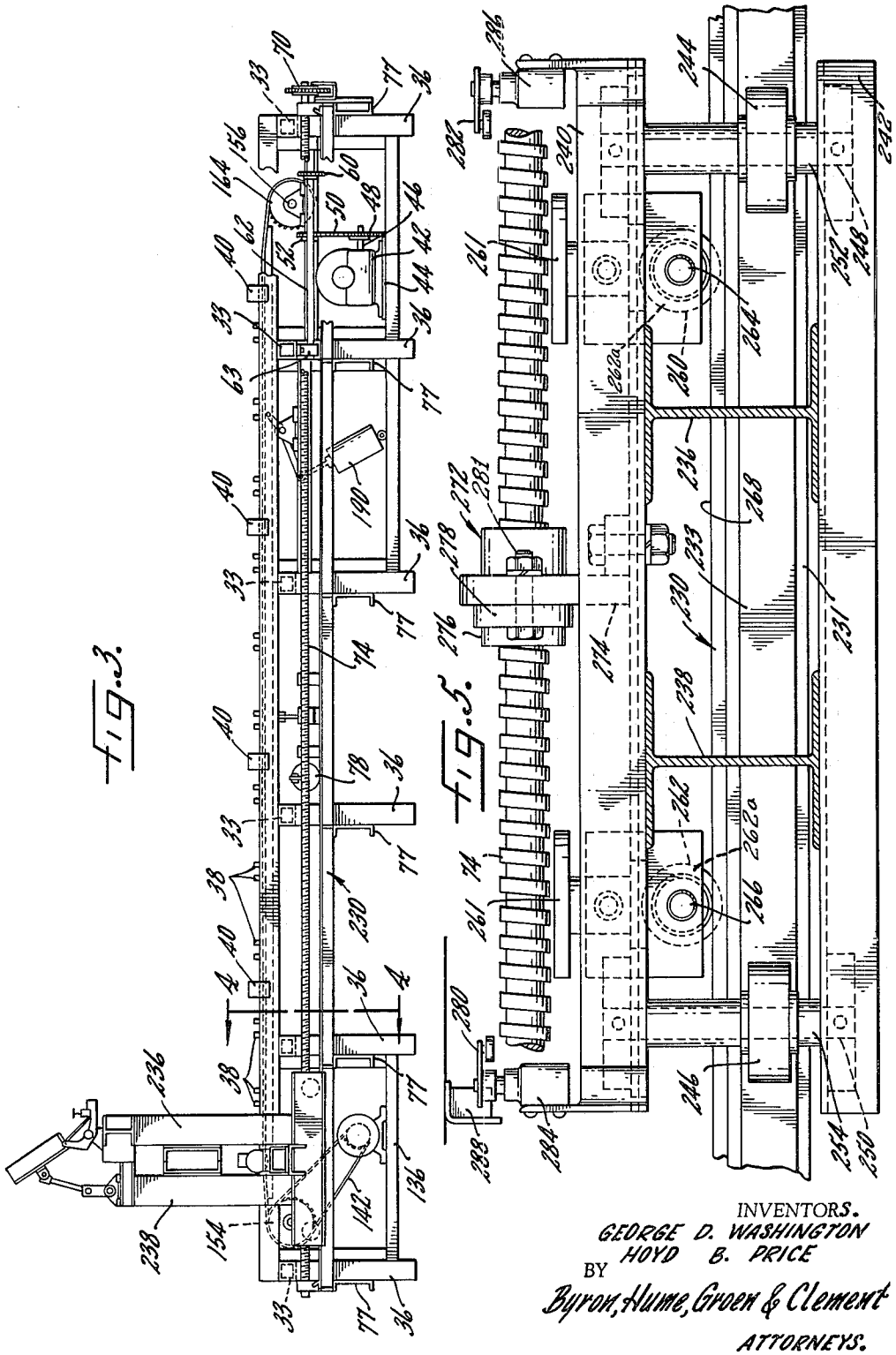


FIG. 3.

FIG. 5.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Green & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

NAIL DRIVING APPARATUS

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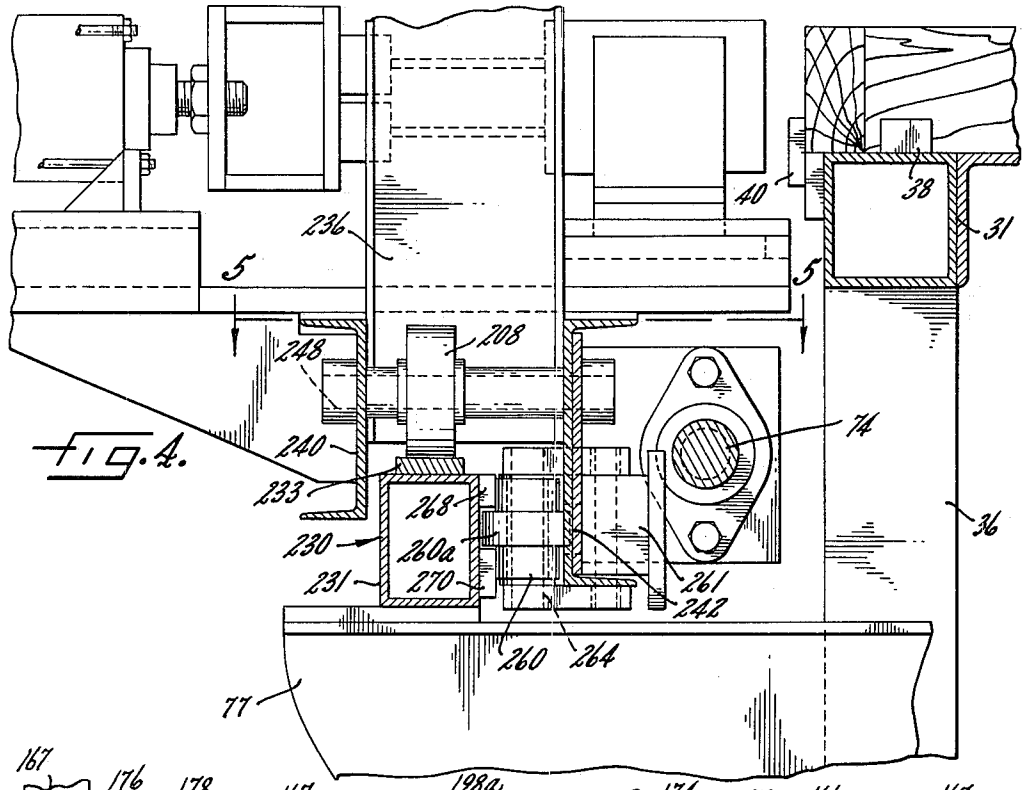


fig. 4.

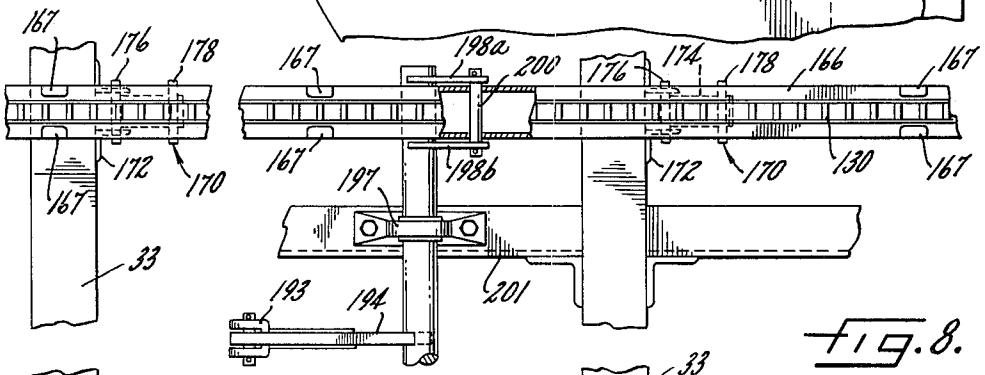
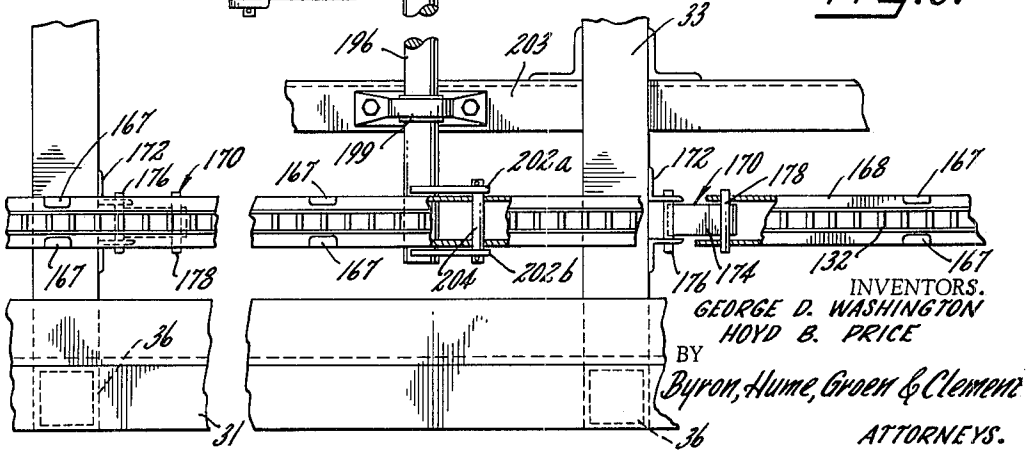


fig. 8.



INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Green & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

NAIL DRIVING APPARATUS

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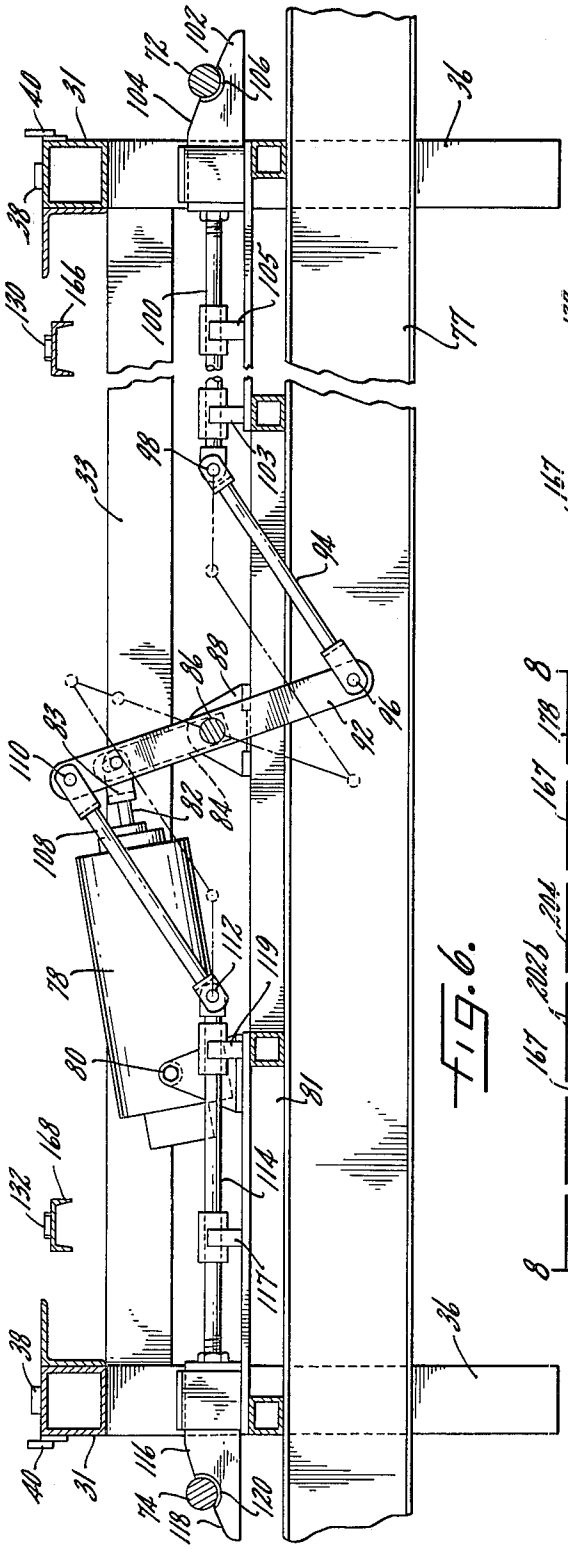


FIG. 6.

