May 7, 1935. G. B. SHIPLEY 2,000,458

ADZING AND BORING MACHINE

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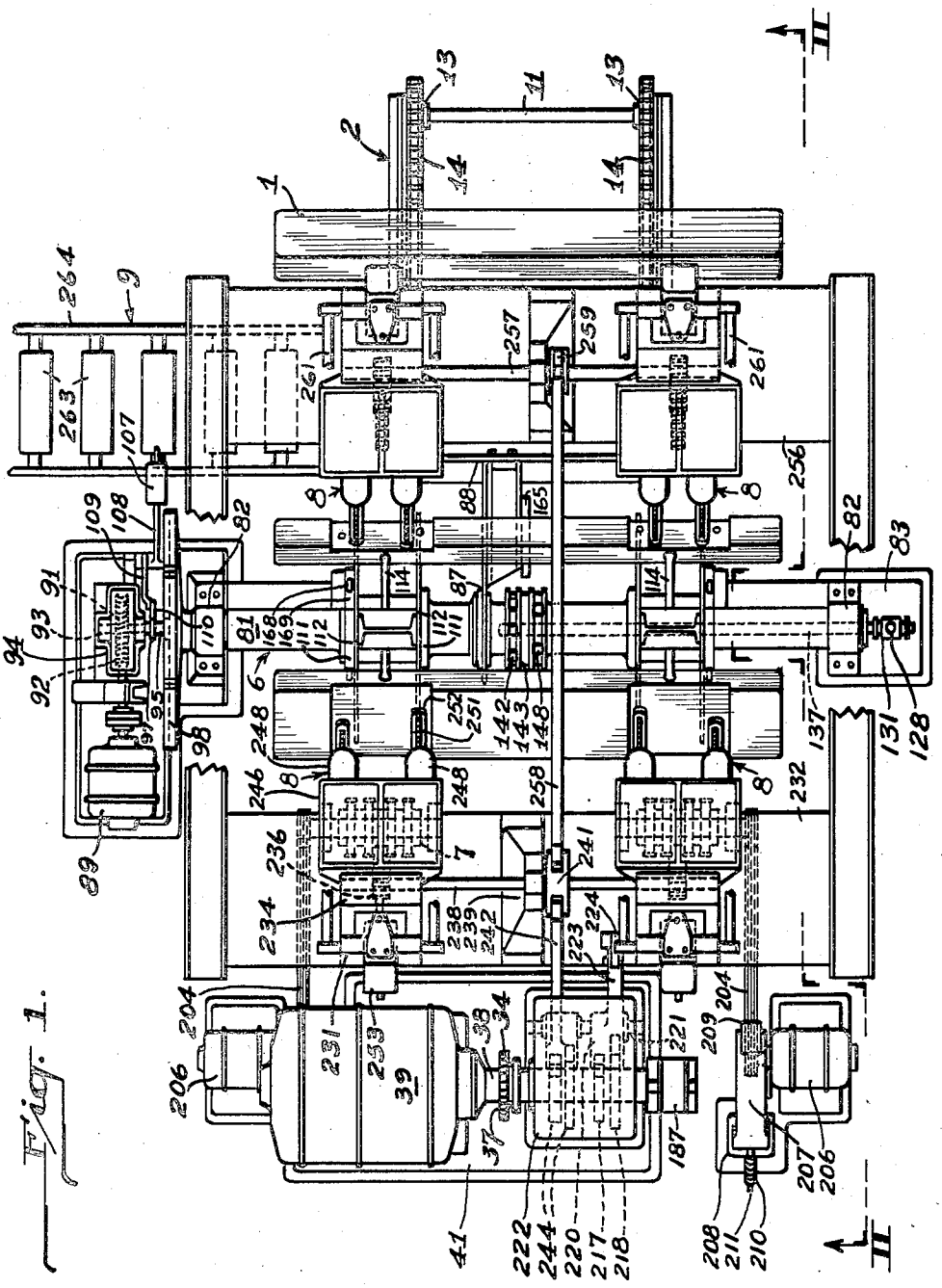

Fig. 1.

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Fig. 2.

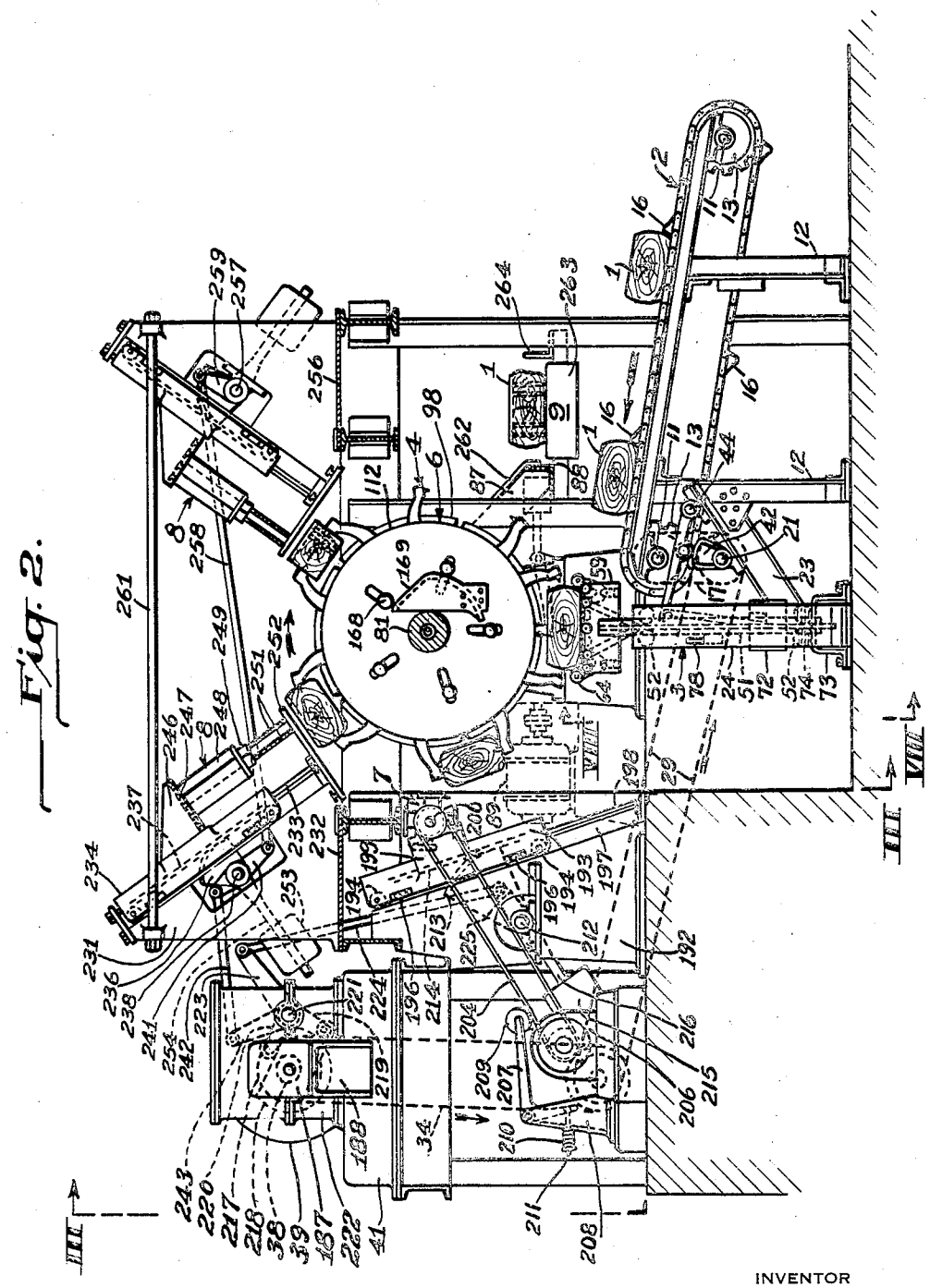

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Fig. 3.

