

March 10, 1959

C. L. EDDLEBLUTE

2,876,450

CONTROL SYSTEM

Filed May 8, 1957

4 Sheets-Sheet 1

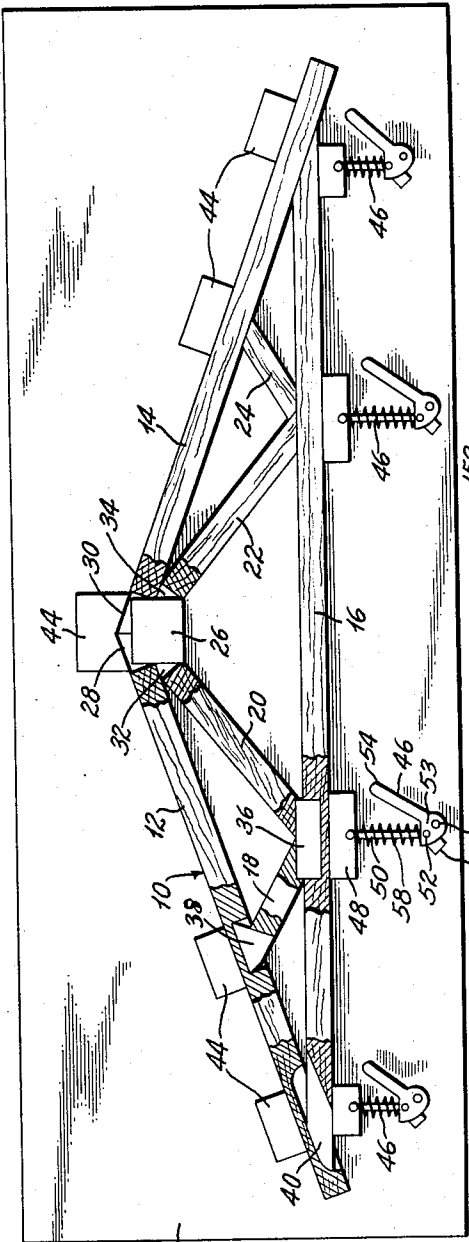


Fig. 1.

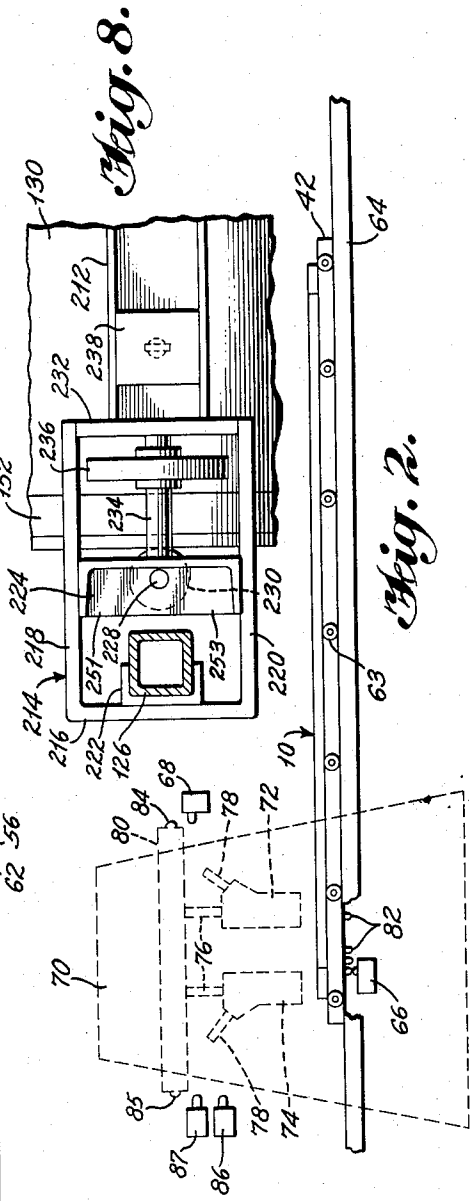


Fig. 8.



Fig. 2.