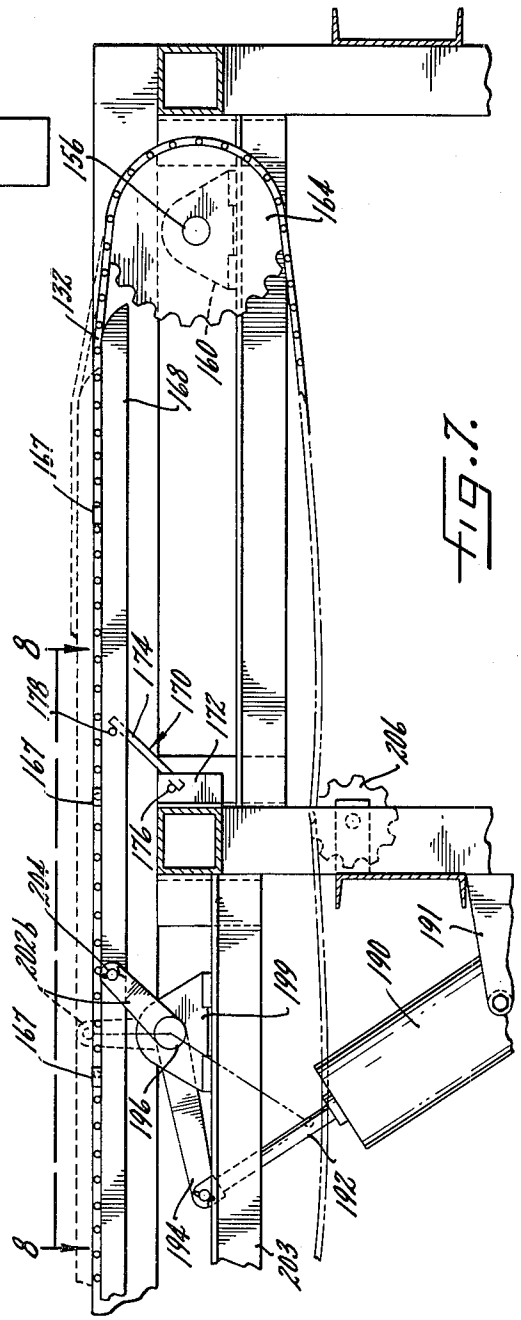


FIG. 7.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Groen & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

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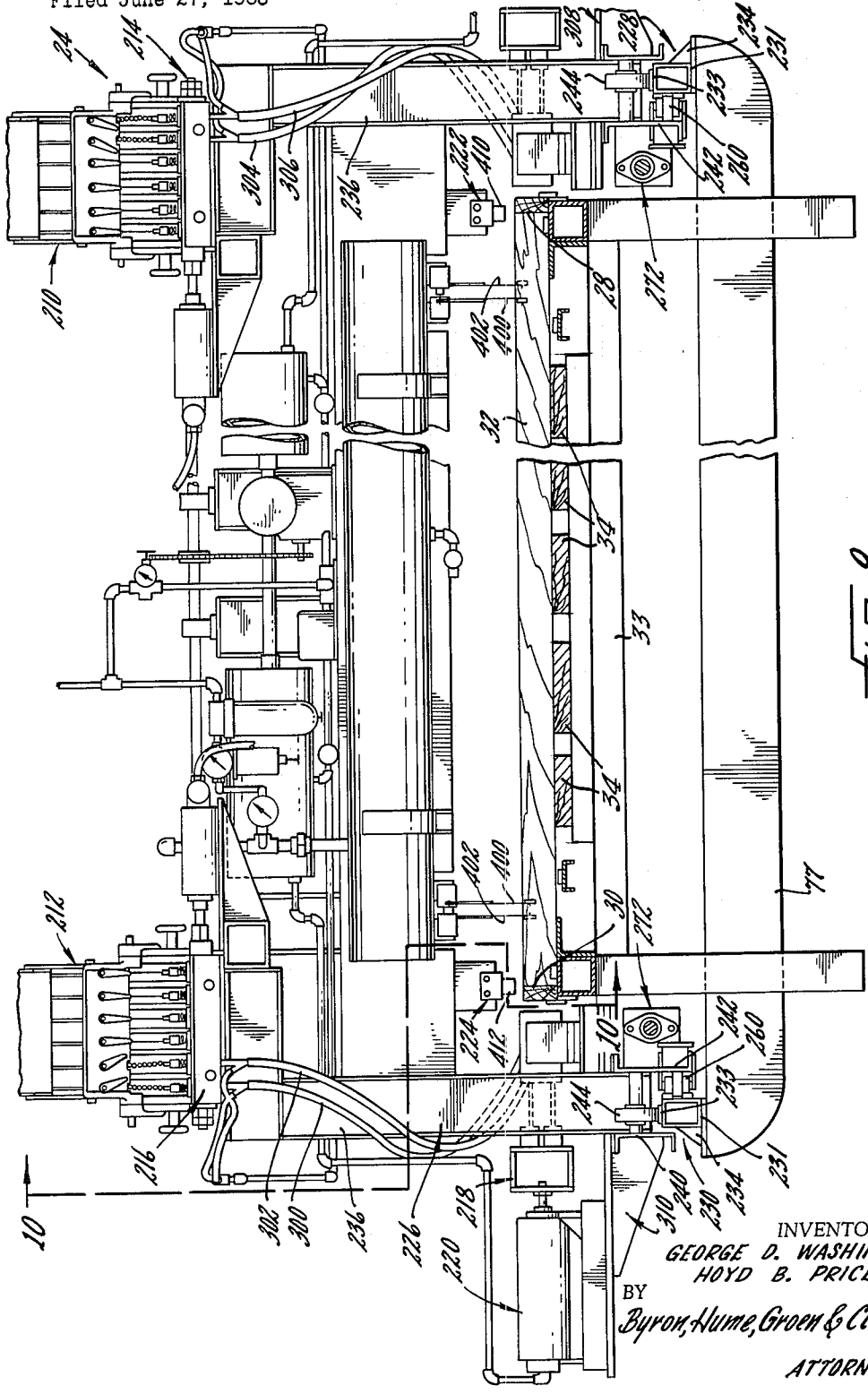


FIG. 9.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Groen & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

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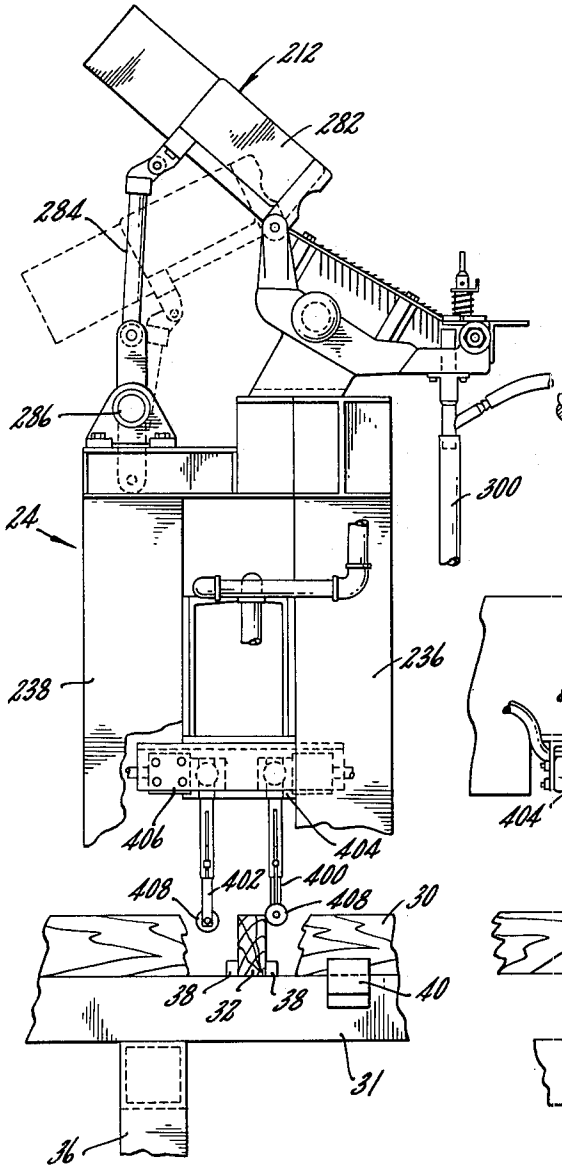


Fig. 10.

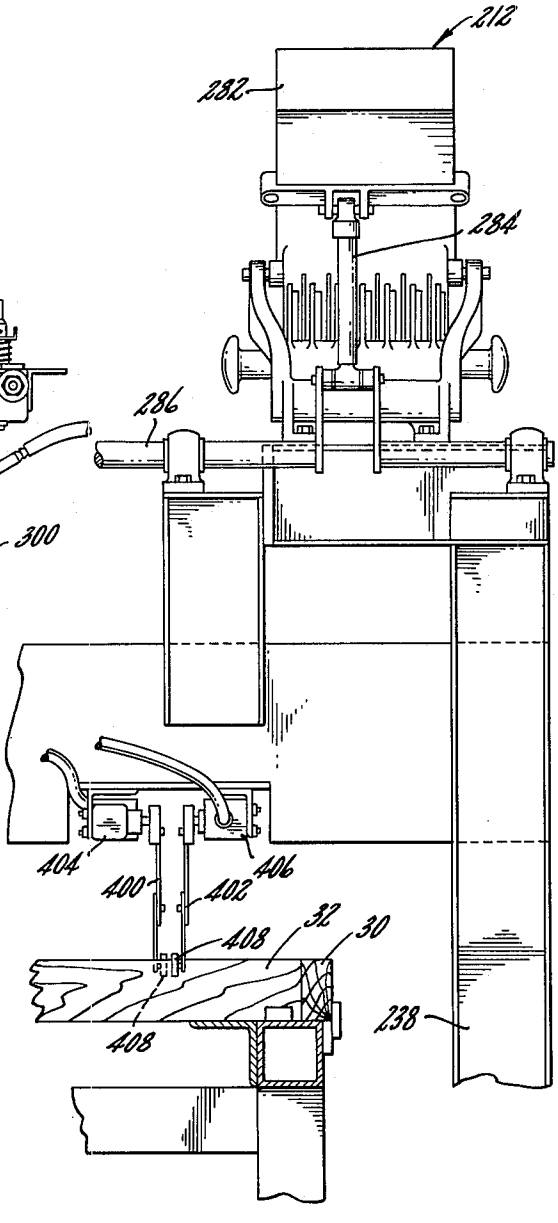


Fig. 11.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Groen & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

NAIL DRIVING APPARATUS

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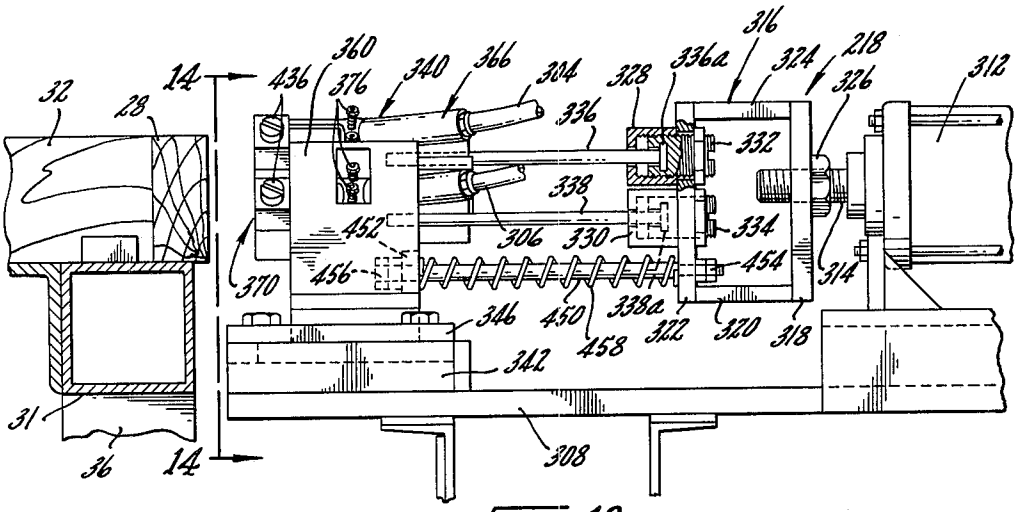


Fig. 12.