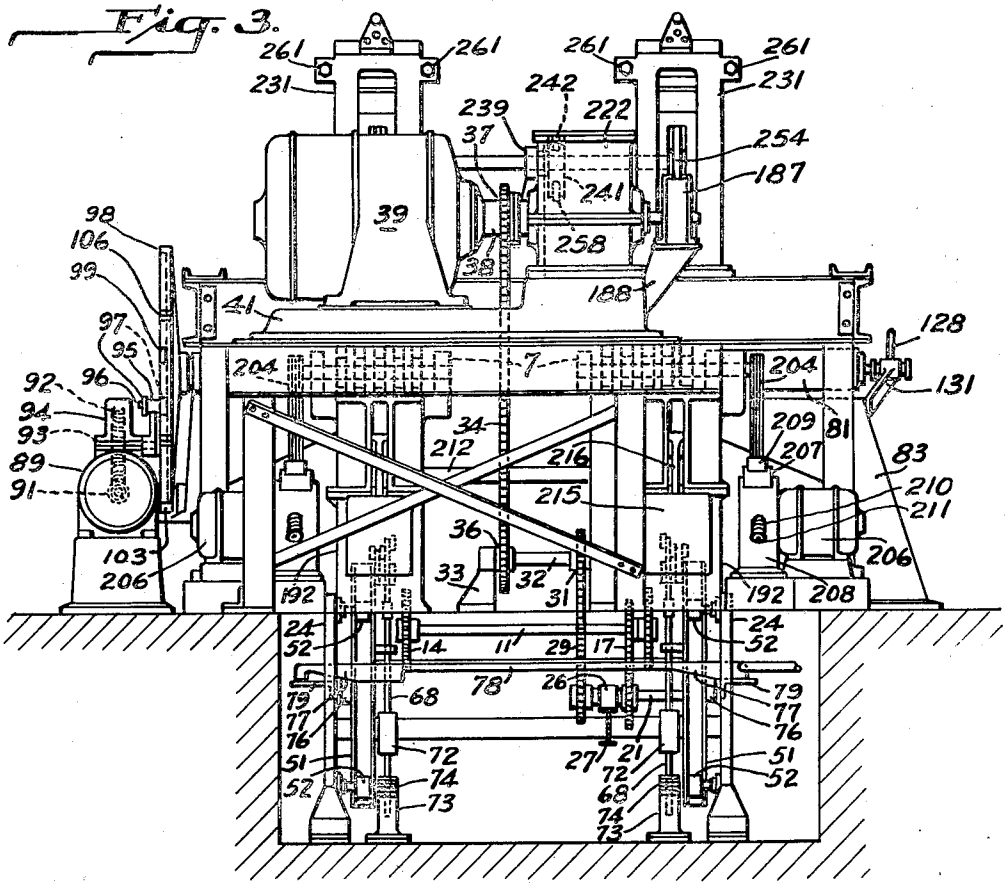

Fig. 4.

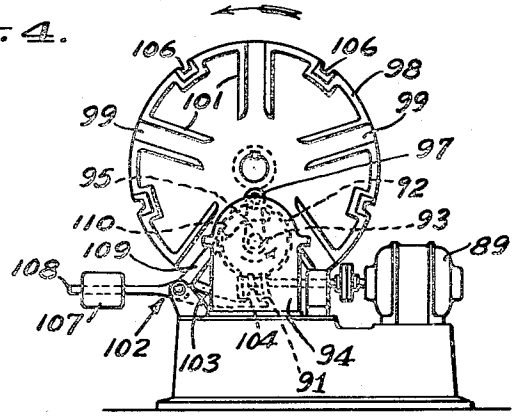

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Fig. 5.

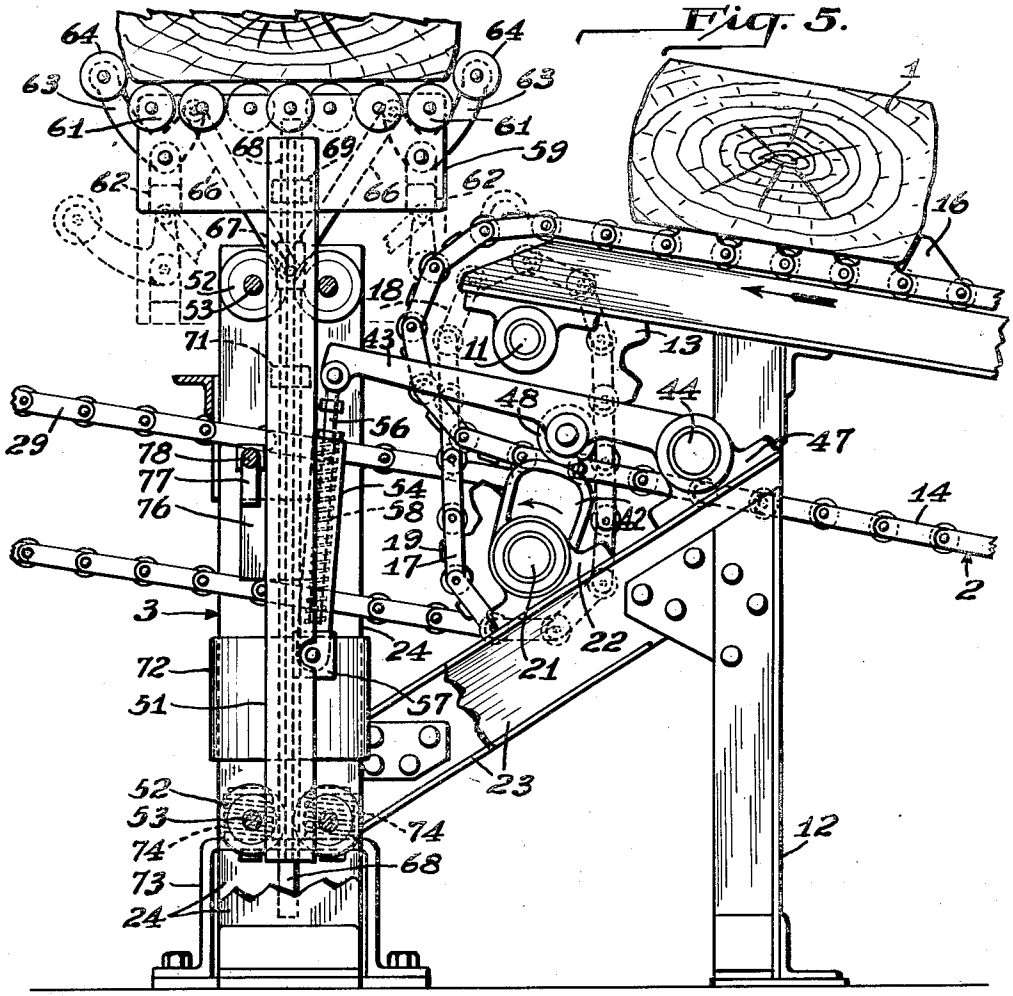


Fig. 6.

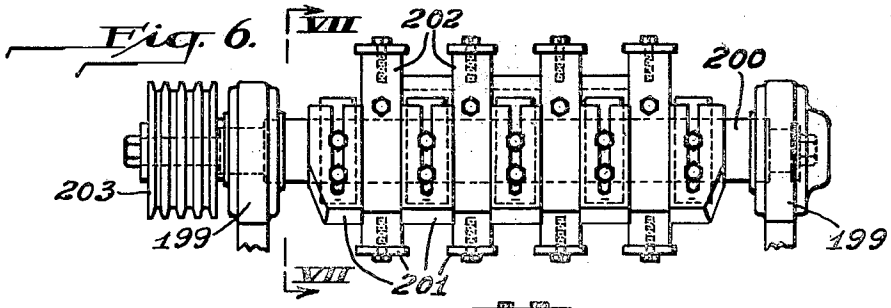
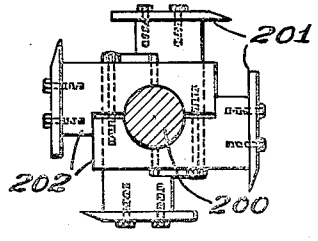


Fig. 7.



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ADZING AND BORING MACHINE

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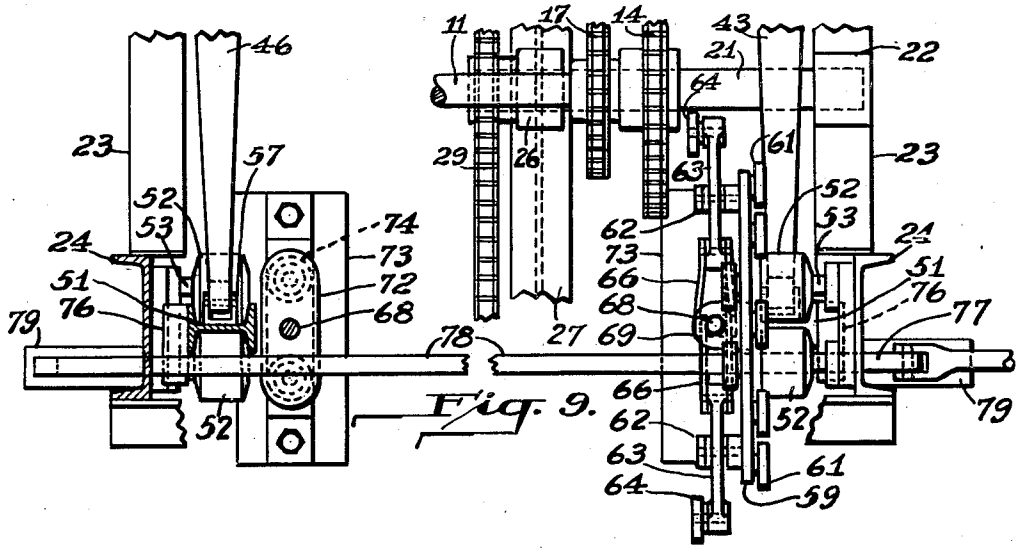

Fig. 9.