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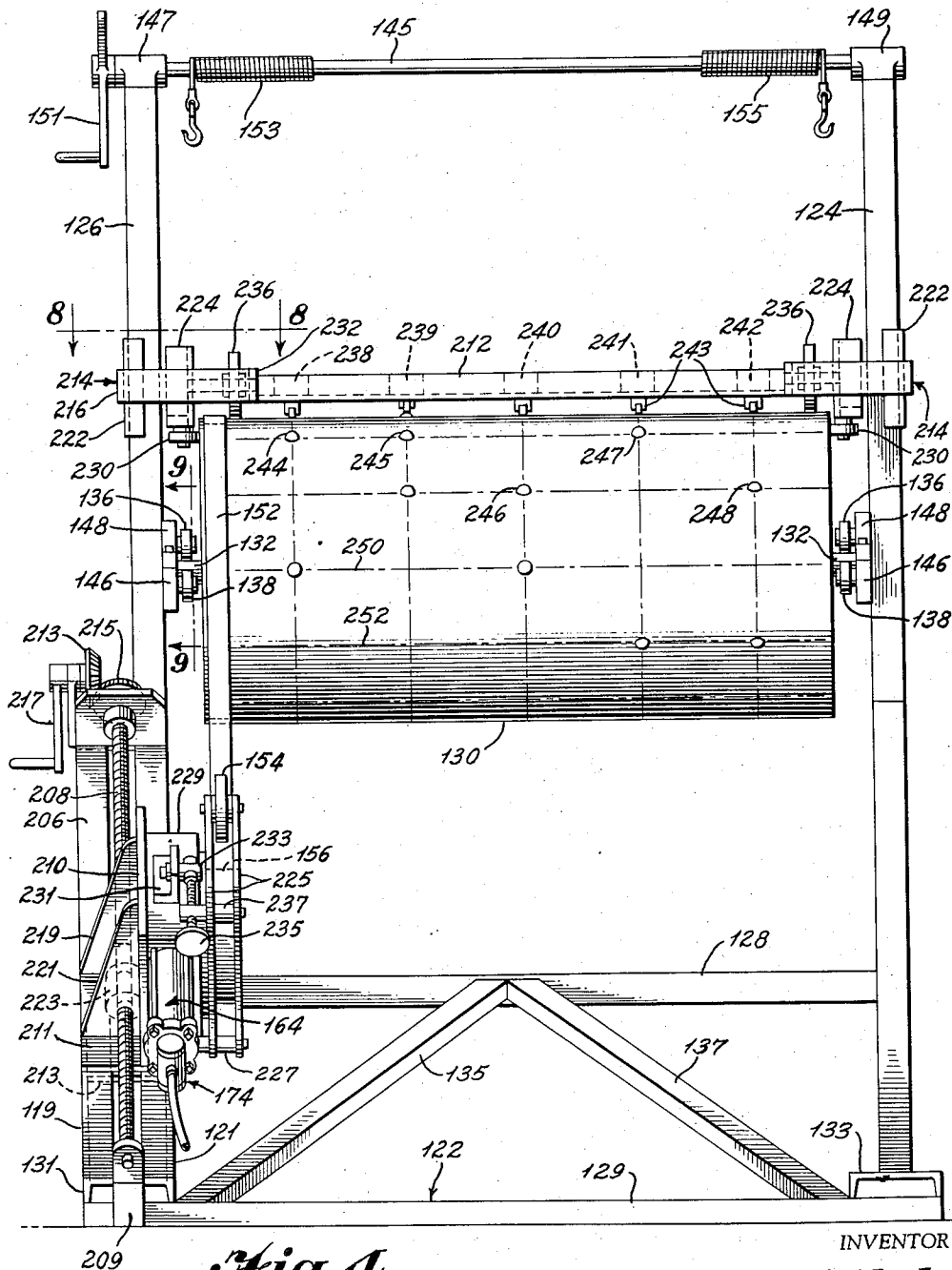
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4 Sheets-Sheet 3



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Fig. 5.

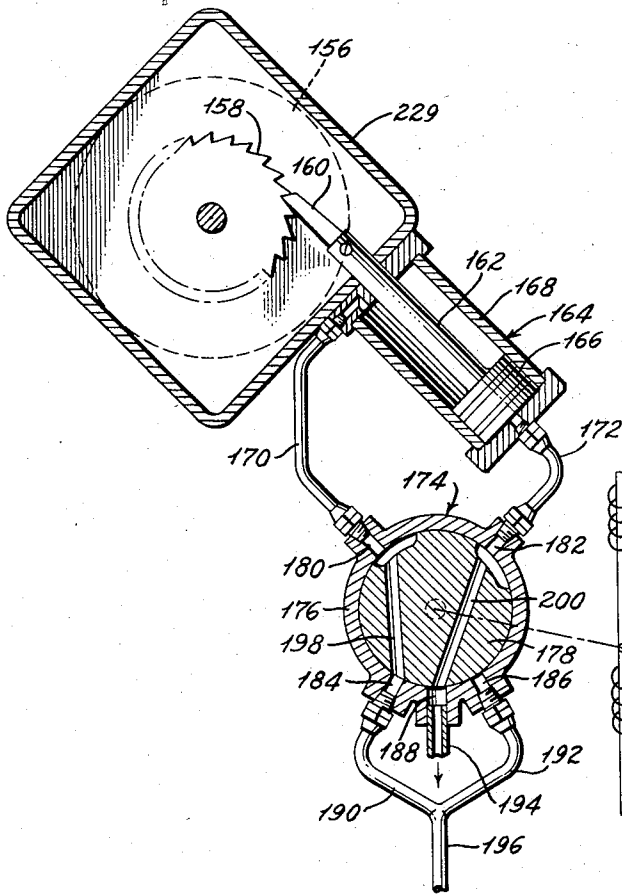


Fig. 6.

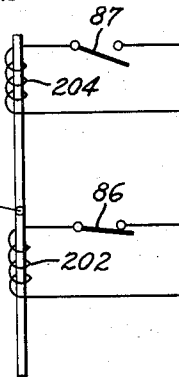
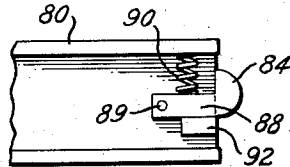
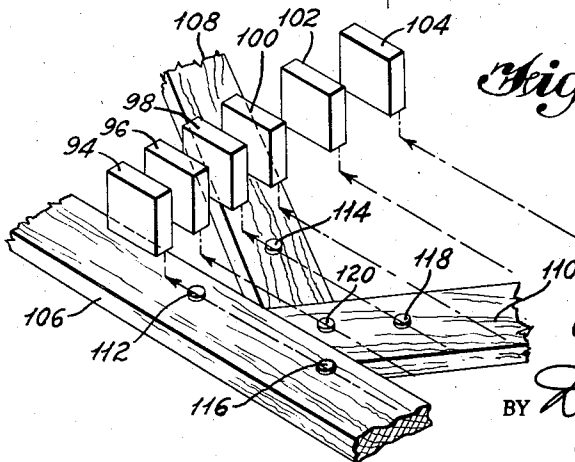


Fig. 7.