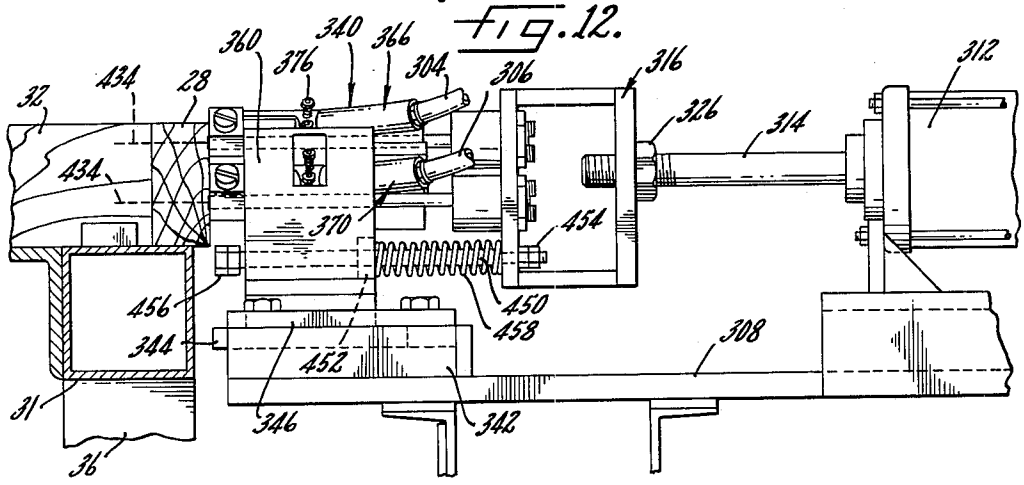


Fig. 13.

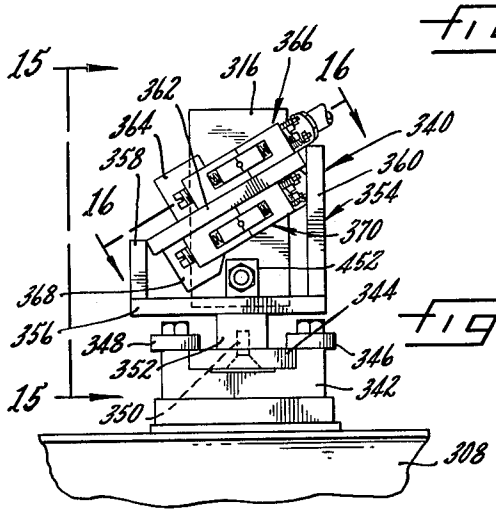


Fig. 14.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Groen & Clement
ATTORNEYS.

Jan. 11, 1966 G. D. WASHINGTON ET AL 3,228,580

NAIL DRIVING APPARATUS

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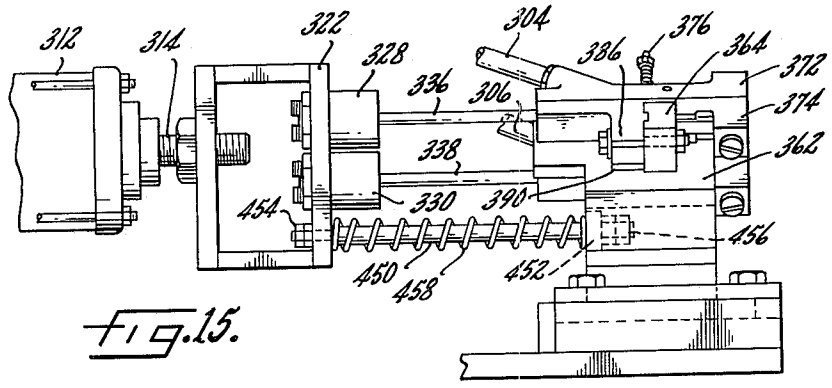


Fig. 15.

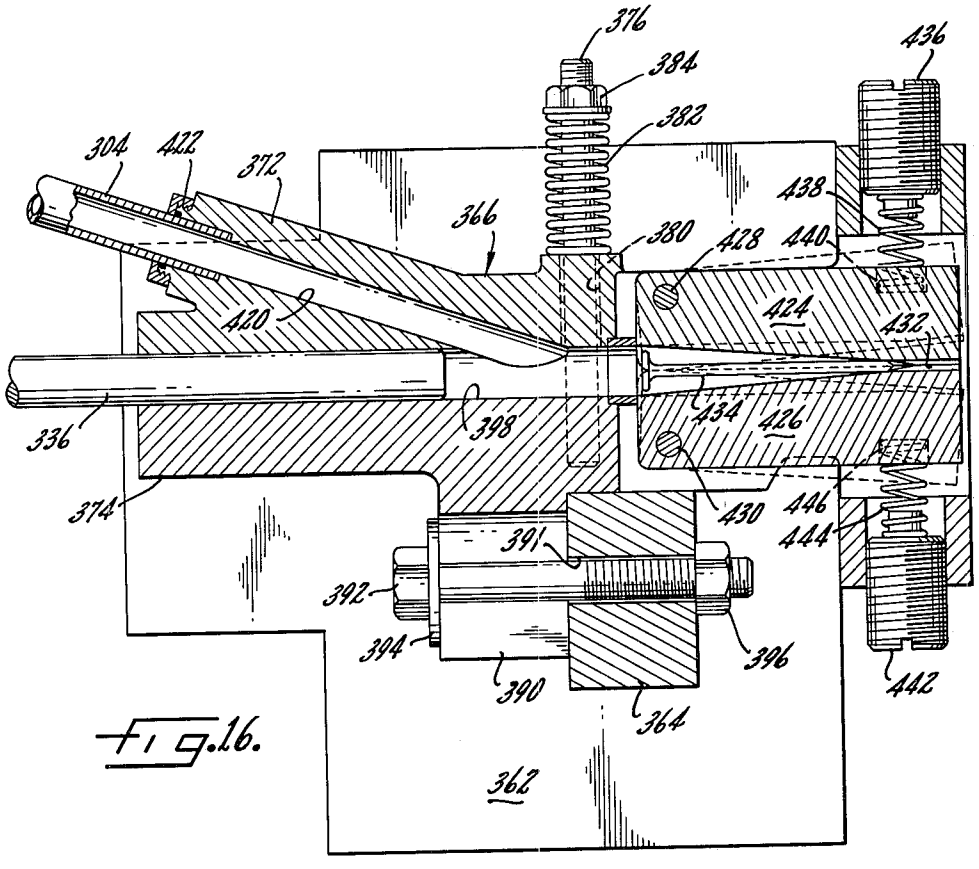


Fig. 16.

INVENTORS.
GEORGE D. WASHINGTON
HOYD B. PRICE
BY
Byron, Hume, Groen & Clement
ATTORNEYS.

United States Patent Office 3,228,580 Patented Jan. 11, 1966

3,228,580

NAIL DRIVING APPARATUS

George D. Washington and Hoyd B. Price, Lafayette, Ind., assignors to National Homes Corporation, Lafayette, Ind., a corporation of Indiana

Filed June 27, 1963, Ser. No. 291,047
18 Claims. (Cl. 227—101)

This invention relates to means for constructing prefabricated wall sections or panels and, more particularly, to a nailing apparatus for constructing frames for building sections, such as wall sections, panels, or the like.

It is an object of the present invention to provide a means for constructing building sections.

It is a further object of the present invention to provide a means for constructing frames for building sections or panels.

It is still another object of the present invention to provide means for nailing frame members together to form building sections.

It is yet another object of the present invention to provide a nailing machine for constructing frames suitable for building sections, the nailing machine being adapted to support the frame members, nail the frame members together to form a frame, and discharge the completed frame.

It is still another object of the present invention to provide a nailing machine adapted to automatically nail together the frame members of a frame for use in a building.

It is another object of the present invention to provide a nail driving assembly suitable for use in a nailing machine for constructing frames for building sections.

It is a further object of the present invention to provide a chuck assembly suitable for use in a nailing machine for constructing frames for building sections.

The invention, both as to its organization and method of operation, taken with further objects and advantages thereof, will be understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a frame nailing machine embodying the features of the present invention;

FIGURE 2 is a top view of the frame nailing machine of FIGURE 1, with the center frame supporting means removed;

FIGURE 3 is a side elevational view of the frame nailing machine of FIGURE 1;

FIGURE 4 is a cross-sectional view of the frame nailing machine of FIGURE 1 taken along line 4—4 of FIGURE 3;

FIGURE 5 is a cross-sectional view of the frame nailing machine of FIGURE 1 taken along line 5—5 of FIGURE 4;

FIGURE 6 is a cross-sectional view of the frame nailing machine of FIGURE 1 taken along line 6—6 of FIGURE 2;

FIGURE 7 is a cross-sectional view of the frame nailing machine of FIGURE 1 taken along line 7—7 of FIGURE 2;

FIGURE 8 is a cross-sectional view of the frame nailing machine of FIGURE 1 taken along line 8—8 of FIGURE 7;

FIGURE 9 is an enlarged front view of the traversing nailing assembly of the frame nailing machine of FIGURE 1;

FIGURE 10 is a cross-sectional view of the nailing assembly shown in FIGURE 9 taken along line 10—10 of FIGURE 9;

FIGURE 11 is an enlarged fragmentary back view of the traversing nailing assembly shown in FIGURE 9;

FIGURE 12 is a side view of a nail driving assembly used in the frame nailing machine of FIGURE 1, said nail driving assembly being in its retracted position;

FIGURE 13 is a side view of the nail driving assembly of FIGURE 15 with the nail driving assembly in its extended position;

FIGURE 14 is an end view of the nail driving assembly of FIGURE 12 taken along line 14—14 of FIGURE 12;

FIGURE 15 is a side view of the nail driving assembly of FIGURE 12 taken along line 15—15 of FIGURE 14; and

FIGURE 16 is a cross-sectional view of a chuck means in the nail driving assembly of FIGURE 12 taken along line 16—16 of FIGURE 14.

Referring to FIGURE 1, a frame nailing machine embodying the features of the present invention is indicated generally by reference numeral **20**. The frame nailing machine **20** comprises a table means, indicated generally by reference numeral **22**, and a traversing nailing assembly, indicated generally by reference numeral **24**. The table means **22** is adapted to support the components of a frame, indicated generally by reference numeral **26**, suitable for use in buildings. In this instance, the frame **26** is for a wall section of a building and comprises a longitudinally extending head frame member **28**, a longitudinally extending foot frame member **30** and a plurality of transversely extending frame members **32**. The frame or stud members **28**, **30** and **32**, which are in this instance 2" x 4" wooden beams, are placed manually on the table means **22** in the position that they are to be attached to one another. The table means **22** has means to hold the frame members **28**, **30** and **32** in proper position as will be more apparent hereinafter.