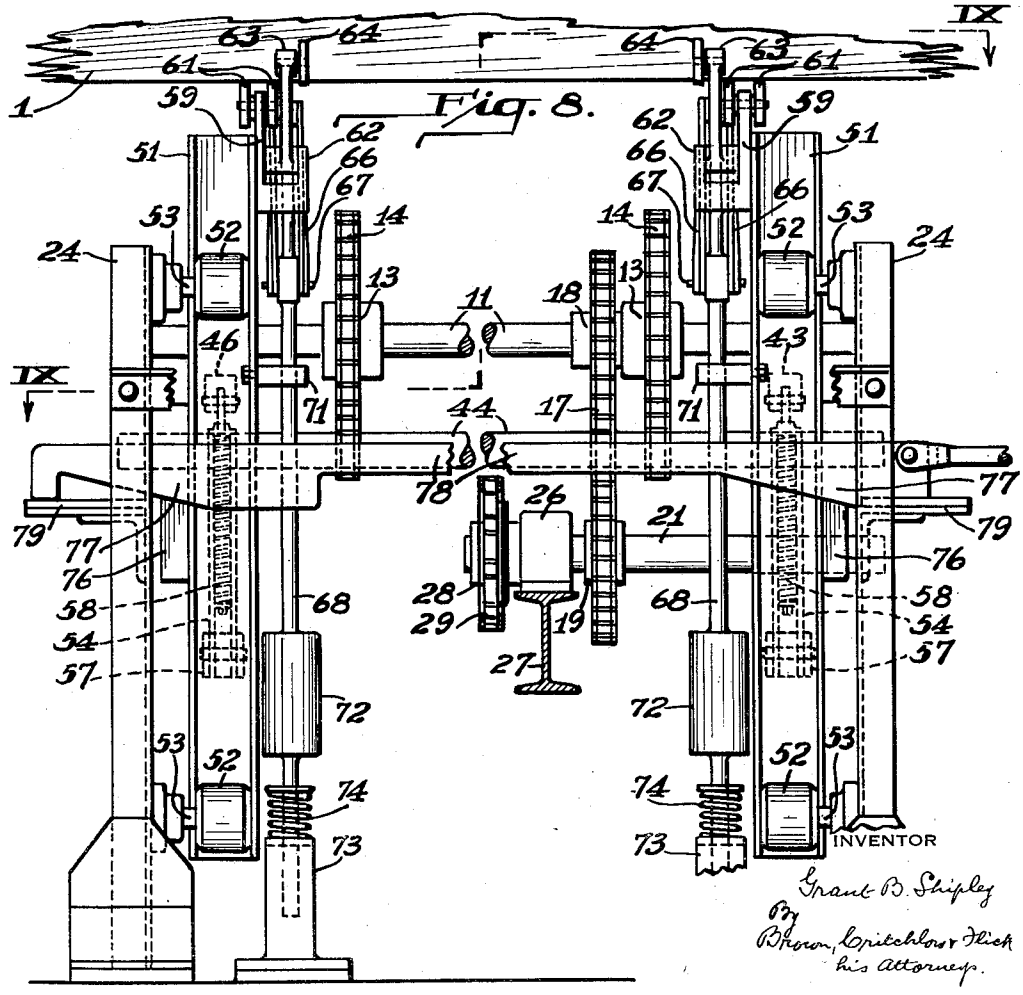

Fig. 8.

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ADZING AND BORING MACHINE

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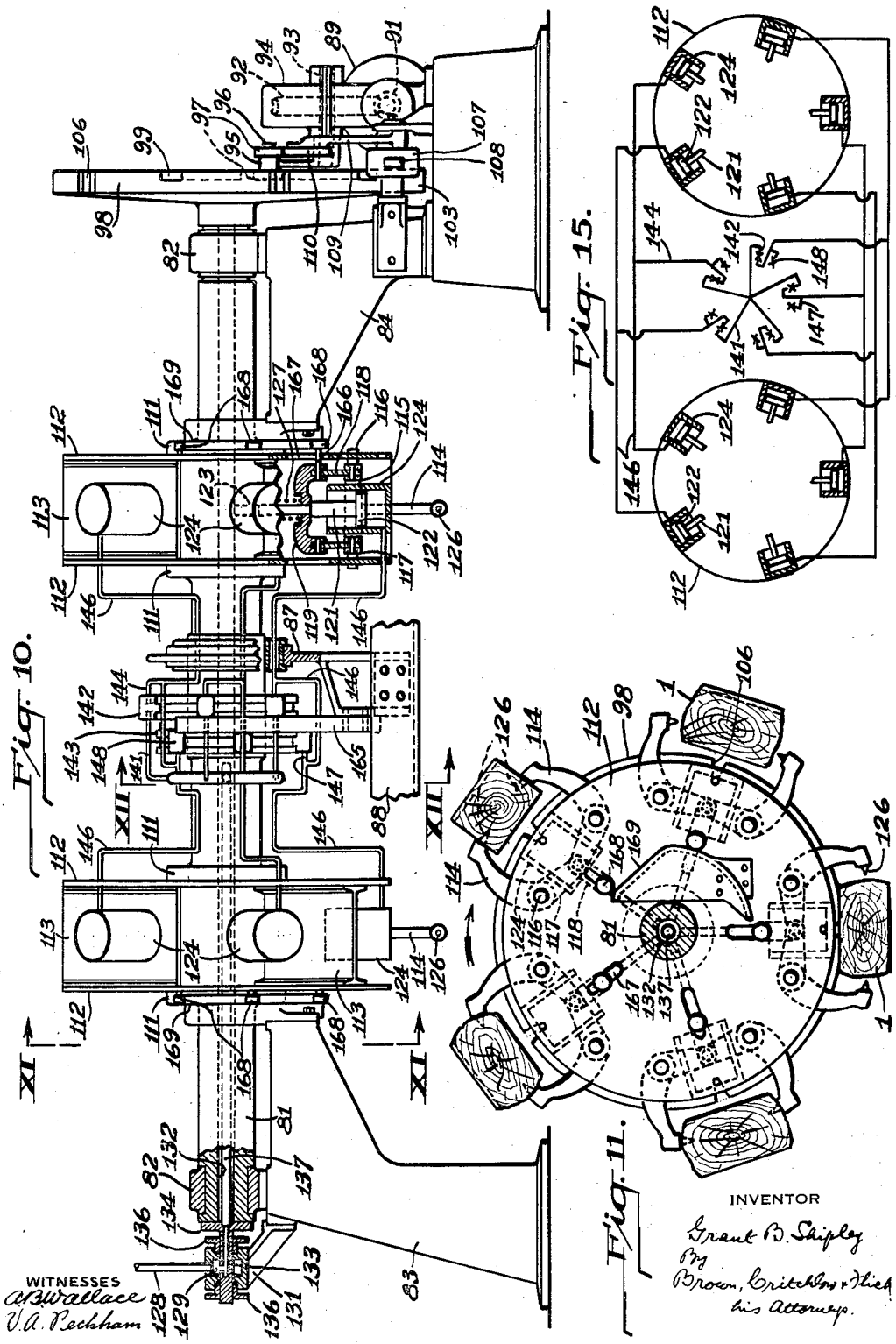

Fig. 10.

Fig. 15.

Fig. 11.