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2,876,450

CONTROL SYSTEM

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Application May 8, 1957, Serial No. 657,919

20 Claims. (Cl. 1—16)

The present invention relates to a machine for fabricating structural members and assemblies such as roof trusses, wall sections, floor sections, ceiling sections and other structures produced in the erection or prefabrication of buildings and more particularly relates to a system of controlling a generally conventional nailing machine for performing this work.

The present application is a continuation-in-part of my co-pending patent application Serial No. 556,341, filed December 29, 1955, for Control System, now Patent No. 2,803,012, issued August 20, 1957.

In accordance with the invention of the aforesaid co-pending application, there is provided a control system which permits conventional nailing machines to be utilized in the automatic fabrication of building sections or similar structural elements. A conventional nailing machine is provided employing a plurality of nailing chucks and a reciprocating nail driving beam for driving nails supplied to the chucks into an assembly to be fabricated. A plurality of the nailing chucks are aligned above a movable bed to which the structure to be assembled is secured. A chuck is provided above each possible location at which it may be desired to drive a nail into the assembly. The novel control system provided by the aforesaid co-pending application controls the feed of nails to the chuck such that the nail is fed only to those chucks located above the position where it is desired to drive a nail.

The control apparatus comprises a large drum having formed thereon a grid of selectively positionable buttons which cooperate with micro switches aligned with the buttons to selectively feed the nails to the nailing chucks. The switches are mounted on a bar immovably secured to the frame of the machine, each switch being aligned with a row of buttons on the drum so that upon rotation of the drum each switch is selectively actuated in accordance with the pattern of buttons dispersed in its associated row on the drum. The drum is rotated by means of a pawl and ratchet mechanism mechanically coupled to the nail driving beam such that the drum is advanced one step upon movement of the device to be fabricated from one position in which it is to receive nails to further subsequent positions in which it is to receive nails. The drum is rotatably mounted by two pairs of three rollers which engage opposite ends of the drums at angular positions of approximately 120° with respect to each other. Each of the rollers is adjustably mounted so that various sized drums may be applied to the apparatus by merely adjusting the relative positions of the three rollers at each end, so that their three points of tangency to each different diameter drum describe a circle equal to the diameter of the drum. As previously indicated, the micro-switches to be actuated by buttons on the drum are secured to an immovable bar so that each time a different size drum is inserted in the machine the rollers must not only be adjusted to the size of the drum but must be adjusted such that the surface of the drum is properly spaced from the switches to effect actuation thereof by the buttons.

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In accordance with the present invention the drum is provided with end stub shafts and three rollers are provided for each of the stub shafts for rotatably mounting the shafts. In order to replace drums, one of the rollers of each group is removably secured to the frame so that it may be readily removed to allow the drums to be interchanged. The switches which are to be actuated by the buttons on the drum are carried on a switch plate slidably positioned above the drum. The mounting for the switch plate carries rollers which engage the circumferential surface of the drum so as to maintain the switch plate at a fixed position with respect to the drum, regardless of its size or possible movement. The switch plate also carries rollers which engage the ends of the drum so that in spite of end play in the drum mounting, the switch plate maintains a fixed horizontal position with respect thereto and the switches remain aligned with their respective rows of buttons.

The pawl and ratchet mechanism for rotating the drum is driven by an air motor which is controlled by solenoids actuated in response to predetermined movements of the nail driving beam. The present invention is particularly adapted for use with drums which are considerably smaller than the drums for which the apparatus of the aforesaid copending application is designed. By using stub shafts for mounting the drums the necessity for readjusting all rollers with each change of drums is eliminated.

It is accordingly a primary object of the present invention to provide an improved automatic nailing system for fabricating building sections or similar structural elements.

It is another object of the present invention to provide a novel arrangement for driving a control drum of an automatic nail driving apparatus in accordance with various positions of the nail driving beam.

It is another object of the present invention to provide a simple and inexpensive control system for nailing machines whereby a large variety of different size and different shape building sections and similar structural elements may be fabricated by means of simple and rapid adjustment of the control device.

Further objects and advantages of the invention will become apparent upon reference to the following specification and claims and appended drawings wherein:

Figure 1 is a plan view of a roof truss assembled on a pallet prior to nailing;

Figure 2 is a vertical elevation showing the pallet and roof truss of Figure 1 being fed through a nailing machine;

Figure 3 is a side elevation of the control device of the invention;

Figure 4 is a front elevation of the control device of the invention;

Figure 5 is a schematic diagram of a hydraulic motor and control system for driving the drum of the apparatus of the present invention;

Figure 6 is a fragmentary detailed view of control buttons on the nailing machine in the system;

Figure 7 is a perspective view showing a portion of the structural member advancing under the nailing chucks;

Figure 8 is a fragmentary detailed showing of the bracket assembled for holding the switch plates and is taken along line 8—8 of Figure 4, and

Figure 9 is a fragmentary vertical section taken on line 9—9 in Figure 4 and showing the roller assembly.

While this invention is suitable for use with any type of nailing operation, it is particularly advantageous when utilized with the fabrication of building sections by means of sheet metal connectors and nails of the type described in my copending application Serial No. 492,840, filed

March 8, 1955. Referring to Figure 1 of the drawings, a trussed rafter is shown generally at 10 and consists of rafters 12 and 14, a joist 16 and trusses 18, 20, 22 and 24. The rafters 12 and 14 are joined at the peak of the truss by means of a gusset plate 26 received in slots 32 and 34 in trusses 20 and 22. The remaining joints are similarly secured by means of gusset plates 36, 38 and 40 as is more particularly described in my aforementioned copending application.