The traversing nailing assembly **24** is mounted upon the table means **22** and is adapted to traverse the table means **22**, i.e., move from one end of the table means **22** to the other. As the nailing assembly **24** traverses the table means **22**, it will stop and nail each joint where the transverse frame members **32** abut the head frame member **28** and the foot frame member **30**. In this manner, upon each traverse of the nailing assembly **24** the transverse frame members **32** are nailed to the head frame member **28** and the foot frame member **30** to provide a completed rigid frame **26** suitable for use in building sections, walls or panels. The means for driving the traversing nailing assembly **24** is mounted in the table means **22**. Means are also provided for removing the completed frame **26** from the table means **22**.

TABLE MEANS 22

Referring now to FIGURES 1–8, and more particularly to FIGURES 1–3, the table means **22** includes two longitudinal members **31**, a plurality of transverse members **33**, and a plurality of legs **36** which are welded or suitably attached to one another to form the basic framework of the table means **22**. In this instance the members **31** and **33** and the legs **36** are made of hollow rectangular structural steel though other structural elements could be employed. The members **31** include angle irons welded to the rectangular steel elements to further enhance the rigidity of the framework. Mounted between the longitudinal members **31** on this framework is a center frame supporting means **34**. The longitudinal members **31** and the frame supporting means **34** form a table or bed upon which the frame members **28**, **30** and **32** of the frame **26** are placed in proper position for the nailing operation, as shown in FIGURE 1.

To these ends, a plurality of paired, upwardly extending guide means **38**, made of steel or other suitable metal, are welded to the longitudinal members **31** (FIGURES 2 and 3) and are adapted to hold an end of a transverse frame member **32** in the desired location with respect to the head frame member **28** or the foot frame member **30**. The head frame member **28** is placed on one of the longitudinal members **31** between the ends of the transverse members **32** and guide means **40**, shown in FIGURES 2 and 3, which are attached to the outside edges of the longitudinal members **31** by welding or the like. Likewise, the foot frame member **30** is placed on the other longitudinal member **31** between the ends of the transverse members **32** and the guide means **40**. In this manner, the head frame member **28**, the foot frame member **30** and the transverse frame members **32** are in the desired position relative to one another during the nailing operation.

Beneath the center frame supporting means **34** there is positioned a main electric motor **42** (FIGURES 2 and 3) which is adapted to drive the traversing nailing assembly **24** across the table means **22**. The motor **42** is supported upon a platform **44** attached to the framework of the table means **22** by suitable means not constituting a part of the present invention. The motor **42** has a drive shaft **46** with a sprocket **48** thereon which is drivingly connected to an endless chain **50** connected to another sprocket **52**. The sprocket **52** is secured to a rotatable shaft **54** mounted at its ends by bearing members **55** attached by suitable means to transverse members **33** of the framework of the table means **22**. In this manner the shaft **54** is rotated when the motor **42** is actuated. The shaft **54** has a second sprocket **56** drivingly connected by an endless chain **58** to a sprocket **60** on a second rotatable shaft **62**. The shaft **62** is mounted at its ends by bearing members **63** attached by suitable means to transverse members **33** of the framework of the table means **22**. A second sprocket **64** is mounted on the shaft **62** and is drivingly connected by an endless chain **66** to sprockets **68** and **70** on worm gears **72** and **74**, respectively. A pair of idler rollers **67** and **69** are provided to assure that the chain **66** does not become disengaged from the sprockets **64**, **68** and **70**. In this manner, the motor **42** drives the shaft **54**, the shaft **62** and the worm gears **72** and **74**, the latter being driven in the same direction. The sprockets **48**, **52**, **56**, **60**, **64**, **68** and **70** are utilized to achieve desired gear reduction or increase. The worm gears **72** and **74** act in unison to drive the traversing nailing assembly **24**. The motor **42** is reversible and therefore the traversing nailing assembly **24** may tranverse the table means **22** in either direction.

The worm gears **72** and **74** extend the length of the table means **22** and are supported at their ends by bearing members **76** (FIGURES 2 and 3) mounted on transverse channel frame members **77** at the ends of the table means **22**. There are a plurality of transverse channel frame members **77** attached to the legs **36** by welding or the like in the table means **22** and their ends extend outwardly beyond the framework to provide support for the traversing nailing assembly **24** as will be discussed in more detail hereinafter.

The table means **22** may, of course, have any length, but generally will be at least 20 feet in length so that large frames, like the frame **26**, may be made by the frame nailing machine **20**. Since the worm gears **72** and **74** extend the length of the table means **22** and have a diameter as small as 1 inch or less, they must be supported between their ends to prevent excessive sagging. To these ends, the table means **22** has means for supporting the worm gears **72** and **74** at their midpoints. Referring to FIGURES 2, 3 and 6, the worm gear support means includes a pneumatically actuated piston motor **78** having one end pivotally mounted at **80** (FIGURE 6) to a framework **81** mounted on the transverse members **77**. The pneumatically actuated piston motor **78** has a reciprocal drive arm **82** which is pivotally attached by a coupling

member **83** to a lever arm **84** fixedly attached to a shaft **86**. The shaft **86** is pivotally mounted upon the framework **81** by bearing means **88** and **90**. A second lever arm **92** is fixedly attached to the shaft **86** and one end of the lever arm **92** it attached to linkage means for supporting the worm gear **72** and the other end of the lever arm **92** is attached to linkage means for supporting the worm gear **74**.

The linkage means for supporting the worm gear **72** comprises a linkage member **94** having one end pivotally attached by a coupling **96** to the lever arm **92**. The other end of the linkage member **94** is pivotally attached by a coupling **98** to a transversely movable linkage member **100** which has a supporting member **102** for the worm gear **72** on its free end. The linkage member **100** is slidably mounted in bearing members **103** and **105** suitably mounted upon the framework **81**. The supporting member **102** is made of wood or other suitable material and has an inclined upper face **104** with a groove **106** therein to receive the worm gear **72**. In this manner, when the supporting member **102** is moved outwardly to the position shown in FIGURE 6 the worm gear **72** will slide upwardly on the inclined face **104** and rest in the groove **106** so that the worm gear **72** will not sag. Furthermore, the supporting member **102** is thus adapted to be retracted inwardly out of the path of the traversing nailing assembly **24** as it moves along the table means **22**.

The linkage means for supporting the worm gear **74** comprises a linkage member **108** having one end pivotally attached by a coupling **112** to a transversely movable linkage member **114** which has a supporting member **116** for the worm gear **74** on its free end. The linkage member **114** is slidably mounted in bearing members **117** and **119** mounted by suitable means upon the framework **81**. The supporting member **116** is made of wood or other suitable material and has an inclined upper face **118** with a groove **120** therein to receive the worm gear **74**. In this manner, when the supporting member **116** is moved outwardly to the position shown in FIGURE 6 the worm gear **74** will slide upwardly on the inclined face **118** and rest in the groove **120** so that the worm gear **72** will not sag. Furthermore, the supporting member **116** is thus adapted to be retracted inwardly out of the path of the traversing nailing assembly **24** as it moves along the table means **22**.

Normally the supporting members **102** and **116** are in the position shown in FIGURE 6 and supporting the worm gears **72** and **74**. However, in this position the supporting members **102** and **116** block the path of the traversing nailing assembly **24**. Accordingly, as the traversing nailing assembly **24** approaches the supporting members **102** and **116**, regardless of the direction it travels, a limit switch means will be tripped thereby actuating the motor **78**. Upon actuation of the motor **78**, the drive arm **82** is moved outwardly moving the lever arm **84** and causing the shaft **86** to rotate in a clockwise direction when viewing FIGURE 6. Accordingly, the second lever arm **92** is likewise rotated in a clockwise direction through the arc indicated in phantom in FIGURE 6. This movement of the lever arm **92** pulls the linkage members **94** and **108** and, accordingly, the linkage members **100** and **114**, respectively, inwardly thereby retracting the supporting members **102** and **116** from beneath the worm gears **72** and **74**, respectively, so that the traversing nailing assembly **24** may pass without obstruction. After the traversing nailing machine **24** has moved a predetermined distance past the supporting means **102** and **116**, another limit switch means will be tripped causing the motor **78** to be actuated in the reverse direction and the drive arm **82** to be retracted. Accordingly, the shaft **86** and lever arm **92** are rotated in a counterclockwise direction back to the position shown in FIGURE 6. This causes the linkage members **100** and **114** and therefore the supporting members **102** and **116**, respectively, to move outwardly to the position

shown in FIGURE 6 wherein the worm gears 72 and 74 are supported by the supporting members 102 and 116. The limit switch arrangement for actuating the motor 78 to extend and retract the supporting members 102 and 116 will be more fully explained hereinafter.

The frame 26 is completed by nailing the transverse frame members 32 to the head frame member 28 and the foot frame member 30 and the table means 22 is adapted to discharge the completed frame 26. Referring to FIGURES 1–3 and 6–8, the means for removing the completed frame 26 from the table means 22 comprises two endless chains 130 and 132 which may be moved upwardly above the top of the center frame support member 34 and the longitudinal members 31 to lift and thereby support the frame 26. The endless chains 130 and 132 are then driven and carry the frame 26 off of the table means 22 by moving it longitudinally with respect to the table means 22. To these ends, the table means 22 includes a reversible electric motor 134 mounted upon a platform 136 attached by suitable means to the framework of the table means 22. The electric motor 134 has a drive shaft 138 with a sprocket 140 and is drivingly connected to a rotatable shaft 146 by an endless chain 142 which cooperates with the sprocket 140 and a sprocket 144 fixedly secured to the rotatable shaft 146. The rotatable shaft 146 is mounted in suitable bearing means 148, 149 and 150 suitably secured to the framework of the table means 22. The shaft 146 has sprockets 152 and 154 at its end which are operatively connected to the endless chains 130 and 132, respectively. At the opposite end of the table means 22 another rotatable shaft 156 is supported by suitable bearing means 158 and 160 suitably secured to the framework of the table means 22. The rotatable shaft 156 has sprockets 162 and 164 affixed thereto which cooperate with the chains 130 and 132, respectively. In this manner, actuation of the motor 134 causes the shaft 146 to rotate whereby the chains 130 and 132 rotate in the same direction about the sprockets 152 and 162 and the sprockets 154 and 164, respectively.

The chains 130 and 132 pass across and on top of longitudinally extending guide members 166 and 168, respectively, which are adapted to be moved upwardly and downwardly so that the chains 130 and 132 are moved above or below the top level of the longitudinal members 31 and the center frame supporting means 34 so that the frame 26 may be lifted from the table means 22 by the endless chains 130 and 132. The guide members 166 and 168 are, in this instance, made of channel iron and are positioned so that the legs of the channel iron extend downwardly (see FIGURE 6). The guide members 166 and 168 are on opposite sides of the center frame supporting means 34 and between the longitudinal members 31. Each of the guide members 166 and 168 has a plurality of upwardly extending guide tabs 167 (FIGURE 8) spaced along its length to prevent the chains 130 and 132 from slipping off the guide members 166 and 168.