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ADZING AND BORING MACHINE

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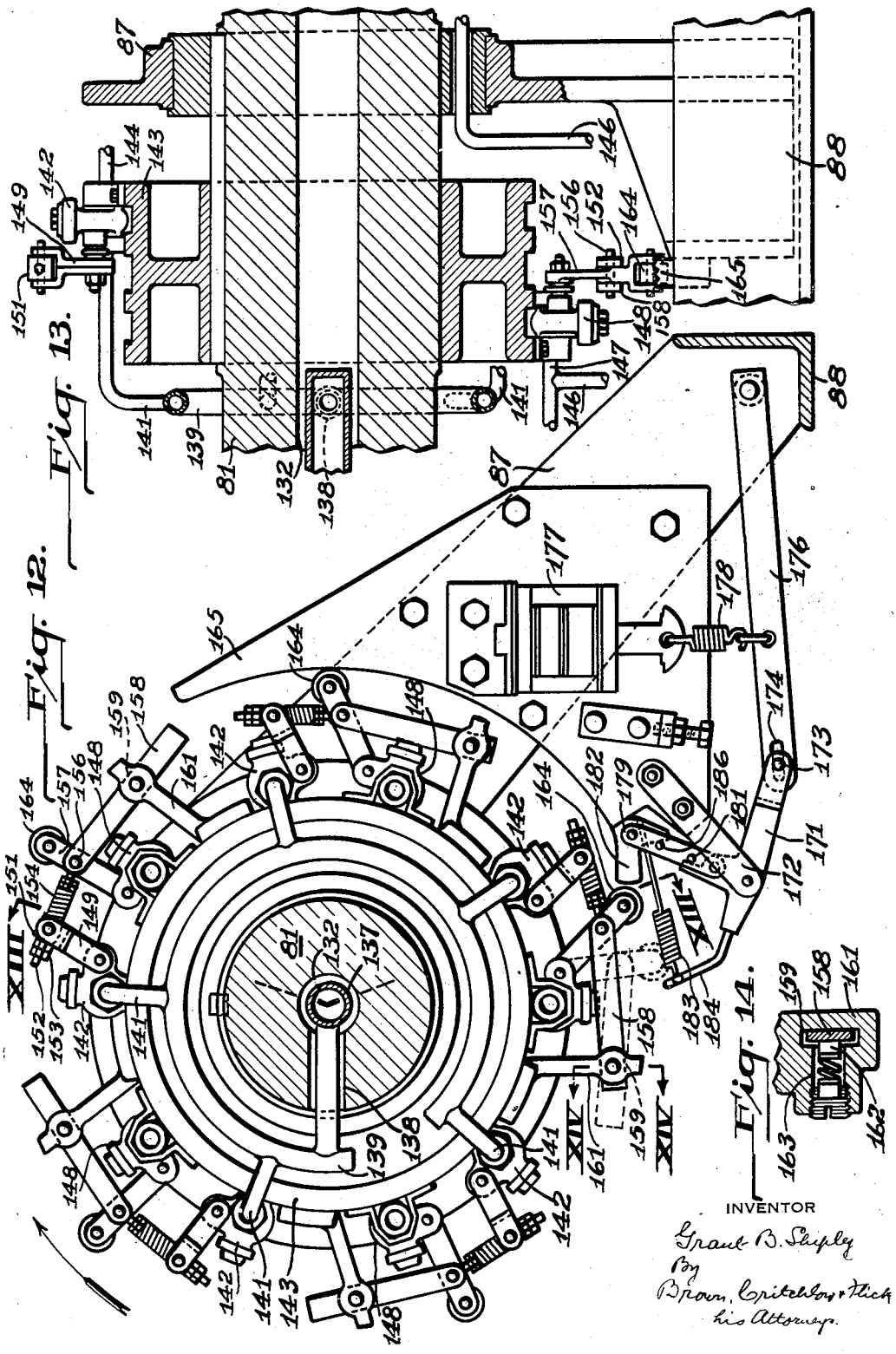

Fig. 12.

Fig. 13.

Fig. 14.

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Patented May 7, 1935 2,000,458

UNITED STATES PATENT OFFICE

2,000,458

ADZING AND BORING MACHINE

Grant B. Shipley, Pittsburgh, Pa., assignor to The Wood Preserving Corporation, Pittsburgh, Pa., a corporation of Delaware

Application May 17, 1934, Serial No. 726,017

10 Claims. (Cl. 144—3)

This invention relates to combined adzing and boring machines for railroad ties and the like.

Tie plates having various numbers of spike holes in different positions are used with railroad ties. In adzing and boring ties for use with tie plates it is, therefore, highly desirable to have a combined adzing and boring machine which is able to provide the ties with spike holes for registering with the holes in any particular type of tie plate that a railroad may specify. In such machines known heretofore it has frequently been necessary to install new boring heads for changes either in position or in number of the holes to be bored. Furthermore, the boring units of these machines are located in inaccessible positions from which it is difficult to adjust them or to remove them for replacement or repair.

It is an object of this invention to provide a combined adzing and boring machine with individual boring heads, each carrying a single drill or bit and each being adjustable in position relative to the other boring heads, whereby holes can be bored in various positions and relations.

Another object is to provide such a machine equipped with a sufficient number of individual heads to bore the maximum number of holes required and which can bore any required number of holes in a tie within this maximum in any position.

A further object is to provide a machine in which the adzing and boring tools are readily accessible for adjustment, replacement and repair.

A still further object is to provide a combined adzing and boring machine which is dependable and efficient in operation.

The preferred embodiment of the invention is illustrated in the accompanying drawings of which Fig. 1 is a plan view with parts broken away; Fig. 2 is a side view taken on the line II—II of Fig. 1; Fig. 3 an end view taken on the line III—III of Fig. 2; Fig. 4 a side view of the rotor-driving means shown in Fig. 1; Fig. 5 an enlarged view with parts broken away of the tie-elevating means shown in Fig. 2; Fig. 6 a longitudinal view of an adzing tool; Fig. 7 a section of the adzing tool taken on line VII—VII of Fig. 6; Fig. 8 an enlarged end view of the elevating means taken on the line VIII—VIII of Fig. 2; Fig. 9 a view taken on the line IX—IX of Fig. 8 with the tie removed; Fig. 10 a longitudinal view of the rotor with parts in section and parts removed; Fig. 11 a view taken on the line XI—XI of Fig. 10; Fig. 12 a view of the clamp-controlling valve assembly taken on the line XII—XII of Fig. 10; Fig. 13 a section through the valve assembly taken on the line XIII—XIII of Fig. 12; Fig. 14 a section taken on the line XIV—XIV of Fig. 12; and Fig. 15 a diagram showing the connections between the clamp-actuating pistons and the valves controlling the supply of fluid under pressure to the pistons.

In explaining the construction and operation of the illustrated embodiment of this combined adzing and boring machine the general structure and operation will first be described briefly, and then the specific construction of the various component parts will be explained in detail.

Referring to Fig. 2 of the drawings, ties **1** are carried in spaced relation by an infeed conveyor **2** to elevating members **3** on which a tie is automatically deposited every time the elevators are lowered. The elevators intermittently raise successive ties to a position between the open jaws of clamping members **4** carried by a rotor or carriage **6** which rotates intermittently, the carriage having five stations during each revolution.

The jaws are automatically closed upon the tie, preferably by pressure fluid mechanism, and the tie carriage then carries the tie a short distance and stops. While the tie is stationary it is adzed by reciprocable rotating adzing tools **7**, after which the carriage carries the tie a short distance further to the first boring station where the tie is bored by reciprocable individually adjustable boring tools **8**. The carriage then carries the tie to the second boring station where it is provided with additional bores if required. Before the clamping members again reach the elevators they release the adzed and bored tie which falls onto a conveyor **9** for removal from the machine.

From the foregoing brief description it is seen that this machine comprises several major parts which cooperate in the adzing and boring of ties fed to the machine. Each of these major parts will now be described in detail in the order in which they become associated with a tie passing through the machine, the order being as follows: infeed conveyor, elevators, carriage, tie clamps, adzing units, boring units, and outfeed conveyor.

Infeed conveyor

As best shown in Figs. 1, 2 and 5, the infeed conveyor includes a pair of horizontally disposed shafts **11** journalled at their ends in op-

posite ends of a suitable framework 12. On the ends of shafts 11 sprockets 13 are rigidly mounted, the sprockets carrying endless chains 14 for transporting railroad ties 1 from one end to the other of the conveyor. The chains are provided at predetermined intervals with outwardly projecting lugs 16 for engaging the sides of ties to properly space them apart and to push them off the rear or inner end of the conveyor.

Referring to Figs. 3, 5 and 8, the conveyor is driven by a chain 17 passing around a sprocket 18 keyed on the inner shaft 11, and a sprocket 19 keyed on a cam shaft 21 below it. The cam shaft is journalled at its outer end in a bearing 22 mounted on an inclined I-beam 23 which is fastened at one end to conveyor framework 12 and at the other end to an upright channel 24. The inner end of the cam shaft is journalled in a bearing 26 mounted on a horizontal I-beam 27 which projects from the inner end of the conveyor framework. The cam shaft is also provided with a sprocket 28 driven by a chain 29 passing around a sprocket 31 keyed on a short shaft 32 which is journalled in pedestal bearings 33 at the rear end of the machine (Figs. 2 and 3). Short shaft 32 is in turn driven by a chain 34 passing around a sprocket 36, keyed on the shaft, and up and over a sprocket 37 mounted on a driving shaft 38 driven by a main power unit 39. This unit, which is mounted on a base 41 at the rear of the machine, comprises an electric motor and speed-reducing gearing.