The trussed rafter 10 is assembled in this position on a jig pallet 42 and is held in an assembled position by means of stops 44 and toggle action clamps 46. Clamps 46 may consist of a clamp block 48 pivotally connected to a bar 50 which is slidably received in a journal pivoted at 52 to a lug 53. Lug 53 is carried by a lever 54 mounted on a pivot pin 56 which secures the lever to the pallet 42. A spring 58 is mounted on the rod 50 and bears against the clamp block 48 and lug 53 on the lever 54 to urge the bottom side of the lug into engagement with a stop block 62 when the truss rafter is in a clamped position.

Referring to Figure 2, the pallet 42 is mounted upon a series of rollers 63 for rolling movement upon a suitable track 64 and is moved therealong by any suitable conveyor drive such as, for instance, a chain drive of the type shown in United States patent Serial No. 2,574,163. The conveyor system is driven by means of a conventional magnetic clutch-brake drive and the simultaneous energization of the drive and de-energization of the brake and vice versa is controlled by a pair of micro switches 66 and 68.

The nailing machine may consist of a conventional nailing machine such as, for example, the type shown in United States patent Serial No. 2,232,725, as is shown in outline at 70 in Figure 2. The nailing machine includes a series of conventional nailing chucks 72 and 74 and each nailing chuck is provided with a conventional nailing punch 76 and with a flexible tube 78 which extends upwardly to the nail receiving funnels which are not shown. It will be understood that each of the nailing chucks 72 and 74 shown in the drawing represents a series of nailing chucks arranged in a line extending perpendicularly into Figure 2 of the drawing. The nailing punches 76 are actuated by means of conventional nail driving beams 80 which reciprocate in an up and down motion to perform the nailing operation.

Beneath pallet 42 is mounted a series of buttons 82 which, upon engaging micro switch 66, de-energize the drive and apply the brake to bring the pallet to a halt with the button 82 depressing the switch 66. The buttons 82 are so placed that the pallet is brought to a halt when the nailing chucks 72 and 74 are directly above positions on the truss rafter where nails are to be driven and the switch 66 also actuates the nail punch mechanism. Thus, when the pallet comes to a halt with a button 82 depressing the micro switch 66, nails are automatically driven by the punches in a pattern determined by a control mechanism to be described in detail hereafter.

The nail driving beam 80 is provided with two buttons 84 and 85 disposed on opposite ends of the beam, the button 84 momentarily closing the micro switch 68 and the button 85 momentarily and successively closing micro switches 86 and 87 upon upward movement only of the beam 80. The closure of the switch 68 momentarily releases the brake and energizes the conveyor mechanism to jog the pallet forward a short distance to allow button 82 to clear the switch 66. Once the switch 66 is cleared the pallet moves forward under control of switch 66 until another button 82 is engaged. The momentary closure of the switches 86 and 87 which occurs when the beam 80 is adjacent its lower and upper limits of movement respectively, actuates circuits for controlling the movement of an element in the nail selection mechanism to be described subsequently.

In order to actuate the switches 68, 86 and 87 upon

upward movement only of the beam 80, the buttons 84 and 85 are made movable as illustrated in Figure 6 in one direction only. It is to be understood that the mechanism illustrated in Figure 6 applies to both buttons 84 and 85. Where beam 80 is an I beam the button 84 is carried by a lever 88 pivoted to the web of the beam at 89. The lever is urged by a spring 90 into a stop 92. As the beam 80 moves upwardly the button 84 depresses the operation button on switch 68, while on downward movement the lever 88 pivots about the pin 89 and the button 84 does not actuate the switch 68. Switches 86 and 87 operate in a similar manner.

When a pallet 42 is placed upon the conveyor 64 and the entire mechanism is turned on by an operator, the drive system moves the pallet to the left until the first button 82 actuates micro switch 66 to thereby de-energize the drive motor, actuate the brake and actuate the nailing mechanism. The beam 80 thereupon moves downwardly and the button 84 passes over the switch 68 without actuating the same. The beam 80 then moves upwardly on its return stroke whereupon the button 84 momentarily actuates switch 68 to release the brake and energize the drive system which moves the pallet forward to clear switch 66. Once switch 66 is cleared the pallet continues to move until another button 82 strikes the switch 66. It will be readily appreciated that by placing the buttons 82 at positions on the pallet where nails are desired, a longitudinal placement of nails is effected. After the last button 82 on the pallet 42 clears the switch 66, the pallet continues to move until a button 82 on another pallet strikes the switch 66 to initiate another nailing operation.

Reference to the trussed rafter shown in Figure 1 will show that it is necessary to control not only the longitudinal but also the lateral spacing of nails in the structure. This is accomplished by means of a control mechanism shown in Figures 3, 4, 5, 8 and 9. Prior to running a series of trussed rafters or any other structure through the nailing machine, the nailing chucks on the machine are positioned transversely of the rafter in such a manner that there is a nailing chuck at each transverse position that it is desired to drive a nail. The nailing chucks on conventional nailing machines, particularly the type shown in United States patent Serial No. 2,232,725, are normally adjustably mounted to facilitate such positioning as will be well understood by those skilled in the art.

Referring to Figure 7 there is shown a series of nailing chucks 94, 96, 98, 100, 102 and 104 arranged in transverse positions above a building structure consisting of joist 106 and trusses 108 and 110 which passes therebeneath. In order to drive nails at the positions 112, 114, 116 and 118, it is necessary to supply nails to chucks 94 and 98 when positions 112 and 114 are therebeneath, while at the same time withholding a supply of nails to the remaining chucks. The same chucks 94 and 98 are supplied with nails when the positions 116 and 118 are therebeneath, whereas when position 120 is reached only chuck 96 is supplied with a nail to be driven into the position 120. It will be readily apparent from this illustration that any satisfactory control system must be flexible so that the machines can easily handle building structures of different sizes and shapes.