The guide members 166 and 168 are attached to the framework of the table means 22 and are adapted to be pivoted upwardly and downwardly with respect to this framework. To these ends each of the guide members 166 and 168 is supported along its length by a plurality of pivotal support means indicated generally by reference numeral 170 and best seen in FIGURES 7 and 8. The pivotal support means 170 comprise a bracket 172 attached by welding or other suitable means to a transverse member 33 of the framework of the table means 22. A lever arm 174 is pivotally attached to the bracket 172 by a pin member 176 rotatably supported by the bracket 172. The other end of the lever arm 174 is welded or otherwise fixedly attached to a pin 178 which extends through a pair of holes in the legs in the guide members 166 or 168. The lever arm 174 of each pivotal support means 170 is, therefore, able to pivot about the axis of the pin 176 whereby the pin 178 will be pivoted through an arc and cause the guide members 166 and 168 to likewise pivot through the arc of the pin 178.

A pneumatic actuated piston motor 190 has one end pivotally attached to a bracket 191 suitably secured by welding or the like to the framework of the table means 22 (see FIGURE 7). The pneumatic actuated motor 190 has a reciprocal drive arm 192 pivotally connected by a coupling 193 to a free end of a lever arm 194 which is fixedly attached to a rotatable shaft 196. The shaft 196 is supported by bearing means 197 and 199 which are mounted by nuts and bolts or the like upon frame members 201 and 203, respectively, which are attached by suitable means to the framework of the table means 22. The shaft 196 has a pair of cooperating lever arms 198*a* and 198*b* fixedly secured thereto having a pin 200 secured thereto, the pin 200 extending through a pair of holes in the legs of the guide member 166. Cotter pins or the like may be utilized to hold the pin 200 in place with respect to the lever arms 198*a* and 198*b* and the guide member 166.

In addition, the shaft 196 has a pair of cooperating lever arms 202*a* and 202*b* fixedly secured thereto. The free ends of the lever arms 202*a* and 202*b* receive a pin 204 which extends through an aligned pair of holes in the legs of the guide member 168. The pin 204 is held in proper position with respect to the guide member 168 and the lever arms 202*a* and 202*b* by cotter pins or the like.

The retractable drive arm 192 is shown in FIGURE 7 in its extended position wherein the guide members 166 and 168 are in their lower or retracted position, i.e., the frame 26 rests upon the central supporting panel 34 and the longitudinal members 31. After the frame 26 has been completed and the transverse frame members 32 nailed to the head frame member 28 and the foot frame member 30, the motor 190 is actuated either manually or automatically by means not shown and not constituting a part of the present invention. Upon actuation, the motor 190 retracts the drive arm 192 causing the lever arm 194 and the shaft 196 to be pivoted in a counter-clockwise direction when viewing FIGURE 7. The motor 190 retracts the drive arm 192 sufficiently to cause the lever arms 198*a*, 198*b*, 202*a* and 202*b* to rotate in a counter-clockwise direction through an arc of about 45° to the position shown in dotted lines in FIGURE 7. The movement of the lever arms 198*a*, 198*b*, 202*a* and 202*b* causes the guide members 166 and 168 to be pivoted upwardly from their retracted position to their upper position shown in dotted lines in FIGURE 7. As the guide members 166 and 168 move from their retracted position to their upper position they are, of course, pivoted about the pins 176 of the pivotal support means 170. In this manner the guide members 166 and 168 lift the chains 130 and 132, respectively, above the level of the center frame supporting panel 34 and the longitudinal members 31 whereby the frame 26 is lifted from these members and is supported by the chains 130 and 132. The tabs 167 are not as high as the chains 130 and 132 and, therefore, do not interfere with the chains 130 and 132 supporting the frame 26.

Once the frame 26 has been lifted from the longitudinal members 31 and the center supporting panel 34 and is supported by the chains 130 and 132, the electric motor 134 is actuated manually or automatically by means not shown and not constituting a part of the present invention. Upon actuation of the electric motor 134, the endless chains 130 and 132 are driven in the same direction in the manner described hereinbefore and therefore convey the frame 26 off an end of the table means 22. If desired, suitable conveyor means may be placed at either end of the frame nailing machine 20 to receive the discharged completed frame 26. The chains 130 and 132 may, of course, be rotated in either direction to discharge the frame 26 off of either end of the table means 22. After the frame 26 has been discharged from the table

means 22 the electric motor 134 is turned off and the pneumatic motor 190 actuated. Actuation of the motor 190 causes the drive arm 192 to move to its extended position whereby the lever arm 194, the shaft 196 and the lever arms 198*a*, 198*b*, 202*a* and 202*b* are rotated in a clockwise direction back to the position shown in solid lines in FIGURE 7. In this manner the guide members 166 and 168 are pivoted back to their retracted position so that the chains 130 and 132 are below the level of the longitudinal members 31 and the center frame supporting panel 34.

The chains 130 and 132 are, of course, oversize since they must be moved to their extended position. Thus, a plurality of idler wheels 206, such as shown in FIGURE 7, are attached to the framework of the table means 22 to guide the chains 130 and 132 and prevent them from coming off the sprockets 152, 154, 162 and 164.

NAILING ASSEMBLY 24

The nailing assembly 24 is adapted to traverse or move longitudinally with respect to the table means 22. As the nailing assembly 24 traverses the table means 22, it will stop at each joint between the transverse members 32 and the head frame member 28 and the foot frame member 30 and nail the transverse members 32 to the head frame member 28 and the foot frame member 30. To these ends, as best seen in FIGURES 1 and 9, the nailing assembly 24 includes two nail hopper assemblies, indicated generally by reference numerals 210 and 212, nail picking assemblies associated therewith, indicated generally by reference numerals 214 and 216, respectively, and nail driving assemblies, indicated generally by reference numerals 218 and 220, respectively. The nail hopper assemblies 210 and 212 are adapted to deliver nails to the nail picker assemblies 214 and 216, respectively. The nail picker assemblies 214 and 216 each deliver two nails to the nail driving assemblies 218 and 220, respectively, which in turn drive the nails into the frame 26 to secure the transverse members 32 to the head frame member 28 and the foot frame member 30, respectively. In addition, the nailing assembly 24 has holding means to prevent movement of the transverse member 32 and the head frame member 28 or foot frame member 30 as these members are being nailed together, these holding means being indicated generally by reference numerals 222 and 224. Furthermore, the nailing assembly 24 is provided with means for stopping the nailing assembly 24 so that the nail driving assemblies 218 and/or 220 are in proper position to nail the transverse frame members 32 to the head frame member 28 and/or the foot frame member 30.

The frame nailing assembly 24 includes a U-shaped frame indicated generally by reference numeral 226. The U-shaped frame 226 straddles the longitudinal members 31 and the center frame supporting panel 34 upon which the frame members 28, 30 and 32 rest. The frame 226, which is made of I-beams, channel irons, angle irons or other suitable structural material is adapted to ride on the table means 22. To these ends, the table means 22 has two tracks indicated generally by reference numerals 228 and 230 (FIGURES 1, 2 and 9). The tracks 228 and 230 are mounted on opposite sides of the table means 22 on the outwardly extending ends of the supporting members 77. Each of the tracks 228 and 230 include a hollow rectangular-shaped structural steel member 231 which extends the length of the table means 22. In this instance, a steel strip 233 is placed on top of the member 231 to provide a surface upon which the nailing assembly 24 will ride as it travels from one end to the other of the table means 22. A plurality of gussets 234 may be utilized to enhance the rigidity of the tracks 228 and 230. The gusset plates 234 may be welded or otherwise suitably secured to the structural elements 231 and 77.

Referring to FIGURES 1–5, 9 and 10, the frame 226 of the nailing assembly 24 has two vertical frame members 236 and 238 at each side. In this instance the vertical frame members 236 and 238 are I-beams, though any other suitable structural material may be employed. At the lower end of the vertical members 236 and 238 there are attached thereto by welding or the like an exterior channel member 240 and an internal channel member 242. Rollers 244 and 246 are supported by the channel members 240 and 242 upon rods 248 and 250 secured by suitable means to the channel members 240 and 242. To prevent misalignment of the rollers 244 and 246, each of the rollers is mounted upon a sleeve 252 and 254, respectively, which cooperate with the rods 248 and 250, respectively. The rollers 244 and 246 ride on the strips 233 of the tracks 228 and 230 to provide the means by which the nailing assembly 24 may move from one end of the table means 22 to the other end and back again.

To further prevent the nailing assembly 24 from moving off of the tracks 228 and 230, lateral movement of the nailing assembly 24 on the tracks 228 and 230 is limited. To these ends, as best seen in FIGURES 4 and 5, a pair of outwardly extending rollers 260 and 262 are attached to each of the channel members 242. The rollers 260 and 262 are rotatable about vertical pins 264 and 266, respectively, and are adapted to be adjustable in a lateral direction with respect to the tracks 228 and 230. The rollers 260 and 262 may be supported by and attached to the channel member 242 in a myriad of ways well known to one with ordinary skill in the art and not constituting a part of the present invention. Accordingly, the means 261 for supporting the rollers 260 and 262 need not be discussed in detail. Rollers 260 and 262 have an enlarged diameter at their center portion which extends between two metal strips 268 and 270 welded or otherwise suitably secured to the interior vertical face of the member 231. The strips 268 and 270 are spaced from one another so that the center portion 260*a* and 262*a* of the rollers 260 and 262 extend therebetween, the narrow end portions of the rollers 260 and 262 riding upon the strips 268 and 270.

The other side of the frame 226 is constructed in the same manner so that it cooperates with the track 228 in the same manner that the nailing assembly 24 cooperates with the track 230. In this manner, the traversing nailing assembly 24 is adapted to ride upon the tracks 228 and 230 and will not fall laterally off these tracks.

Extending inwardly from each channel member 242 is a worm gear drive means indicated generally by reference numeral 272. The worm gear drive means 272 comprises a bracket 274 bolted or otherwise suitably secured to the channel member 242. The bracket 274 has a hole therein adapted to receive a worm gear follower 276 which is attached to the bracket 274 by a plate 278 and nuts and bolts 281. The worm gears 72 and 74 extend through and cooperate with the worm gear followers 276 so that upon rotation of the worm gears 72 and 74 in the same direction the followers 276 will move along the worm gears 72 and 74 in the same direction thus moving the entire nailing assembly 24 along the tracks 228 and 230 toward either end of the table means 22. In this manner, the worm gears 72 and 74 drive the nailing assembly 24 along the tracks 228 and 230 so that it traverses the table means 22.

Referring to FIGURES 9–11, the nail hopper assemblies 210 and 212 are each adapted to deliver two nails to the nail driving assemblies 218 and 220, respectively. The nail hopper assemblies 210 and 212, and their associated nail picker assemblies 214 and 216, respectively, are per se well known in the art and do not constitute a part of the present invention. In this instance, the nail hopper assemblies and nail picker assemblies are of the general type described in detail in the Willhauck Patent No. 2,982,965, issued May 9, 1961. Accordingly, a detailed discussion of the nail hopper assemblies and nail

picking assemblies is not necessary in this application. Suffice it to say that nail hopper assemblies **210** and **212** have bins **282** which are filled with nails and oscillated by rocker arms **284** which are attached to a crank shaft **286** driven by a motor not shown. The oscillating motion of the bins **282** causes the nails therein to be aligned in rows, with the nail heads up, from which the nails are picked by the nail picking assemblies whereby one nail is delivered to each of the tubes **300, 302, 304** and **306**. The nails delivered to the tubes **300** and **302** are transmitted to the nail driving assembly **220**, while the nails delivered to the tubes **304** and **305** are delivered to the nail driving asembly **218**. The nails delivered to the tubes **300, 302, 304** and **306** are transmitted by gravity therethrough, their movement being assisted by a blast or air to assure that they are properly positioned in the nail driving assemblies **218** and **220** prior to being driven into the frame **26**. The nail driving assemblies **218** and **220** are operatively connected to their associated nail picking assemblies **214** and **216** so that after the respective nail driving assembly has driven the nails therein into the frame **26** it is supplied with two additional nails for the next nailing operation. Suitable means for effecting such cooperation between the picker assemblies and the nail driving assemblies is well known in the art and does not per se constitute a part of the present invention. Other types of nail hopper assemblies and nail picker assemblies may be used in the frame nailing apparatus of the present invention. Exemplary of such nail hopper and picker assemblies are those illustrated and described in detail in United States Patent Nos. 2,456,221, 2,785,400 and 2,879,509.