As shown in Fig. 5, cam shaft 21 is provided adjacent its outer bearing 22 with a cam 42 adapted to periodically lift a rocker arm 43 rigidly mounted on one end of a rocker shaft 44. Another rocker arm 46 (Fig. 9) is rigidly mounted on the opposite end of the shaft, which in turn is pivoted at its ends in bearings 47 attached to the upper ends of the inclined I-beams 23 at opposite sides of the machine. Rocker arm 43 has a roller 48 journalled therein for bearing against cam 42, and, when the arm is oscillated by the cam, rocker arm 46 at the opposite end of the rocker shaft is oscillated in unison therewith. These rocker arms are designed for reciprocating tie elevators 3 vertically, while the infeed conveyor is in motion, in order to raise successive ties from the conveyor to tie clamps 4.

Elevators

Referring to Figs. 5, 8 and 9, each elevator includes an upright I-beam 51 reciprocable vertically between upper and lower pairs of rollers 52 bearing against its web between its flanges and journalled on pins 53 projecting inwardly from the web of upright channel 24 at the side of the machine. The upright I-beam is connected to the free end of the adjacent rocker arm by a generally U-shape strap 54 and an eye bolt 56 extending through an opening in the closed upper end of the strap. The open lower end of the strap is pivoted on a bracket 57 attached to the I-beam, and the upper end of the eye bolt is pivoted on the free end of the rocker arm. A coil spring 58, disposed on the eye bolt, is confined between the top of the strap and a nut on the lower end of the bolt, the spring permitting relative movement between the rocker arm and I-beam 51 when the latter is restricted in its upward movement in a manner to be described later.

To the upper end of the inner flange of each upright I-beam 51 is attached a plate 59 substantially as wide as the widest of railroad ties. A plurality of tie-supporting rollers 61 are pivoted on opposite sides of this plate, above which they project a short distance for carrying a tie as it is pushed thereon from the infeed conveyor by lugs 16 when the elevators are in lowered position.

Because ties of various widths are conveyed to the elevators, it is desirable that means be provided for centering ties thereon regardless of their widths. Accordingly, each plate 59 is provided at both ends with inwardly and upwardly projecting brackets 62, between which and the plate there are pivoted bell cranks 63 (Fig. 5). The long arms of the cranks extend beyond the ends of the plate and have small rollers 64 journalled in their ends, while the short arms are pivotally connected by links 66 to a pin 67 (Fig. 8) extending through a vertical rod 68 which is slidable axially in a collar 69 projecting from the inner face of plate 59 and also in a similar collar 71 mounted on the inner flange of I-beam 51. When the elevators are in their lower position, the upper surface of rollers 64 is substantially in line with the tops of rollers 61, as shown in dotted lines in Fig. 5, so that movement of a tie from the infeed conveyor onto the elevators is not obstructed.

The lower portion of rod 68 is provided with a counterweight 72 for delaying upward movement of the rod until rollers 64 have been swung into contact with the sides of a tie by the outer ends of the bell cranks whose inner ends are restrained by links 66 and the counterweighted rod from moving upward. When rollers 64 are moved toward each other they center the tie on the plate, and when they can move no further links 66 raise rod 68 with them. The lower end of the rod slides in an opening in a guide bracket 73 secured to the machine foundation, and a pair of coil springs 74 are mounted on this bracket for breaking the fall of counterweight 72 when cam 42 moves away from rocker arm roller 48 and lets the arm drop.

To vary the distance that ties project beyond tie clamps 4 so that the depth to which the ties may be adzed can be varied, the height to which the elevators can be raised is made adjustable. This is done by means of stops 76 attached to the outer flanges of I-beams 51 and whose upward movement is limited by wedge-shaped portions 77 of a horizontal bar 78. This bar is slidable through slots in upright channels 24, and rests at its ends on brackets 79 connected to the outer faces of these channels. As appears from Fig. 8, if the wedge bar is moved to the right the elevators will be permitted to rise farther than if it were moved to the left.

Tie carriage

As previously stated, each elevated tie is gripped by the jaws of a set of clamping members 4 mounted on a carriage 6 which ceases rotation at predetermined intervals to hold the ties stationary so that they can be worked upon. Referring to Figs. 1 and 10, the carriage includes a horizontal shaft 81 extending the full width of the machine and journalled at its ends in bearings 82 mounted on the outer ends of pedestals 83 and 84.

The intermittent rotation of shaft 81 is imparted to it by a driving unit operating in the manner of a Geneva wheel and mounted on an extension of the base of pedestal 84. As best

shown in Figs. 4 and 10, this driving unit includes an electric motor 89 whose extended shaft is provided with a worm gear 91 meshing with a gear 92 keyed on a horizontal shaft 93 journalled in a gear housing 94. A crank 95 is mounted on the inner end of gear shaft 93 and is provided at its outer end with a transverse pin 96 rigidly mounted in the crank and projecting therethrough. A small roller 97 is mounted on each end of the pin.

Keyed on the end of shaft 81 adjacent pin 96 is a wheel 98 provided on its outer face with a plurality of uniformly spaced radial grooves 99, each formed by a pair of parallel integral ribs 101 which extend from the periphery of the wheel to a predetermined distance from its center. It will be seen in Fig. 4 that as crank 95 slowly revolves to the left the inner roller 97 will enter the inner end of a groove 99 and engage the right-hand rib defining that groove, whereby the wheel will be rotated until the groove is swung to the right of gear housing 94 where the roller will leave the inner end of the groove.

To hold the wheel absolutely stationary while the inner roller is passing from a right-hand groove over to the next succeeding groove at the left, a latching device is provided comprising a three-arm lever 102 pivotally mounted on the extended base of pedestal 84 opposite motor 89. Inner arm 103 of this lever extends under wheel 98 and is provided at its inner end with an upwardly extending lug 104 which is adapted to project into notches 106 formed in the periphery of the wheel midway between grooves 99. Lug 104 is normally biased toward the wheel by means of a counterewight 107 mounted on the outer end of the lever's outer arm 108 projecting substantially horizontally from the pedestal.

To unlock the wheel when inner roller 97 is about to engage a rib 101, the inner end of upwardly projecting lever arm 109 is provided with a cam 110 offset toward the wheel. As inner roller 97 approaches a rib 101 the outer roller 97 engages this cam and depresses arm 109 until at substantially the instant the inner roller engages the rib the latch lug 104 is swung clear of notch 106 so that the wheel is free to turn. The outer roller then passes under the cam as crank 95 turns in a counterclockwise direction, and lug 104 bears against the peripherey of the rotating wheel until the next notch reaches the lug. Counterweighted arm 108 forces the lug up into the moving notch, whereupon the wheel is again stopped and locked while the inner roller travels from its groove to the next succeeding groove at the left.

It is during the periods that the carriage shaft is held stationary by the latching mechanism just described that the adzing and boring tools operate on ties carried by clamps 4. The number of grooves and notches in wheel 98 determines the number of times the shaft 81 will be stopped and started during one complete revolution. Therefore, if it is desired that each tie clamp have five stations during each revolution, the wheel is provided with five grooves and five notches.

Adjacent the inner end of each pedestal 83 and 84 the shaft 81 is provided with a pair of circular flanges 111. Circular plates 112 are secured to the inner faces of the flanges of each pair. Each pair of plates is reinforced by a plurality of I-beams 113 disposed between them radially thereof. The two drums thus formed carry the clamping members 4 for simultaneously gripping the opposite ends of ties which are raised to them by the elevators.

Tie clamps

The clamping members are shown in Figs. 2, 10, 11, all but one of them in Fig. 10 being shown incompletely and somewhat diagrammatically. There are five clamps associated with each drum in such position that each tie is simultaneously gripped by one clamp of each drum. Each jaw 114 of the clamps is integral with the central portion of a hollow transverse shaft 115, into the ends of which project pivot pins 116 secured in the circular plates 112 of a clamp-carrying drum. At each end of shaft 115 an arm 117 projects at substantially right angles to jaw 14, whereby the element resembles and functions like a bell crank. Arms 117 of each clamp are disposed adjacent opposite sides of the drum and are pivotally connected by links 118 to the ends of a yoke 119 extending transversely of the drum. The yoke is carried by a piston rod 121 having a piston 122 at its outer end and slidably disposed at its inner end in a radial bore 123 in shaft 81. The piston is reciprocable in a cylinder 124 connected to the side plates of the drum by suitable brackets or the like, not shown.

It will be understood of this construction that when the piston is forced toward the rotor shaft the yoke 119 is carried along with it, whereby arms 117 are drawn toward the carriage shaft and the outer ends of jaws 114 are swung toward each other. The ends of the jaws are provided with pointed dogs 126 for penetrating and securely holding ties. The piston rod is encircled by a coil spring 127 between yoke 119 and the carriage shaft to prevent the yoke from striking the shaft if the piston is actuated with no tie between the jaws.