Referring to Figures 3, 4 and 9 there is shown a control system which satisfies these requirements. This unit comprises a frame having a base shown generally at 122 and end supports 124 and 126 carried by the base. The base consists of a first pair of parallel channels 127 and 129 to which are secured a second pair of parallel channels 131 and 133. The end supports 126 and 124 are welded to channels 131 and 133 respectively. A cross brace 128 extends between end supports 124 and 126 and is diagonally braced at 135 and 137. Further diagonal supports 139, 141 and 143 rigidify the end supports 124 and 126. A shaft 145 extends across the top of the unit

and is journaled at 147 and 149 on end supports 126 and 124. A crank 151 is provided along with a pair of ropes and hooks 153 and 155 for lifting the drums during drum replacement. Mounted within the frame thus formed is a drum 130 which is provided with two stub shafts 132 coaxial with the drum 130, one of the shafts 132 extending outwardly from each end of the drum. Each of the shafts 132 is supported on a set of three rollers 134, 136 and 138, the rollers 134, 136 and 138 being rotatably supported on shafts 140, 142 and 144, respectively, which are parallel to shafts 132. The shafts 140 and 144 are horizontally aligned and are mounted in blocks 146 each secured to one of the end supports 124 and 126. The shaft 142 is mounted in a cap 148 which may be bolted to the block 146 by bolts 149, the roller 136 being preferably disposed vertically above the stub shaft 132. The angular spacing between the rollers 134, 136 and 138 is preferably 120° although other spacings may be employed.

The block 146 and cap 148 are each provided with semi-circular grooves so that the shaft 132 may pass therebetween.

The shafts 132 are provided of sufficient length to allow end play of the drum without the shafts 132 falling off the rollers 134, 136 and 138.

In consequence of the structural mounting of the drum 130 as described above, drums of various sizes may be employed for purposes to be described so long as the diameter of the shafts 132 is approximately the same for all drums. A new drum may be mounted in the apparatus merely by removing the bolts 149 holding the cap 148, removing the old drum, inserting the new drum and replacing the cap 148 and its holding bolts.

The drum 130 is driven by means of a toothed timing belt 152 which engages teeth 153 on the drum 130 and which passes beneath an idler roller 154 and over a drive wheel 156. The drive wheel 156 carries on its circumference teeth 158 which are engaged by a ratchet lever or pawl 160 pivotally secured to the end of a piston shaft 162 of a reciprocating piston-type pneumatic motor 164. Referring to Figure 5, the shaft 162 is secured to a piston 166 slidably received in a cylinder 168. The cylinder 168 is provided with ports at either end which are connected through conduits 170 and 172 to a pneumatic valve 174.

Under control of the valve 174, the piston 166 is caused to reciprocate between two predetermined limits of movement established by the length of the cylinder. Upon movement of the piston 166 to the right, as viewed in Figure 5, the pawl 160 slides over the teeth 158 of wheel 156, while upon movement of the piston 166 to the left, the pawl 160 engages teeth 158 and rotates the wheel 156 through an angle determined by the linear movement of the piston.

The movement of the motor 164 is controlled by the rotary pneumatic valve 174 which comprises an outer cylindrical casing 176 and a rotary internal member 178. The casing is provided with ports 180, 182, 184, 186 and 188 which communicate externally with conduits 170, 172, 190, 192 and 194. As previously indicated the conduits 170 and 172 communicate with the opposite ends of the cylinder 168 of motor 164, while conduits 190 and 192 communicate with an air pressure supply conduit 196. Conduit 194 communicates with the surrounding air.

The cylindrical rotary member 178 is provided with two channels 198 and 200, one end of channel 198 remaining in communication with port 180 and one end of channel 200 remaining in communication with port 182 within the limits of rotation of the member 178. The other ends of the channels 198 and 200 selectively register with the ports 184 and 188 and 188 and 186, respectively, at the limits of rotation of the member 178.

With the rotary member in the position illustrated in Figure 5, the conduit 170 is placed in direct communica-

tion with the source of air pressure through the port 180, channel 198, port 184 and conduits 190 and 196. The conduit 192 is blocked by member 178. The conduit 172 is exhausted to the surrounding atmosphere through port 182, channel 200, port 188 and conduit 194. In consequence, air pressure is applied to the left side of the piston 166 and it moves to the extreme right of the cylinder as viewed in Figure 5.

Upon counterclockwise rotation of the member 178 within prescribed limits, the upper ends of channels 198 and 200 remain in communication with ports 180 and 182, respectively, while the lower ends of these channels communicate with ports 188 and 186, respectively. Air pressure is now applied to conduit 172 and conduit 170 is exhausted to the surrounding air. In consequence, the piston 166 moves to the extreme left of the cylinder 168 and in so doing rotates the drive wheel 156.