Referring to FIGURES 9 and 12–16, the nail driving assemblies **218** and **220** are each mounted on a downwardly extending leg of the U-shaped frame **226** of the nailing assembly **24**. The nail driving assembly **218** is mounted on a platform indicated generally by reference numeral **308** attached by welding or other suitable means (not shown) to the vertical frame members **236** and **238**. The nail driving assembly **218** is positioned between the vertical frame members **236** and **238** on the platform **308** and is adapted to drive two nails **434** through the head frame member **28** and into the end of each transverse frame member **32** abuting the head frame member **28**, as seen in FIGURE 13. In this manner each transverse frame member **32** is attached by two nails **434** to the head frame member **28** by the nail driving assembly **218**.

The nail driving assembly **220** is mounted on a platform indicated generally by reference numeral **310** attached by welding or other suitable means (not shown) to the vertical frame members **236** and **238** on the other leg of the U-shaped frame **226**. The nail driving assembly **220** is positioned between the vertical frame members **236** and **238** on the platform **310** and is adapted to drive two nails through the foot frame member **30** and into the end of each transverse frame member **32** abutting the foot frame member **30**. In this manner each transverse member **32** is attached by two nails **434** to the foot frame member **30** by the nail driving assembly **220**.

The nailing assembly **24**, as it moves from one end of the table means **22** to the other, is adapted to stop so that the nail driving assemblies **218** and **220** are in proper position to nail a transverse frame member **32** to the head frame member **28** and the foot frame member **30**. After this nailing operation is completed the nailing assembly **24** automatically begins to traverse the table means **22** again until it comes to the next transverse frame member **32**, stops the nailing assemblies **218** and **220** nail this transverse frame member **32** to the head frame member **28** and the foot frame member **30**. This sequence continues until all the transverse frame members **32** have been nailed to the head frame member **28** and the foot frame member **30** and the frame **26** is thereby completed.

Referring specifically to FIGURES 12–16, the nail driving assembly **218** includes a pneumatic actuated piston motor **312** fixidly attached by suitable means to the platform **308**. The motor **312** has a reciprocal drive arm **314** having its free end attached to a driving block **316**. The driving block **316** comprises steel members **318, 320, 322** and **324** which are welded together or otherwise suitably attached to one another to form a rectangular frame. The reciprocal arm **314** threadably engages a hole in the member **318**, a nut **326** preventing the driving block **316** from rotating about the arm **314**. Female stroke adjusters **328** and **330**, cup-shaped members having a hole in their bottoms, are welded to the member **322**. The interior surface of the female stroke adjusters **328** and **330** is threaded and adapted to receive male stroke adjusters **332** and **334**, respectively, through holes in the member **322**. The male stroke adjusters **332** and **334** have threaded exterior surfaces which engage the threaded interior surface of the female stroke adjusters **328** and **330**, respectively. The outwardly extending ends of the male stroke adjusters **332** and **334** are adapted to receive a screwdriver or the like so that they may be moved into or out of the female stroke adjusters **328** and **330** to adjust the position of the drivers **336** and **338**, respectively. The other ends of the male stroke adjusters **332** and **334** have grooves adapted to receive heads **336***a* and **338***a* of the drivers **336** and **338**, respectively. The drivers **336** and **338** extend through the holes in the bottom of the female stroke adjusters **328** and **330**, respectively, and are adapted to drive the nails **434** into the frame **26** in a manner more apparent hereinafter.

The nail driving assembly **218** includes a chuck assembly indicated generally by reference numeral **340**. The chuck assembly **340** includes two chuck means **366** and **370**, which each hold a nail in proper position for the nailing operation and means for supporting the chuck means **366** and **370**. The means for mounting the chuck means **366** and **370** includes a U-shaped bracket **342** welded or otherwise suitably secured to the platform **308**. The U-shaped bracket **342** slidably receives between its upwardly extending legs a plate **344** held therein by overlapping plate means **346** and **348** bolted or otherwise suitably secured to the upwardly extending legs of the U-shaped bracket **342**. The slidable plate **344** is attached by a bolt **350** to a vertical support member **352**, which, in turn, is welded or otherwise suitably secured to a mounting means **354**. The mounting means **354** comprises plate members **356, 358**, and **360** which are welded together to form a U-shaped frame. The plate members **358** and **360** form the upwardly extending legs of the U-shaped mounting means **354**, the member **358** being shorter than the member **360** as seen in FIGURE 14. A chuck mounting plate **362** is welded to the upwardly extending ends of the plate members **358** and **360** in such a manner that it is on an angle of about 45° with the horizontal. Welded to the upper side of the chuck mounting plate **362** is a L-shaped bracket means **364** for holding the chuck means **366**. Welded to the underside of the chuck mounting plate **362** is a L-shaped bracket means **368**, which is identical to the bracket means **364**, for holding the chuck means **370**.

The chuck means **366** and **370** are identical to one another. Referring particularly to FIGURES 15 and 16, the chuck means **366** comprises a first chuck member **372** and a second chuck member **374**. The second chuck member **374** has fixedly attached thereto two stud members **376** (see FIGURES 12–14), each of which extends through an oversize hole **380** in the first chuck member **372**. A spring **382** is held on the stud member **376** by a nut **384** and biases the first chuck member **372** against the second chuck member **374**. The second chuck member **374** has two outwardly extending flanges **386** and **390**. A bolt **392**, having a washer **394**, extends between the flanges **386** and **390** and through a hole **391** in the bracket

means 364 and with a nut 396 holds the chuck means 366 on the mounting means 354.

The first and second chuck members 372 and 374 each have grooves therein which, when they are placed together and mounted on the mounting means 354, form a passageway 398 adapted to receive the driver 336. The first chuck member 372 has a passageway 420 which communicates with the passageway 398 at a small angle. The tube 304 communicates with the passageway 420 and is attached to the first chuck member 372 by a coupling member 422. Jaw members 424 and 426 are pivotally mounted in cut-away portions of the first and second chuck members 372 and 374, respectively. The jaw member 424 is pivotal about a pin 428 attached by suitable means to the first chuck member 372. The jaw means 426 is pivotal about a pin 430 attached by suitable means to the second chuck member 374. The jaw members 424 and 426 have longitudinally extending grooves therein which form a passageway 432 having a tapered entrance. A nail 434 from the tube 304 passes through the passageway 420 and into the passageway 432 as shown in FIGURE 16. The free ends of the jaw members 424 and 426 are spring biased. To these ends, the first chuck member 372 has a threaded adjustment member 436 which engages and holds one end of a spring 438, the other end of the spring 438 being held in a recess 440 in the jaw member 424. By rotating the adjustment means the force exerted by the spring 438 on the jaw member 424 may be adjusted. Similarly, the second chuck member 374 is provided with a threaded adjustment member 442 which engages and holds one end of a spring 444, the other end of the spring 444 being held in a recess 446 in the jaw member 426. Rotation of the adjustment member 442 adjusts the force exerted by the spring 444 on the jaw member 426. The chuck assembly 370 is identical to the chuck assembly 366 and is mounted on the underside of mounting means 354 by the bracket means 368 in the same manner that the chuck assembly 366 is mounted on the top of the mounting means 354 by the bracket means 362. The chuck assembly 370 receives the driver 338 and is connected to the tube 306.

The driving block 316 is connected to the mounting means 354 by a compensator rod 450 which extends through a hole in a plate 452 welded or the like to the member 356 (FIGURES 12–15). The compensator rod 450 threadedly engages a hole in the member 332 and is properly held in position with nuts 454. The free end of the compensator rod has nuts 456 thereon. A spring 458 on the compensator rod 450 exerts force against the driving block 316 and the member 452.

In operation, the nail driving assembly 218 is in its retracted position shown in FIGURES 12 and 14–16 when it receives the nails 434, one from each tube 304 and 306. The nails 434 come down through the tubes 304 and 306, pass through the passageway 420 and a portion of the passageway 398 and are forced into the passageway 432 between the jaw members 424 and 426 so that the head of the nail 434 is just in the passageway 432, as shown in FIGURE 16. The nail driving assembly 218 is now ready to drive the nails 434 into the frame 26. When traversing nailing assembly 24 has stopped and the motor 312 is actuated, the arm 314 is extended causing the drivers 336 and 338 to contact the head of the nails 434 and drive them through the jaw members 424 and 426 and into the head frame member 28 and the transverse frame members 30. As the drivers 336 and 338 drive the nails 434 through the jaw members 424 and 426, the jaw members 424 and 426 pivot about their respective pins 428 and 430 against the force of the springs 438 and 444, respectively. In this manner, the jaw members 424 and 426 open to allow the heads of the nails 434 to pass therethrough and still guide the nails 434 as they are being driven into the frame 26 as shown in dotted lines in FIGURE 16.

Furthermore, as the pring 458 is compressed and pushes the mounting means 354, which slides in the bracket 342, until the chuck means 366 and 370 abut the head frame member 28. The chuck means 366 and 370 will be moved into abutting relationship with the head frame member 28 prior to the nails 434 beginning to leave the jaw members 424 and 426. This further reduces the chance of the nails 434 entering the frame 26 in an improper position.

After the nails 434 have been driven into the head frame member 28 and the transverse frame member 32, the motor 312 is actuated whereby the driving block 316 is retracted which, of course, retracts the drivers 336 and 338 and the compensator rod 450. As the compensator rod 450 is being retracted, the nuts 456 on its end will engage the member 452 and thereby also retract the mounting means 354 and the chuck means 366 and 370. In this manner, the chuck assemblies 366 and 370 are withdrawn from the head frame member 28 and the nailing assembly 24 may move on for the next nailing operation.

It will be understood that the studs 376 and springs 382 allow the first and second chuck members 372 and 374 to separate should nail jamming or the like occur within the chuck means 366 or 370. Furthermore, the compensator rod 450 and spring 458 allow the frame 26 to be at variable distances from the nail driving assembly 218 without adversely affecting the nailing operation. The nail driving assembly 220 is constructed and operates identical to the nail driving assembly 218.

The nailing assembly 24 is adapted to automatically stop so that the nail driving assemblies 218 and 220 are in proper position to nail the joints between the transverse frame member 32 and the head frame member 28 and the transverse frame member 32 and the foot frame member 30, respectively. To these ends, referring to FIGURES 9–11, the frame 226 of the nailing assembly 24 has a pair of pivotal limit switches 400 and 402 on each side which are adapted to trip suitable switch means 404 and 406, respectively, which will turn off the electric motor 42 which is driving the traversing nailing assembly 24. Assuming, for example, that the traversing nailing assembly 24 is moving from left to right when viewing FIGURE 10, the leading pivotal limit switch 400 and its associated switch means 404 are activated and the trailing pivotal limit switch 402 and its associated switch means 406 is deactivated. Accordingly, when the limit switch 400 contacts a transverse frame member 32, the limit switch 400 trips the switch means 404 which in turn, by means not shown and not constituting a part of the present invention, turns off the electric motor 42. The limit switches 400 are positioned so that by the time the motor 42 is turned off and the nailing assembly 24 stops that the juncture between the transverse frame member 32 and the foot frame member 30 will be in proper position with respect to the nail driving assembly 220 and the juncture between the transverse frame member 32 and the head frame member 30 will be in proper position with respect to the nail driving assembly 218. The limit switches 400 on opposite sides of the nailing assembly 24 are aligned with one another so that they will contact the same transverse member 32 at the same time. When the nail driving assemblies 218 and 220 have completed their function of driving the nails into the joints between the transverse frame member 32 and the head frame member 28 and the transverse frame member 32 and the foot frame member 30, means not shown and not constituting a part of the present invention cause the motor 42 to be energized again whereby the nailing assembly 24 once again begins to traverse the table means 22. This sequence of operation continues until the traversing nailing assembly 24 has travelled to the end of the table means 22. The completed frame 26 is removed in the manner described hereinbefore and new frame members 28, 30 and 32 placed on the table means 22.