The pistons of all the tie clamps are forced toward shaft 81 by means of fluid under pressure, such as air, introduced to cylinders 124 preferably in the following manner. A suitable source of fluid under pressure is connected by a conduit 128 to a chamber 129 in a casting 131 mounted on the outer end of pedestal 83. The casting is also provided with an axial bore in line with a similar bore 132 in the carriage shaft. Extending through the casting's bore is a tubular member 133 closed at its outer end and having an integral circular flange 134 at its inner end which is bolted to the end face of the carriage shaft so that the tube will rotate with the shaft. The portion of this tubular member within chamber 129 is perforated to permit the pressure fluid to enter the member, while fluid is prevented from escaping from the chamber around the tubular member by packings 136 encircling it at both ends of the casting.

The inner end of tubular member 133 is joined to one end of a tube 137 which extends through bore 132 to a point between the two clamp-carrying drums, where it emerges from the shaft through a radial bore 138, as shown in Fig. 12. This end of the tube is joined to a closed-end tube 139 that substantially encircles shaft 81, from which tube a plurality of short pipes 141 lead to inlet valves 142 mounted on a collar 143 keyed on the carriage shaft (Figs. 10, 12 and 13), there being one inlet valve for each cooperating pair of tie clamps. From the opposite side of each inlet valve a branch pipe 144 leads to a pipe 146 that connects a co-

operating pair of tie clamps carried by the two drums. From each pipe 146 another branch pipe 147 leads to an exhaust valve 148 also mounted on collar 143 in staggered relation to the inlet valves, whereby when the inlet valves are closed and the exhaust valves opened, pressure fluid in cylinders 124 is allowed to escape to the atmosphere. A diagram of this piping arrangement is shown in Fig. 15.

The manner in which these valves are operated for controlling the supply of pressure fluid to cylinders 124 is shown in Figs. 12, 13 and 14. Connected to each inlet valve is a lever 149, in the bifurcated outer end of which there is pivotally mounted a block 151 having a through bore, slidably disposed in which is an eye bolt 152 having lock nuts 153 threaded on its end and a coil spring 154 encircling its shank between the block and its eye. A pin 156 extends through the eye of the bolt and also through a lever 157 and one end of a bar 158. This lever is operatively connected to the exhaust valve in front of the inlet valve, and bar 158 is slidably disposed in a slot 159 (Fig. 14) through the end of an arm 161 projecting rigidly from collar 143 in front of the exhaust valve. The bar is normally held against movement in the arm by a spring-biased plunger 162 disposed in a transverse bore 163 in the arm and bearing against one side of the bar.

The outer end of exhaust lever 157 is bifurcated and provided with a small roller 164. When this roller encounters an obstruction as shaft 81 revolves, the exhaust lever is thrown backward, which opens the exhaust valve, and which, by means of eye bolt 152 and its encircling spring, simultaneously forces inlet lever 149 backward to close the inlet valve. Coil spring 154 allows relative movement between the two valve levers to assure that the inlet valve will be tightly closed without danger of damaging any of the parts. The backwardly swung exhaust lever also pulls bar 158 rearward through rigid arm 161, the forces being sufficient to slide the bar across plunger 162.

The valves are operated in this manner by means of a vertically disposed cam 165 secured to a bracket 87 in the path of the exhaust lever rollers and having an arcuate concave face down which the rollers roll. The cam is positioned to be struck by a roller 164, in order to close an inlet valve and open an exhaust valve, after a tie carried by the tie clamps controlled by those valves has been completely adzed and bored, and the cam face is of such length that roller 164 rolls off its lower end before those tie clamps again stop at the tie-receiving station above the elevators.

For opening the jaws of a set of tie clamps as soon as an exhaust valve is opened, the outer pins 166 connecting piston yokes 119 to links 118 are extended through radial slots 167 in the outer circular drum plates 112 (Fig. 10). Rollers 168 are journalled on the outer ends of these pins where they strike and roll on cams 169 attached to the inner ends of pedestals 83 and 84. The cams are shaped to force these rollers and, through them, the piston yokes radially outward to open clamping jaws 114 and release a tie gripped thereby, and the cams are so positioned as to do this as soon as the exhaust valve related to those jaws is opened, that is, at the tie-discharging station of the carriage.

The mechanism for again closing an exhaust valve and opening an inlet valve, in order to close a set of jaws 114 on a tie supported in raised position by the elevators, is also shown in Fig. 12. It includes a bell crank 171 pivoted on a bracket 172 attached to the lower end of cam 165. The long arm of the crank has a pin 173 in its end, slidable in a slot 174 in a lever 176, which lever is pivoted at its opposite end on a lateral extension of bracket 87. A solenoid 177 is mounted on the side of cam 165, the core of the solenoid being connected through a coil spring 178 to lever 176 for raising it and rocking the bell crank when the solenoid is energized.

Pivoted to the short arm of bell crank 171 is a lever 179 provided with a stud 181 for limiting its forward movement relative to the crank. On the upper end of this lever a pawl 182 is mounted for striking a roller 164 when the bell crank is actuated by the solenoid, the impact moving the adjoining bar 158 in the slot in a cooperating rigid arm 161, and simultaneously closing the associated exhaust valve and opening the associated inlet valve. In order for the pawl to drive the exhaust lever forward it must strike roller 164 from the rear, but in such position the pawl would tend to block the path of the next succeeding roller. Therefore, the pawl is pivoted on lever 179 so that it can be swung down and out of the way by a roller passing over it. To return the pawl to its normal position after a roller has passed over it, a coil spring 183 connects its lower arm to a rod 184 extending forward and obliquely upward from bell crank 171. Forward movement of the lower arm of the pawl is limited by a stud 186 projecting laterally from lever 179.

A timing device 187, actuated by driving shaft 38 and supported on a bracket 188 attached to the end of base 41, controls the energizing of the solenoid and also the timing of operation of carriage-rotating motor 89 in such a manner as to assure that the carriage stops turning just before the elevators raise a tie to position between the open jaws of a set of clamps 4, and that the solenoid is energized directly after the tie is so positioned. Consequently, when the clamping jaws directly above the elevators are forced together, there is a tie between them for them to grip.

Adzing units

As viewed in Fig. 2, the carriage assembly revolves in a clockwise direction and includes five pair or sets of tie clamps, five clamps being carried by each drum. The machine is provided with means for adzing each successive tie during the interval it is held stationary for the first time after it has been carried away from the elevators by a set of these tie clamps. Accordingly, an adzing unit is disposed at each side of the machine near said first station of the ties. Each unit includes a stand 192 mounted on the machine's foundation with its front face disposed in an inclined plane parallel to the opposing face of a tie held motionless in front of it by a set of tie clamps.

Reciprocable lengthwise of this inclined face of the stand is a slide 193 provided with rollers 194 bearing against the stand. The slide is also equipped with rollers 195 journalled at right angles to rollers 194 for engaging the outer sides of a track 197 mounted on the inclined face of the stand, which track guides the slide in a straight line and is provided with flanges 198 which project outward over rollers 194 to hold the slide on the stand.

The sides of the slide are equipped with bearings 199 in which a horizontal adzing shaft 200 is journalled (Figs. 6 and 7). Between the bearings the adzing shaft is provided with a plurality of knives 201 arranged in pairs with the knives of each pair parallel to each other on opposite sides of the shaft to which they are clamped by cooperating blocks 202 bolted together, the pairs of knives being alternately disposed at right angles to each other. On the outer end of the adzing shaft there is keyed a pulley 203 which is rotated by a belt drive 204 driven by a motor 206 disposed at the rear of the machine. The belts are held taut, regardless of the position of slide 193 on stand 192, by a tensioning device comprising a bell crank 207 pivoted in a bracket 208 behind the belt. The long arm of this crank is provided with a roller 209 which is constantly pressed against the belts to take up slack by a coil spring 210 compressed between the rear face of bracket 208 and the outer end of a bolt 211 whose inner end extends into the bracket where it is pivotally connected to the short arm of the bell crank.

For reciprocating slides 193 to carry the rotating adzing knives through a tie adjacent its ends, a horizontal shaft 212 is journalled at both ends in the stands 192, and a gear segment 213 is keyed on this shaft inside each stand with its toothed portion projecting through a slot in the inclined face thereof. The teeth of each segment register with the teeth of a gear rack 214 mounted on the under side of the adjoining slide so that when the segment is oscillated the slide is reciprocated on its stand. The weight of the slide and adzing tool is balanced by a counterweight 215 mounted on an arm 216 extending rearwardly from the gear segment.

The movement of segment-carrying shaft 212 is controlled by a pair of cams, 217 and 218, mounted on shaft 38 of power unit 39 and engaged by arms 219 and 220, respectively, of a three-arm bell crank journalled on a horizontal shaft 221 in a cam box 222. The third arm 223 of the crank is connected by a link 224 to a lever 225 rigidly connected to shaft 212. When cam 217 presses down on arm 219 the third arm 223 of the crank is raised, which causes the gear segments on shaft 212 to likewise rise and draw the slides and adzing tools to the upper ends of their supporting stands. Following this, cam 218 presses upward against arm 220 which reverses the movement of the connected members and forces the slides down their inclined tracks. The downwardly moving slides carry the adzing tools through a tie held in rigid position adjacent thereto by the carriage assembly.