The rotation of the drum 130 must be synchronized with the nailing operation; that is, the drum 130 must be rotated only during those intervals when a nailing operation is not taking place. In order to properly synchronize the drum advancing and nailing operations, the movement of the rotary member 178 of valve 174 is controlled by solenoids 202 and 204 electrically energized under control of switches 86 and 87. Immediately after completing a nailing operation, the nailing beam 80 begins to rise and closes switch 86 to energize solenoid 202. The solenoid rotates the member 178 to the position illustrated in Figure 5, the piston 166 is moved to the right and the pawl 160 is returned to a retracted position. When the beam 80 is adjacent the top of its stroke, it closes switch 87 which energizes solenoid 204. Energization of solenoid 204 rotates member 178 counterclockwise and the piston 166 moves to the left and advances the drum. It will be noted that the piston 166 of motor 164 remains in whatever position it is placed and is maintained there by air pressure so long as the member 178 remains in a fixed position. The member 178 remains in the position in which it was placed by the last solenoid to be actuated. The form of valve 174, described above, is purely exemplary and in a preferred embodiment of the invention a slide valve of the type disclosed in Bellows Patent No. 2,641,229 is employed.

As described in detail in the aforementioned copending application, the diameter of drum 130 is equal to the number of nailing operations times the circumferential increment of movement of drive wheel 156 caused by one upward movement of the nailing beam 80. Since the increment of movement of the drive wheel 156 is fixed, it will be seen that the diameter of the drum is dependent upon the number of nailing operations in a sequence. Thus, as an example, if it be assumed that in the fabrication of a given building structure there must be 100 actuations of the nailing punches, and if it is further assumed that each upward movement of the nailing beam 80 moves the periphery of the drive wheel 156 one inch, then the circumference of the drum 130 must be equal to 100 inches. Where a different type building structure is fabricated utilizing, as an example, 50 nailing operations, the circumference of the drum must then be 50 inches.

Since it is normally desirable to employ only one belt 152 regardless of the size of the drum, and in order to adjust the tension in belt 152, the roller 154, the drive wheel 156, the motor 164, valve 174 and solenoids 202 and 204 are mounted for movement with respect to the drum 130. A platform 206 is secured to the base 122 and end support 126 and rotatably supports an elongated screw 208 which is parallel to a line drawn between the centers of the wheel 156 and drum 130. The screw 208 has its lower end journaled in a bracket 209 and its upper end journaled in a bracket 211. A pair of bevel gears 213 and 215 cooperate with a crank 217 for rotating the screw. The platform 206 consists of an outer angle 119 and a parallel inner angle 121, as best seen in Figure 4. The upper end of angle 119 is welded to a lug

123 on the end support 126, while the upper end of angle 121 is welded to the end support 126. The lower ends of both angles are welded to channel 131.

A plate 211 slides over angles 119 and 121 while a plate 213 slides therebeneath and therewithin. These two plates are separated by suitable sleeves 215a and are secured together by bolts 217 which prevent removal of the assembled plates from the platform 206 while permitting sliding movement thereover. An upstanding plate 210 is welded to upper plate 211 and brackets 219 and 221 are welded to both. A threaded bushing 223 mounted on screw 208 is welded to bracket 221 to lock the plate assembly to the screw.

Roller 154 is mounted on upright plate 210 by a pair of bent levers 225 and pivot 227. Drive wheel 156 is rotatably carried in a box 229 which is secured to upright plate 210. Mounted on top of box 229 is a bracket 231 carrying a rotatable lug 233 which screw threadedly receives an adjusting screw 235. Screw 235 also screw threadedly engages a second rotatable lug 237 in levers 225 to provide an adjustment for these levers and the roller 154. The piston motor 164 is fastened to the box 229 and its piston rod 162 extends thereinto. Valve 174 and its controlling solenoids are mounted on motor 174. It will thus be seen that the drive wheel 156 may be moved generally radially of drum 130 by rotation of crank 217 and screw 208. The tension of the belt may be adjusted by means of screw 235. Thus through adjustment of screws 208 and 235 it is possible to accommodate varying drum sizes while maintaining proper belt tension.

A micro-switch support channel 212 is supported vertically above the drum 130 and parallel to the axis thereof by bracket assemblies 214, one being secured to each end of the channel 212. Referring to Figure 8, the bracket assembly 214 includes a U-shaped member having a base 216 and parallel legs 218 and 220. The base 216 is disposed outwardly of the end support 126 and a plate 232 is secured between and perpendicular to the legs 218 and 220, inwardly of the member 126. The members 216, 218, 220 and 232 define a rectangular frame which is connected to the switch support channel by the plate 232 being welded to the end thereof. A vertically disposed channel 222 is secured to the inside of base 216 and slidably receives the end support 126.

A second U-shaped member 224 is secured vertically between legs 218 and 220 and carries at its lower or base end a plate 251 which supports a vertically disposed shaft 228. Rotatably mounted on the shaft 228 is roller 230 which rotates in a horizontal plane about a vertical axis. The spacing between the rollers 230 mounted on the brackets 214 at opposite sides of the drum 130 is such that each roller contacts a different end of the drum 130 and in consequence axial movement of the drum 130 resulting from end play allowed by its supports is transmitted to the brackets 214. Brackets 214 prevent most lateral movement of drum 130 but any movement which does occur is transmitted to the switch support so that the position of the switch support 212 in a horizontal plane is maintained fixed with respect to the drum.

A second shaft 234 is secured between the base 253 of U-shaped member 224 and plate 232. The shaft 234 is parallel to the axis of drum 130 and rotatably supports a roller 236, in a position over the drum 130 and adjacent its edge. The rollers 236 rest on the circumferential surface of the drum and, since brackets 214 are vertically slidable on frame members 126 and 124, respectively, the rollers 236 maintain the brackets and therefore the switch support 212 in a fixed vertical position with respect to the surface of the drum 130.

In consequence of the bracket and roller structure described, the switch support is maintained in a fixed position with respect to the drum in all three dimensions in space. Further, since the brackets 214 are freely positionable vertically, various size drums 130 may be employed,

the rollers 236 immediately adjusting the position of the switch support 212 to that required.