The nailing assembly 24 is then driven by the motor 42 in the reverse direction, i.e., from right to left when viewing FIGURE 10. Now the limit switches 400 and their associated switch means 404 are deactivated and the limit switches 402 and their associated limit switch means 406 are activated. Accordingly, when the limit switch 402 contacts a transverse frame member 32, the limit switch 402 trips the switch means 406 which in turn, by means not shown and not constituting a part of the present invention, turns off the electric motor 42. The limit switches 402 are positioned so that by the time the motor 42 is turned off and the nailing assembly 24 stops that the joints between the transverse frame member 32 and the foot frame member 30 and the transverse frame member 32 and the head frame member 28 are in proper position with recpect to the nail driving assemblies 220 and 218, respectively. The limit switches 402 on opposite sides of the nailing assembly are aligned with one another so that they will contact the same transverse member 32 at the same time. When the nail driving assemblies 218 and 220 have completed their function of driving the nails into the joints between the transverse frame member 32 and the head frame member 28 and the transverse frame member 32 and the foot frame member 30, means not shown and not constituting a part of the present invention cause the motor 42 to be energized again whereby the nailing assembly 24 once again begins to traverse the table means 22 from left to right when viewing FIGURE 10. This sequence of operation continues until the traversing nailing assembly 24 has travelled to the end of the table means 22. The completed frame 26 is removed in the manner described hereinbefore and the frame nailing apparatus 20 is ready for another frame.

The limit switches 402 and their associated switch means 406 are the same as the limit switches 400 and their associated switch means 404. The limit switches 400 and 402 have rotatable wheels 408 on their end so that the limit switches 400 and 402 will roll over the upwardly extending transverse frame members 32, being pivoted in this manner upon contacting the transverse frame members 32.

Often in constructing frames for building sections, walls, and panels, the transverse members of the panel will not extend from the head frame member to the foot frame member, i.e., they will abut the head frame member or the foot frame member only. By placing the limit switches 400 and 402 on each side of the nailing assembly 24 this assures that such transverse frame members will be nailed to the head frame member or foot frame member, depending upon which frame member it abuts. In other words the limit switches 400 and 402 on one side of the traversing nailing assembly 24 are connected to the nail driving assembly on that side of the traversing nailing assembly 24 and the limit switches 400 and 402 on the other side of the traversing nail assembly 24 are connected to the other nail driving assembly. In this manner, when one of the transverse frame members 32 abuts only the head frame member 28 or the foot frame member 30, one of the limit switches 400 or 402 will cause the nailing assembly 24 to stop and the appropriate nail driving assembly to be actuated. Thus, in such instances, only one of the nail driving assemblies 218 and 220 are utilized, depending upon the side of the frame 26 to be nailed. Thus the traversing nailing assembly 24 is adapted to nail a transverse member to the head frame member or the foot frame member, or both depending upon which the transverse frame member abuts. The electrical control system to effect such operation of the traversing nailing assembly 24 does not per se constitute a part of the present invention, the selection of a suitable system being within the ordinary skill of one in the art.

In addition, and referring now to FIGURE 9, the holding means 222 and 224 are actuated by means not shown to firmly hold the transverse frame member 32 in position with respect to the head frame member 28 and the foot frame member 30, respectively. The electrical system employed to effect cooperation between the nail driving assemblies 218 and 220 and the holding means 222 and 224, respectively, is not shown and does not per se constitute a part of the present invention it being within the ordinary skill of one in the art to provide such a suitable electrical system. In any event, the holding means 222 and 224 have pneumatic actuated pistons 410 and 412, respectively. When the nailing assembly 24 stops, the holding means 222 and 224 are actuated whereby the pistons 410 and 412 are extended downwardly until they contact both the transverse frame members 32 and the head frame member 28 and the transverse member 32 and the foot frame member 30, respectively. In other words, the piston 410 comes down on the transverse member 32 and the head frame member 28 in the area in which these two members abut one another and are to be nailed to one another. Similarly, the piston 412 comes down on the transverse member 32 and the foot frame member 30 in the area where these two members abut one another and are to be nailed to one another. The pistons 410 and 412 exert sufficient force to hold the transverse member 32 and the head frame member 28 and foot frame member 30 in proper position with respect to one another during the nailing operation of these joints by the nail driving assemblies 218 and 220, respectively. After the nailing operation has been completed the holding means 220 and 224 are deactivated and the pistons 410 and 412 are retracted in order that the nailing assembly 24 may proceed to traverse the table means 22.

The holding means 222 and 224 may be operatively connected to the nail driving assemblies 218 and 220, respectively, so that they are actuated only when their associated nail driving assembly is to be utilized by an electrical system within the ordinary skill of one in the art and not per se constituting a part of the present invention.

As the traversing nailing assembly 24 moves from one end of the table means 22 to the other end, it is adapted to cause the supporting members 102 and 116 to move out of the path of the traversing nailing assembly 24 as the latter passes the mid-point area of the worm gears 72 and 74. To these ends, limit switches (not shown) are placed on opposite sides of the supporting member 102, for example. As the traversing nailing assembly 24 moves from one end of the table means 22 to the other end, it will contact the first of these limit switches and cause the piston motor 78 to be actuated whereby the supporting members 102 and 116 are retracted in the manner described hereinbefore so that the traversing nailing assembly 24 may pass the mid-point area of the worm gears 72 and 74 without contacting the supporting members 102 and 116. After the traversing nailing assembly 24 has passed the supporting members 102 and 116 it contacts the second limit switch whereby the motor 78 is actuated to cause the supporting members 102 and 116 to be moved outwardly in the manner described hereinbefore so that they again support the worm gears 72 and 74. In this manner the supporting members 102 and 116 are retracted inwardly so that they do not obstruct the movement of the traversing nailing assembly 24 as it moves from one end of the table means 22 to the other end.

When the traversing nailing assembly is travelling in the reverse direction, it will contact the second limit switch which will actuate the motor 78 to cause the supporting members 102 and 116 to be retracted. After the traversing nailing assembly 24 has passed the retracted supporting members 102 and 116, it will contact the first limit switch which will actuate the motor 78 and cause it to move the supporting members 102 and 116 outwardly to again support the worm gears 72 and 74. The limit switches are placed on either side of the supporting member 102 a sufficient distance to allow the supporting members 102 and 116 to be retracted before the traversing nailing assembly 24 has reached the point where the supporting members 102 and 116 support the worm gears

72 and 74. Likewise the supporting members 102 and 116 are not extended until the traversing nailing assembly 24 has passed the mid-point area of the worm gears 72 and 74 sufficiently so that it will not block the outward movement of the supporting members 102 and 116.

Suitable limit switches and electrical systems for actuating the motor 78 to effect the extension and retraction of the supporting members 102 and 116 are well known in the art per se, the selection of the partciular limit switches and electrical system being within the ordinary skill of one in the art. The limit switches may be placed on the traversing nailing assembly 24 or on the framework of the table means 22.

Referring to FIGURES 1–3 and 5, means are provided to prevent the traversing nailing assembly 24 from rolling off the ends of the tracks 228 and 230. To these ends, one of the interior channel members 242 (FIGURE 5) of the traversing nailing assembly 24 is provided with pivotal limit switches 280 and 282 which are connected to limit switch means 284 and 286, respectively. The limit switch 280 is at one end of the channel member 242 and the limit switch 282 is at the other end of the channel member 242. Assuming, for example, that the traversing nailing assembly 24 is moving from right to left when viewing FIGURE 5, the limit switch 280 will contact a stop member 288 welded or otherwise suitably secured to the framework of the table means 22. The stop means 288 will cause the limit switch 280 to pivot thereby actuating the limit switch means 284 which, in turn, de-energizes the motor 42 causing the traversing nailing assembly 24 to come to a stop before it reaches the end of the tracks 228 and 230. The stop means 288 is, of course, placed a sufficient distance away from the end of the track 230 so that the traversing nailing assembly 24 will stop before it reaches the end of the tracks 228 and 230. A stop means (not shown) identical to the stop means 288 is placed at the other end of the table means 22 so that when the traversing nailing assembly is moving from left to right when viewing FIGURE 5 the limit switch 282 will be pivoted by this stop means thereby actuating the limit switch means 286 which, in turn, will de-energize the motor 42 and cause the traversing nailing assembly 24 to stop before reaching the other end of the track means 228 and 230. As a further precautionary measure, the ends of the tracks 230 and 228 have upwardly extending members 290 (FIGURES 1 and 2) which prevent the traversing nailing assembly 24 from rolling off the ends of the tracks 228 and 230.

It will be understood that the limit switches 280 and 282 are merely exemplary of a myriad of suitable limit switch means which may be employed to de-energize the motor 42 thereby causing the traversing nailing assembly 24 to stop prior to reaching the end of the tracks 228 and 230. Furthermore, the electrical system utilized to connect the limit switches 280 and 282 and the limit switch means 284 and 286, respectively, to the motor 42 does not per se constitute a part of the present invention and a myriad of suitable systems may be employed, the selection of the particular electrical system to be employed being a matter of choice within the ordinary skill of one in the art.

Though the nailing machine 20 has been described as a fully automatic unit wherein the nailing assembly 24 automatically moves from one of the table means 22 to the other end of the table means 22 making intermittent stops to nail the transverse frame members 32 to the head frame member 30 and the foot frame member 28, the nailing machine 20 may be adapted for many varied types of semi-automatic operation also. For example, the electrical and pneumatic system may be adapted to allow the operator to start and stop the nailing assembly 24, cause each or both of the nail driving assemblies 218 and 220 to drive nails into the frame 26 and the like. In addition, the transverse frame members 32 may be part of prefabricated window or door sections which are to be a part of the frame 26. Furthermore, the transverse frame members need not abut both the head frame member 28 and the foot frame member 30 since the nailing machine 20 is adapted to nail the transverse members to the head frame member 28 and/or the foot frame member 30 as discussed hereinbefore. Furthermore, the nailing machine 20 may be adjusted to handle instances where the transverse members are not perpendicular to the head frame member and/or the foot frame member by adjusting the angle of the nail driving assemblies 218 and 220 and/or the position of the limit switches 400 and 402.

While the embodiments described herein are at present considered to be preferred, it will be understood that various modifications and improvements may be made therein and it is intended to cover in the appended claims all such modifications and improvements as fall within the true and scope of the invention.

What is claimed is:

1. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means adapted to support frame members of said frame, said table means having means for supporting a traversing assembly, means for driving said traversing nailing assembly, said traversing nailing assembly being adapted to be driven from one end of said table means to the other end of said table means, said nailing assembly having a nail driving assembly and means to supply nails to said nail driving assembly mounted thereon, limit switch means to stop said nailing assembly, said limit switch means being actuated by contact with a frame member and actuating said nail driving assembly to nail said frame member to another of said frame members.

2. The nailing apparatus of claim 1 wherein said means for supporting said nailing assembly includes first and second longitudinally extending track means positioned on opposite sides of said table means, said nailing assembly being adapted to ride on said first and second track means, said means for driving said nailing assembly including first and second longitudinally extending worm gears and motor means to rotatably drive said first and second worm gears, said first and second worm gears being positioned on opposite sides of said table means, said first and second worm gears being operatively connected to said traversing nailing assembly whereby rotation of said first and second worm gears moves said nailing assembly on said first and second track means.