Boring units

After a tie has been adzed, the carriage-driving unit at the side of the machine again turns the carriage to carry the next succeeding tie from the elevators to the adzing station. Simultaneously, the adzed tie is moved by the carriage to its next station where it is provided with spike-receiving holes through its adzed portions by means of a pair of boring units. Each unit includes a stand 231 disposed above the adzing units on a plate 232 extending substantially the full width of the machine on top of the main framework. The stand has an inclined front face perpendicular to the adzed surface of the tie rigidly disposed near its lower end, and an outwardly flanged track 233, similar to the adzing unit tracks, mounted on its inclined face.

A reciprocable slide 234, of the same general construction as the adzing unit slides, is mounted on stand 231 where it is reciprocated by a gear segment 236 meshing with a gear rack 237 on the under side of the slide. The gear segments for both boring units are keyed on a shaft 238 journalled in stands 231 and in a pedestal 239 mounted on plate 232 between them. This shaft is oscillated by a lever 241 whose central portion is keyed thereon and one end of which is connected by a link 242 to the longest arm of a three-arm bell crank 243 journalled on shaft 221 in cam box 222. The remaining two arms of the crank engage a pair of cams 244 carried by the shaft of power unit 39, the rotation of the cams causing the long arm of the crank to swing back and forth in the same manner as the long arm of the bell crank connected to the adzing units, and thereby oscillating segment-carrying shaft 238 on its axis.

Each boring unit slide 234 carries a bracket 246 having its base parallel to the adzed tie with a plurality of transverse slots 247 through the base. As shown in the drawings, the upper ends of a pair of cylindrical boring heads 248 are adjustably connected to each bracket by T-bolts passing through some of the slots 247 with their heads disposed in T-slots in the boring heads; however, brackets 246 are generally large enough to permit connecting as many as four boring heads to each bracket. Each boring head contains a motor which drives a spindle 249 projecting from the lower end of the head and in which a bit 251 is removably secured. The bit is steadied and guided by an elongate bite guide 252 through one end of which it extends. The opposite end of the bit guide is provided with a longitudinal slot at right angles to transverse slots in the lower end of a stand 231 to which the guide is connected by bolts extending through the slots (not shown).

With the boring heads connected to the brackets and the bit guides connected to the stands in the described manner, and with each boring head carrying only one bit, each bit is independently adjustable longitudinally and transversely of the adzed tie about to be bored so as to permit holes to be bored therein in various positions relative to the tie and to one another to conform with the requirements of different types of tie plates. Consequently, it is unnecessary to substitute a different boring head when a change in the position of the bores is specified, as was necessary many times heretofore, thereby providing a saving in time and equipment. The weight of the slides with their boring tools is balanced by counterweights 253 mounted on arms 254 projecting rearwardly from gear segments 236.

The necessary diameter of the boring heads limits to substantially four the number of bits that can be simultaneously disposed within the area in which the spike holes must be bored at each end of a tie. For the same reason these bits can not always be disposed as close together as the holes are required to be. To overcome these limitations in number and spacing of spike holes, a second pair of boring units is mounted on a top plate 256 at the front of the machine. These units are the same in construction and operation as the previously described boring units, except that they face in the opposite direction, so they will not be described in detail. The two pairs of units are connected

to each other at their tops by combined compression and tension members 261.

The gear-segment-carrying shaft 257 of the front pair of boring units is oscillated in unison with, but in a direction opposite to, segment-carrying shaft 238 of the rear pair of boring units. This is accomplished by means of a link 258 connecting the end of lever 241, opposite that to which link 242 is connected, to one end of a lever 259 rigidly connected to shaft 257. Thus the boring tools of the two pairs of units are reciprocated relative to the tie carriage in unison, but the forward boring tools act on a tie that has already been bored by the tools at the other end of the machine while the latter are boring a tie that has just been adzed and the adzing tools are adzing a tie carried to them from the elevators. The forward group of boring tools are adjusted on their brackets for boring holes as close to the first-bored set of holes as desired, thereby providing the tie with holes which it may have been impossible for the rear group of tools alone to bore. Of course, if less than the maximum number of holes are desired in a tie, a sufficient number of bits can be disconnected from their boring heads to leave only the required amount.

Outfeed conveyor

As the carriage moves a tie from the second boring station, the valves associated with the tie clamps carrying that tie are manipulated by cam 165 as previously described to release fluid pressure from the cylinders connected to those valves, and rollers 168 engage cams 169 and spread the clamping jaws apart. This releases the completely adzed and bored tie held by that particular set of jaws and the tie slides down inclined skids 262, attached at their lower ends to angle iron 88, and onto outfeed conveyor 9. This conveyor is composed of rollers 263 journalled at their ends in bearings attached to an angle iron 88 and a similar angle iron 264 attached to the framework parallel to the first angle iron.

Operation

To more clearly illustrate the operation of this adzing and boring machine and the automatic cooperation of its parts, the passage of a tie through the machine will now be traced.

A tie is placed on the endless infeed conveyor 2 and against the inner ends of a pair of lugs 16 which are so disposed relative to the vertical positions of elevators 3 as to reach the elevators when they are in their lowest positions. The movements of the infeed conveyor and elevators are coordinated because they are both operated through sprocket chains 29 and 34 operatively connecting power unit 39 at the rear of the machine to cam shaft 21 which drives the conveyor and reciprocates the elevators. After lugs 16 have pushed the tie onto the elevators the latter are raised by rocker arms 43 and 46 which are oscillated by cam 42 on cam shaft 21. The height to which the elevators can rise is limited by wedge-shaped portions 77 on bar 78 which is moved to the right or left, depending on the depth to which the tie is to be adzed.

The tie is raised to a position directly between the open jaws of two tie clamps 4, one clamp being disposed near each end of the tie. A pair of tie clamps is brought to rest above the elevators every time the elevators approach tie carriage 6 because motor 89, which drives the mechanism that intermittently rotates the carriage, is connected to timer 187 operated by power unit 39, the timer coordinating the operation of the carriage-rotating mechanism with that of the elevators to secure the above result. Furthermore, the tie clamp jaws at the tie-receiving station are open for receiving an elevated tie because the inlet valve 142, which admits fluid under pressure to the cylinders 124 associated with those jaws, has been closed just previously by cam 165, the exhaust valve 148 in the same pressure line has been opened simultaneously by the same means, and the jaws have been opened by rollers 168 engaging cams 169.

After the tie has been disposed between the open clamping jaws, timer 187 initiates the energizing of solenoid 177, whereby the open exhaust valve 148 is kicked shut by bell crank 171. The closing movement of the exhaust valve opens the associated inlet valve, and fluid under pressure is again admitted to cylinders 124 for closing the jaws on the tie. By this time cam 42 begins to move away from the rocker arms, which permits the elevators to lower to pick up the next tie from the infeed conveyor, and the tie carriage is turned by motor 89 and wheel 98 to the adzing station.

After the arrival of the tie at the adzing station, cam 216, turned by power unit 39, raises arm 220 which, through link 224 and gear segments 213, forces adzing slides 193 down their inclined tracks 197. As these slides move downward, the adzing knives 201 carried thereby and continuously rotated by motors 206, cut transversely through the outer face of the tie which is thereby adzed near each end. The adzing slides are then returned to their upper positions by cam 217, and the tie carriage carries the adzed tie to the next station which is the first boring station.

While the tie is held stationary in this position, boring slides 234 are reciprocated on their inclined tracks 233 by gear segments 235 which are connected through links 242 to cams 244 mounted on the driving shaft of power unit 39. On their downward stroke the boring tools 8, carried by slides 234, provide each end of the tie with one or two bores, as desired. Before the machine is set in operation the boring heads 248 are adjusted on their brackets 246 to provide the desired spacing and positioning of the spike holes to be bored in the tie by bits 251. Simultaneously with the boring of this tie the next succeeding tie is being adzed. The bored tie is then carried by the carriage to the second boring station where the tie is provided with additional bores in the desired positions, this second set of boring tools being operated in unison with the first set by means of link 258 which connects rocker shafts 238 and 257.

When the adzed and bored tie is moved away from the second boring station by the tie carriage, the valves which control the supply of fluid under pressure to the cylinders associated with the tie clamps engaging that tie, and which are mounted on the center of carriage shaft 81, strike cam 165 whereby they are actuated to permit the clamping jaws to be opened for releasing the tie carried thereby. The released tie falls on outfeed conveyor 9 by which it is removed from the machine.