Mounted upon the support 212 are a number of micro-switches 238—242 equal in number to the number of nailing chucks. The actuating buttons 243 on the micro-switches are held in close proximity to or in light contact with the surface of the drum 130 and each micro-switch cooperates with a circularly disposed series of buttons 244—248 which lies in a plane passing through the particular micro-switch button 243. The surface of the drum 130 is divided by these planes into a grid wherein the axial spacing between the planes is equal to the spacing between the actuating buttons 243 on adjacent micro-switches 238—243 and wherein the vertical or circumferential spacing between axial button lines is equal to the peripheral increment of movement of the drive wheel 156 per reciprocation of the nailing beam 80. The buttons 244—248 may conveniently consist of headed pins frictionally held in equally spaced holes in the drum surface although other equivalent arrangements will be apparent to those skilled in the art.

Each micro-switch 238—242 is connected in the circuit of a solenoid which controls the feed of nails to a nailing chuck and the nailing chuck is supplied a nail only when its corresponding micro-switch is energized. In order to energize the desired micro-switches circularly disposed series of buttons 244—248 are placed on the circumferential surface of the drum in the proper positions to actuate the desired micro-switches and solenoids at any given position of the drum. Thus referring to Figure 4 it will be seen that when the buttons in horizontal or axial line 250 are opposite the control buttons 243 on the micro-switches 238—240, micro-switches 238 and 240 are energized whereas the remaining micro-switches remain de-energized. Likewise when the following vertical or axial line of buttons 252 is in position adjacent the buttons 243 on the micro-switches 241—242, each of the micro-switches 241—242 is actuated. It will be apparent that the control buttons may either close or open the micro-switches depending upon the particular solenoid arrangement used.

Referring to Figure 7 and remembering that for each nail chuck 94—104 shown there is a corresponding micro-switch 238—242, it will be seen that in order to drive nails at positions 112 and 114 the micro-switches corresponding to nailing chucks 94 and 98 must have drum buttons therebeneath when the nailing chucks 94 and 98 are vertically aligned with positions 112 and 114. In order to drive a nail at position 120 there must be but one button on the drum in a position to actuate the micro-switch corresponding to the nailing chuck 96.

It will be apparent from the foregoing that for the fabrication of any given structural member the size of the control drum is easily calculated and the position of the buttons thereon is easily determined from a knowledge of the nails to be driven at each forward advance of the structural member. The buttons on the drums may be readily movable so that a change in the nailing pattern is accomplished simply by removing or inserting buttons. Where different size or different shape structural members are to be fabricated different drums are provided and a stock of such drums may be maintained so that a change over from the fabrication of one structural member to another structural member is simple and quick and requires a minimum of equipment.

The overall operation of the device is as follows: A trussed rafter is assembled upon a pallet 42 and is clamped thereon by means of stops 44 and clamps 46. The pallet 42 is thereupon placed upon the conveyor 64 which is moving forward in predetermined increments under the control of the preceding pallet. At the end of the final nailing stroke on the preceding pallet the upward movement of the beam 80 rotates the drive wheel 156 in Figure 3 in a counterclockwise direction to bring the drum 130 to a start position wherein the proper

micro-switches 238—242 are actuated to insure that the proper nailing chucks will be supplied with nails during the next downward motion of the nailing beam 80. After the preceding pallet has cleared the nailing machine, the pallet 42 moves forward until the first button 82 engages the micro-switch 66. This de-energizes the drive of conveyor 64, actuates the brake to bring the pallet to rest and simultaneously energizes the nailing beam 80 which thereupon moves downwardly to drive the nails present in the nailing chucks. As the nailing beam moves upwardly on its return stroke, it successively closes micro-switches 86 and 87 and the ratchet lever 160 again advances drive wheel 156 one increment to place another row of buttons beneath micro-switches 238—242 to control the placement of nails for the next downward movement of the beam. This upward movement of beam 80 also causes button 84 to momentarily close micro-switch 68 to de-energize the brake and energize the conveyor whereby the pallet 42 is jogged slightly to the left in Figure 2 so that button 82 clears switch 66. When this button clears switch 66 the driving mechanism is closed by switch 66 and continues in a driving condition until the next button 82 engages switch 66 to de-energize it. Nailing beam 80 is simultaneously driven downwardly to drive another set of nails. The pallet thus advances in stepwise fashion until the final button 82 clears the switch 66 whereupon the drum 130 is again in a starting position and remains in such a position until the first button 82 on a new pallet engages the switch 66.

Speed of operation is determined by the speed of the conveyor and by the rapidity with which the nailing machine 70 may be actuated. The control system is extremely simple and inexpensive and permits a complete flexibility of operation. The system is adapted to use with practically any conventional nailing machine which may be provided with a conveyor system and does not require expensive special purpose equipment.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A control device for a plural chuck nailing machine having a nail driving means and remotely controlled means for feeding nails to said chucks, comprising a drum rotatably mounted within a frame, a series of control devices carried by a member movably mounted on said frame in proximity to said drum and connected to control said means for feeding nails, guide means carried by said member and contacting said drum for positioning said control devices with respect to said drum, spaced means on said drum cooperating with said control devices for selectively actuating said control devices on rotation of said drum, and means for rotating said drum an increment of a turn each time said nail driving means is actuated.