3. The nailing apparatus of claim 1 wherein said nailing assembly includes vertically movable means to contact and hold said frame members being nailed together by said nail driving assembly and said nail driving assembly being positioned to transversely nail together said held frame members.

4. The nailing apparatus of claim 1 including means to lift and remove said frame from said table means after said frame members have been nailed together to form said frame.

5. The nailing apparatus of claim 1 including second limit switch means to stop said nailing assembly before said nailing assembly reaches the end of said table means.

6. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means having means to support components of said frame including a head frame member, a foot frame member, and a plurality of transverse frame members which abut said foot frame member and/or said head frame member, said head frame member and said foot frame member being positioned longitudinally with respect to said table means, a nailing assembly mounted on said table means and being adapted to traverse said table means, means mounted on said table means to drive said nailing assembly from one end of said means supporting the frame components to the other end, said nailing assembly having a generally U-shaped frame means with downwardly extending leg members, said U-shaped frame

means straddling said means supporting the frame components, a nail driving assembly mounted on each of said leg members and being adapted to transversely nail said transverse frame members to said foot frame member and/or said head frame member where said transverse frame members abut said head frame member or said foot frame member, limit switch means to stop said nailing assembly, said limit switch means being actuated by contact with a transverse frame member and actuating said nail driving assemblies to nail said transverse frame member to said foot frame member and/or said head frame member.

7. The nailing apparatus of claim 6 wherein said table means has a first and second track means, said first and second track means being positioned on opposite sides of said means supporting said frame components, said legs of said U-shaped frame means having roller means thereon whereby said U-shaped frame means rides on said first and second track means.

8. The nailing apparatus of claim 6 wherein means are mounted on said nailing assembly which are adapted to hold the transverse frame member and head frame member and/or transverse frame member and foot frame member being nailed together by said nail driving assembly.

9. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means adapted to support frame members of said frame, said table means having means for supporting a traversing nailing assembly, means for driving said traversing nailing assembly, said traversing nailing assembly being adapted to be driven from one end of said table means to the other end of said table means, said nailing assembly having a nail driving assembly and means to supply nails to said nail driving assembly mounted thereon, means to stop said nailing assembly and actuate said nail driving assembly to nail one of said frame members to another of said frame members, said means for supporting said nailing assembly including first and second longitudinally extending track means positioned on opposite sides of said table means, said nailing assembly being adapted to ride on said first and second track means, said means for driving said nailing assembly including first and second longitudinally extending worm gears and motor means to rotatably drive said first and second worm gears, said first and second worm gears being positioned on opposite sides of said table means, said first and second warm gears being operatively connected to said traversing nailing assembly whereby rotation of said first and second warm gears moves said nailing assembly on said first and second track means, means for supporting said first and second worm gears between their ends, and means for moving said means for supporting said first and second warm gears out of the path of said nailing assembly as said nailing assembly moves from one end of said table means to the other end of said table means.

10. The nailing apparatus of claim 9 wherein said supporting means for said first and second worm gears includes a first and second support member adapted to support said first and second worm gears, respectively, said first and second support members each having an upwardly inclined face with a grove therein, said grove being adapted to receive the associated worm gear, said first and second support members being connected to a linkage means, said linkage means being connected to a rotatable shaft mounted on said table means, said rotatable shaft being actuated by a second motor means.

11. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means having means to support components of said frame including a head frame member, a foot frame member, and a plurality of transverse frame members which abut said foot frame member and/or said head frame member, said head frame member and said foot frame member being positioned longitudinally with respect to said table means, a nailing assembly mounted on said table means and being adapted to traverse said table means, means mounted on said table means to drive said nailing assembly from one end of said means supporting the frame components to the other end, said nailing assembly having a generally U-shaped frame means with downwardly extending leg members, said U-shaped frame means straddling said means supporting the frame components, a nail driving assembly mounted on each of said leg members and being adapted to nail said transverse frame members to said foot frame member and/or said head frame member where said transverse frame members abut said head frame member or said foot frame member, said table means having a first and second track means, said first and second track means being positioned on opposite sides of said means supporting said frame components, said legs of said U-shaped frame means having roller means thereon whereby said U-shaped frame means rides on said first and second track means, said means to drive said nailing assembly including first and second worm gears, means mounted on said nailing assembly adapted to cooperate with said first and second worm gears whereby rotation of said first and second worm gears drives said nailing assembly along said table means and motor means to rotate said first and second worm gears, means to remove said frame from said means supporting the frame components after said frame components have been nailed together, said means for supporting the frame components comprising a center frame supporting means and first and second longitudinally extending support members positioned on opposite sides of said center frame supporting means, said means for removing said completed frame including first and second endless chains positioned on opposite sides of said center frame supporting means and between said longitudinal supporting members, said first and second endless chains having a retracted position whereby they are below the top of said first and second longitudinal supporting members and said center frame supporting means and an upper position wherein they are above the top of said longitudinal supporting members and said center frame supporting means, and means for moving said first and second chains from said retracted position to said upper position and from said upper position to said retracted position and

12. The nailing apparatus of claim 11 including first and second longitudinally extending pivotally mounted guide means, said first and second chains passing over said first and second guide means, respectively, means for pivoting said guide means whereby said first and second chains are moved from their upper position to their retracted position or from their retracted position to their upper position.

13. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means having means to support components of said frame including a head frame member, a foot frame member, and a plurality of transverse frame members which abut said foot frame member and/or said head frame member, said head frame member and said foot frame member being positioned longitudinally with respect to said table means, a nailing assembly mounted on said table means and being adapted to transverse said table means, means mounted on said table means to drive said nailing assembly from one end of said means supporting the frame components to the other end, said nailing assembly having a generally U-shaped frame means with downwardly extending leg members, said U-shaped frame means straddling said means supporting the frame components, a nail driving assembly mounted on each of said leg members and being adapted to nail said transverse frame members to said foot frame member and/or said head frame member where said transverse frame members abut said head frame member or said foot frame member, said table means having a first and second track

means, said first and second track means being positioned on opposite sides of said means supporting said frame components, said legs of said U-shaped frame having roller means thereon whereby said U-shaped frame means rides on said first and second track means, said means to drive said nailing assembly including first and second worm gears, means mounted on said nailing assembly adapted to cooperate with said first and second worm gears whereby rotation of said first and second worm gears drives said nailing assembly along said table means and motor means to rotate said first and second worm gears, and means for supporting said first and second worm gears between their ends, said means for supporting said worm gears comprising first and second support members, said first and second supoprt members being adapted to support said first and second worm gears, respectively, said first and second support members each having inclined faces with a groove therein adapted to receive said worm gears, said first and second support members being connected to a linkage means, said linkage means extending and retracting said first and second support members upon rotation of a shaft, said shaft being rotated by a motor means.

14. A nail driving assembly comprising a motor having a reciprocal drive arm, said drive arm being connected to a driving block means, said driving block means being connected to a driver, said driver associated with a chuck means adapted to receive a nail, said chuck means being fixedly positioned on a slidable mounting means, said slidable mounting means being connected to said driving block means and being spring-biased with respect to one another, said driver being connected to said driving block means by a stroke adjuster means, said stroke adjuster means comprising a female stroke adjuster member attached to said driving block member and adapted to threadably receive a male stroke adjuster member, said driver being connected to said male stroke adjuster member, said mounting means having a plate member having a hole therein through which a compensator rod extends, one end of said compensator rod being fixedly attached to said driving block means, spring means on said compensator rod acting against said driving block means and said plate member, said other end of said compensator rod having abutment means attached thereto whereby movement of said driving block means toward said mounting means causes said spring means to move said mounting block means in the direction of movement of said driving block means and reverse movement of said driving block means causes said mounting means to move therewith when said abutment means engages said plate member.

15. A nail driving assembly comprising a motor having a reciprocal drive arm, said drive arm being connected to a driving block means, said driving block means having first and second drivers, said first and second drivers cooperating with first and second chuck means, respectively, said first and second chuck means being secured to a slidable mounting means, said slidable mounting means being attached to said driving block means, said mounting means having a plate member with a hole therein through which a compensator rod extends, said compensator rod having one end fixedly attached to said driving block means, spring means on said compensator rod acting against said driving block means and said plate member, said compensator rod having another end with abutment means attached thereto whereby movement of said driving block means towards said mounting means causes said spring means to move said mounting block means in the same direction and reverse movement of said driving block means causes said mounting means to remove therewith when said abutment means engages said plate member.

16. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means adapted to support frame members of said frame, said table means having means for supporting a nailing assembly, means for driving said traversing nailing assembly, said traversing nailing assembly being adapted to be driven from one end of said table means to the other end of said table means, said nailing assembly having a nail driving assembly, means to supply nails to said nail driving assembly mounted thereon, means to stop said nailing assembly and actuate said nail driving assembly to nail one of said frame members to another of said frame members, said nail driving assembly including a motor having a reciprocal drive arm, said drive arm being connected to a driving block means, said driving block means having first and second drivers, said first and second drivers cooperating with first and second chuck means respectively, said first and second chuck means being secured to a slidable mounting means, said slidable mounting means being attached to said driving block means, and said mounting means having a plate member with a hole therein through which a compensator rod extends, said compensator rod having one end fixedly attached to said driving block means, spring means on said compensator rod acting against said driving block means and said plate member, said compensator rod having another end with abutment means attached thereto whereby movement of said driving block means towards said mounting means causes said spring means to move said mounting block means in the same direction of movement until said first and second chuck means contact a frame member and reverse movement of said driving block means causes said mounting means to move therewith when said abutment means engages said plate member.

17. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means having means to support components of said frame including a head frame member, a foot frame member, and a plurality of transverse frame members which abut said foot frame member and/or said head frame member, said head frame member and said foot frame member being positioned longitudinally with respect to said table means, a nailing assembly mounted on said table means and being adapted to traverse said table means, means mounted on said table means to drive said nailing assembly from one end of said means supporting the frame components to the other end, said nailing assembly having a generally U-shaped frame means with downwardly extending leg members, said U-shaped frame means straddling said means supporting the frame components, a nail driving assembly mounted on each of said leg members and being adapted to transversely nail said transverse frame members to said foot frame member and/or said head frame member where said transverse frame members abut said head frame member or said foot frame member, said table means having a first and second track means, said first and second track means being positioned on opposite sides of said means supporting said frame components, said legs of said U-shaped frame means having roller means thereon whereby said U-shaped frame means rides on said first and second track means, said means to drive said nailing assembly including first and second longitudinally extending worm gears positioned on opposite sides of said table means, means mounted on said nailing assembly adapted to cooperate with said first and second worm gears whereby rotation of said first and second worm gears drives said nailing assembly along said table means and motor means to rotate said first and second worm gears.

18. A nailing apparatus for constructing a frame for building sections or the like which comprises a table means having means to support components of said frame including a head frame member, a foot frame member, and a plurality of transverse frame members which abut said foot frame member and/or said head frame member, said head frame member and said foot frame member being positioned longitudinally with respect to said table

means, a nailing assembly mounted on said table means and being adapted to traverse said table means, means mounted on said table means to drive said nailing assembly from one end of said means supporting the frame components to the other end, said nailing assembly having a generally U-shaped frame means with downwardly extending leg members, said U-shaped frame means straddling said means supporting the frame components, a nail driving assembly mounted on each of said leg members and being adapted to transversely nail said transverse frame members to said foot frame member and/or said head frame member where said transverse frame members abut said head frame member or said foot frame member, said table means having a first and second track means, said first and second track means being positioned on opposite sides of said means supporting said frame components, said legs of said U-shaped frame means having roller means thereon whereby said U-shaped frame means rides on said first and second track means, and means to lift and remove said frame from said means supporting the frame components after said frame components have been nailed together.

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GRANVILLE Y. CUSTER, JR., *Primary Examiner.*