From the foregoing description it will be understood that the operation of this combined adzing and boring machine is entirely auto-

matic from the moment a tie is placed on the infeed conveyor until it is discharged from the machine by the outfeed conveyor. Power unit 39, at the rear of the machine on base 41, controls either directly or indirectly, the operation of all cooperating parts of the machine. It operates the infeed conveyor and the elevators and, by the cams keyed on its rotor shaft, it reciprocates the adzing and boring tools in proper timed relation to the movements of the tie carriage. Furthermore, through timer 187, power unit 39 coordinates the movements of the elevators and the tie carriage to assure proper feeding of ties to the tie clamps mounted on the carriage, and also the clamping and release of the ties.

It will thus be seen that a combined adzing and boring machine constructed in accordance with this invention is capable of automatically and efficiently handling any work assigned to it, among other reasons because the machine can quickly and readily be adjusted for boring any desired number of holes within a certain maximum in any desired positions in an adzed tie without adding or changing boring heads. Furthermore, the adzing and boring tools of this machine are disposed in positions where they are readily accessible for adjustment, replacement or repair.

According to the provisions of the patent statutes, I have explained the principle and operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A combined adzing and boring machine, comprising a tie carriage rotatable on a horizontal axis and provided with means for gripping ties, elevating means for supplying ties to said gripping means, means for automatically actuating the elevating means in synchronism with the movements of the carriage for supplying ties to the gripping means at regular predetermined intervals, power-actuated adzing and boring tools disposed adjacent the path of movement of said gripped ties and arranged to act successively on each tie, means for successively moving said tools into operating relation with each tie, and means for disengaging the gripping means from each tie after it has been adzed and bored.

2. A combined adzing and boring machine, comprising a tie carriage rotatable on a horizontal axis and provided with means for gripping ties, an endless conveyor for conveying ties into the machine, elevators for raising ties from the inner end of the conveyor to the tie-gripping means, means for automatically actuating the elevating means in synchronism with the movements of the carriage for supplying ties to the gripping means at regular predetermined intervals, and a plurality of tie-spacing lugs connected to the conveyor and so spaced longitudinally thereof as to deposit one tie on the elevators each time the elevators are lowered, a plurality of power-actuated adzing and boring tools arranged to adze and bore ties carried by said carriage, means for moving said tools into operating relation with the ties, and means for discharging adzed and bored ties from the carriage and machine.

3. A combined adzing and boring machine, comprising a tie carriage mounted on a horizontal axis for rotation between a plurality of stations, a plurality of sets of tie clamps mounted on the carriage, fluid pressure actuated means for closing said clamps, a plurality of valves mounted on the carriage for controlling supplying of fluid under pressure to said means, electrically controlled means for operating the valves to cause each successive set of tie clamps to grip a tie at the lowermost station of the carriage, means for supplying ties to said lowermost station, a plurality of adzing and boring tools arranged to adze and bore said ties at succeeding stations of the carriage, means for successively moving said tools into operating relation with each tie, a cam for operating the valves to permit the tie clamps to release adzed and bored ties, and means for discharging ties from the machine.

4. A combined adzing and boring machine, comprising a tie carriage mounted on a horizontal axis for rotation between a plurality of stations, a pair of tie-clamping jaws pivotally mounted on the carriage, a cylinder mounted adjacent said pair of jaws, a piston reciprocable in the cylinder and operably connected to the jaws, a conduit for conducting fluid under pressure to the cylinder to close said jaws, an inlet and an exhaust valve mounted on the carriage for controlling passage of fluid through the conduit, electrically-actuated means for closing the exhaust valve and opening the inlet valve to cause said clamping jaws to grip a tie at the lowermost station of the carriage, a plurality of power-actuated adzing and boring tools adapted to adze and bore ties carried by the clamping jaws, means for successively moving said tools into operating relation with each tie, means disposed in the path of the valves for simultaneously closing the inlet valve and opening the exhaust valve to release pressure from said cylinder, a cam mounted in fixed position adjacent the path of the jaws, and means connected to the jaws and adapted to strike the cam to open said jaws after pressure has been released from the cylinder.

5. A combined adzing and boring machine, comprising a tie carriage mounted on a horizontal axis and rotatable between a plurality of stations, a plurality of sets of tie clamps carried by the carriage in circumferentially spaced relation, vertically reciprocable means disposed beneath the carriage, means for intermittently supplying ties to said reciprocable means in its lower position, means for reciprocating said reciprocable means to raise each successive tie to a position adjacent the lowermost station of the carriage, means for causing each successive set of tie clamps to grip an elevated tie at said lowermost station whereby ties are removed from said reciprocable means by the carriage, power-actuated adzing and boring tools disposed adjacent the path of movement of said gripped ties, means for simultaneously moving said tools into operating relation with successive ties at successive stations of the carriage, means for disengaging each successive set of clamps from its tie after the tie has been adzed and bored, and means for discharging ties from the machine.

6. A combined adzing and boring machine comprising a tie carriage mounted on a horizontal axis and rotatable between a plurality of stations, a plurality of sets of tie clamps carried by the carriage in circumferentially spaced relation, a

conveyor for conveying ties into the machine, elevators for raising successive ties to a position adjacent the lowermost station of the carriage, pressure fluid means for causing each successive set of tie clamps to grip an elevated tie at said lowermost station whereby ties are removed from the elevators by the carriage, power-driven adzing and boring tools disposed adjacent the path of movement of said gripped ties, means for simultaneously moving said tools into operating relation with successive ties at successive stations of the carriage, cam means for disengaging each successive set of clamps from its tie after the tie has been adzed and bored, and means for conveying released ties away from the carriage.

7. A combined adzing and boring machine, comprising a tie carriage rotatable on a horizontal axis, means for rotating the carriage between a plurality of stations, a plurality of sets of tie clamps carried by the carriage in circumferentially spaced relation, means for conveying ties into the machine, elevators for raising successive ties from said conveying means to a position adjacent the lowermost station of the carriage, a motor for actuating said conveying means and elevators, means for causing each successive set of tie clamps to grip an elevated tie at said lowermost station whereby ties are removed from the elevators by the carriage, power-driven adzing and boring tools disposed adjacent the path of movement of said gripped ties, a plurality of cams rotated by said motor, means operatively connecting the cams to said adzing and boring tools for simultaneously moving the tools into operating relation with successive ties at successive stations of the tie carriage, means for disengaging each successive set of tie clamps from its tie after the tie has been adzed and bored, and timing means operated by said motor for synchronizing the intermittent movement of the tie carriage with the movements of the other members operated by the motor.

8. A combined adzing and boring machine, comprising a tie carriage mounted for rotation between a plurality of stations, a plurality of sets of tie clamps mounted on the carriage, fluid pressure actuated means for closing said clamps, a plurality of valves mounted on the carriage for controlling supplying of fluid under pressure to said means, electrically controlled means for operating the valves to cause each successive set of tie clamps to grip a tie at one of the stations of the carriage, means for supplying ties to said tie-gripping station, a plurality of adzing and boring tools arranged to adze and bore said ties at succeeding stations of the carriage, means for successively moving said tools into operating relation with each tie, means for operating the valves to permit the tie clamps to release adzed and bored ties, and means for discharging ties from the machine.

9. A combined adzing and boring machine, comprising a tie carriage mounted for rotation between a plurality of stations, a pair of tie-clamping jaws pivotally mounted on the carriage, a cylinder mounted adjacent said pair of jaws, a piston reciprocally mounted in the cylinder and operably connected to the jaws, a conduit for conducting fluid under pressure to the cylinder to close said jaws, an inlet and an exhaust valve mounted on the carriage for controlling passage of fluid through the conduit, electrically-actuated means for closing the exhaust valve and opening the inlet valve to cause said clamping jaws to grip a tie at one of the stations of the carriage, a plurality of power-actuated adzing and boring tools adapted to adze and bore ties carried by the clamping jaws, means for moving said tools into operating relation with ties carried by the clamping jaws, means disposed in the path of the valves for simultaneously closing the inlet valve and opening the exhaust valve to release pressure from said cylinder, a cam mounted in fixed position adjacent the path of the jaws, and means connected to the jaws and adapted to strike the cam to open said jaws after pressure has been released from the cylinder.

10. An adzing and boring machine, comprising a tie carriage rotatable on a horizontal axis and provided with means for gripping ties, tie-supplying means, mechanical means for elevating said tie-supplying means at predetermined intervals to supply ties to said gripping means, means for selectively limiting the height to which the tie-supplying means can rise, a resilient connection between the tie-supplying means and said mechanical means whereby to permit relative movement between them when the height to which the tie-supplying means can rise is varied, adzing and boring tools disposed adjacent the path of movement of ties carried by said gripping means, means for moving said tools into operating relation with each tie, and means for disengaging the gripping means from each tie after it has been adzed and bored.

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