2. A control device for a plural chuck nailing machine having a nail driving means and electrically controlled means for feeding nails to said chucks, comprising a drum rotatably mounted within a frame, a series of switches carried by a member movably mounted on said frame in proximity to said drum and connected to control said means for feeding nails, guide means carried by said member and contacting a peripheral surface of said drum for positioning said member and switches with respect to said drum, spaced means on said drum cooperating with said switches for selectively actuating said switches on rotation of said drum, and means for rotat-

ing said drum an increment of a turn each time said nail driving means is actuated.

3. A control device as set out in claim 2 wherein said frame includes a pair of vertical members on which said member is mounted for sliding motion above said drum, and said guide means comprises rollers rotatably mounted on said member and rolling on said peripheral surface of said drum.

4. A control device as set out in claim 2 including shaft means of a smaller diameter than said drum extending from both ends thereof, and rollers mounted on said frame to receive said shafts to provide a removable mounting for said drum.

5. A control device as set out in claim 4 wherein the movable connection between said member and said frame permits said member to move both radially and axially of said drum, and additional guide means attached to said member and bearing against at least one surface of said drum which is perpendicular to the axis of rotation of said drum to transversely position said member and switches with respect to said drum.

6. A control device as set out in claim 5 wherein said frame includes a pair of vertical members on which said member is mounted for vertical sliding motion above said drum and for transverse sliding motion parallel to the axis of rotation of said drum, said guide means comprises rollers rotatably mounted on said member and rolling on said peripheral surface of said drum, and said additional guide means comprises rollers bearing against the ends of said drum.

7. A control device as set out in claim 6 wherein said rollers mounted on said frame to receive said shaft means constitute three rollers supporting the shaft means extending from each end of said drum, the uppermost of each of said sets of rollers being removably mounted to permit removal of said drum.

8. A device as set out in claim 2 wherein said means for rotating said drum comprises a reciprocable pneumatic motor, and means for rotating said drum an increment of a turn upon each movement of said motor in one direction.

9. A device as set out in claim 8, further comprising electromagnetic means for actuating said valve means, and means responsive to movement of said nail driving means through predetermined positions for selectively energizing said electromagnetic means.

10. A control device for a plural chuck nailing machine having a reciprocating nail driving element and electrically controlled means for feeding nails to said chucks, comprising: a frame including a pair of end supports, a drum, means for rotatably supporting said drum between said end supports, a drive wheel rotatably mounted and connected to rotate said drum upon rotation of said drive wheel, means for rotating said drive wheel through a predetermined increment upon each reciprocation of said nail driving element, a plurality of switches mounted in a line on a cross member disposed between said end supports parallel to the axis of rotation of said drum, a pair of brackets, each of said brackets being secured to a different end of said cross member and slidably mounted on a different one of said end plates, a guide means secured to each of said brackets, said guide means contacting the circumferential surface of said drum for vertically positioning said switches with respect to the circumferential surface of said drum, a plurality of groups of buttons mounted on the surface of said drum, each of said groups of buttons extending circumferentially about the periphery of said drum in a plane passing through a distinct one of said switches, said buttons being of a size to actuate said switches when said buttons are rotated into juxtaposition with said switches, and means actuated by said switches to control said nail feeding means whereby a nailing pattern is controlled by the pattern of said buttons on said drum.

11. The combination in accordance with claim 10,

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wherein said guide means comprise at least one roller secured to each of said brackets, said rollers rotatably engaging the surface of said drum.

12. The combination in accordance with claim 10, wherein said means for rotatably supporting said drum comprises shaft means extending outwardly from the ends of a coaxial with said drum, and roller means supported on said end plates and rotatably and removably supporting said shaft means.

13. The combination in accordance with claim 10, wherein said means for rotating said drive wheel comprises a reciprocable pneumatic motor having a stroke of a predetermined length, valve means for controlling reciprocation of said motor and means for rotating said drive wheel through a predetermined angle upon each movement of said motor in one direction.

14. The combination in accordance with claim 13, further comprising electromagnetic means for actuating said valve means and means responsive to movement of said nail driving element through predetermined positions for selectively energizing said electromagnetic means.

15. A control device comprising a frame including a pair of spaced upstanding support members, a drum having shafts extending from both ends thereof rotatably mounted on said members with said shafts journaled on said members, a switch support beam extending between said members above said drum and slidably mounted thereon for movement therealong, roller means at each end of said beam engaging said drum for maintaining said beam at a fixed radial distance from said drum, switches on said beam, switch actuating means on said drum for engaging and actuating said switches on rotation of said drum, a drive wheel pivotally mounted on said frame,

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means for rotating said drive wheel in fixed increments mounted on said frame, belt means passing around said drum and wheel and drivingly connecting said wheel to said drum, and means for moving said drive wheel substantially radially of said drum.

16. A control device as set out in claim 15 including additional roller means at each end of said beam engaging said drum and maintaining said beam in fixed axial position with respect to said drum.

17. A control device as set out in claim 15 wherein each of said shafts is journaled in a set of three rollers attached to said upstanding support members, two of said rollers in each set being disposed with their axes in a horizontal plane and the third roller being movably mounted on a horizontal axis thereabove.

18. A control device as set out in claim 15 wherein said wheel is mounted on a carriage movably mounted on said frame, and a screw rotatably mounted on said frame and screw threadedly engaging said carriage, said screw being parallel to a line between the centers of said drum and wheel.

19. A control device as set out in claim 18 wherein said means for rotating said drive wheel comprises a reciprocating fluid motor, said drive wheel having teeth on the periphery thereof engaged by a pawl driven by said fluid motor.

20. A control device as set out in claim 18 including a lever pivotally mounted on said carriage, and having a roller carried thereby and engaging said belt to provide adjustable tension therein.

No references cited.