March 5, 1929. H. ALINDER ET AL 1,704,273

ADZING AND BORING MACHINE

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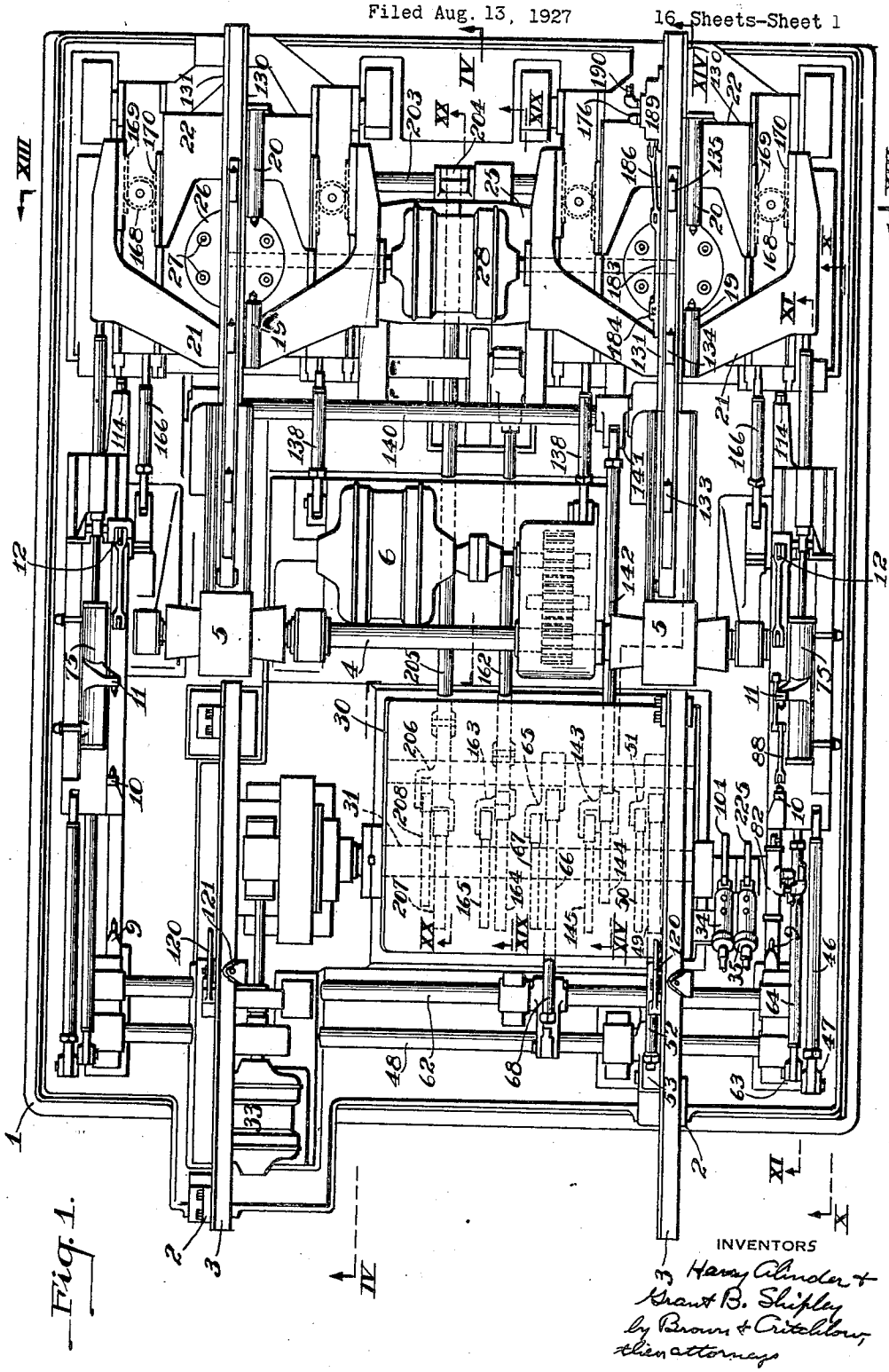


Fig. 1.

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ADZING AND BORING MACHINE

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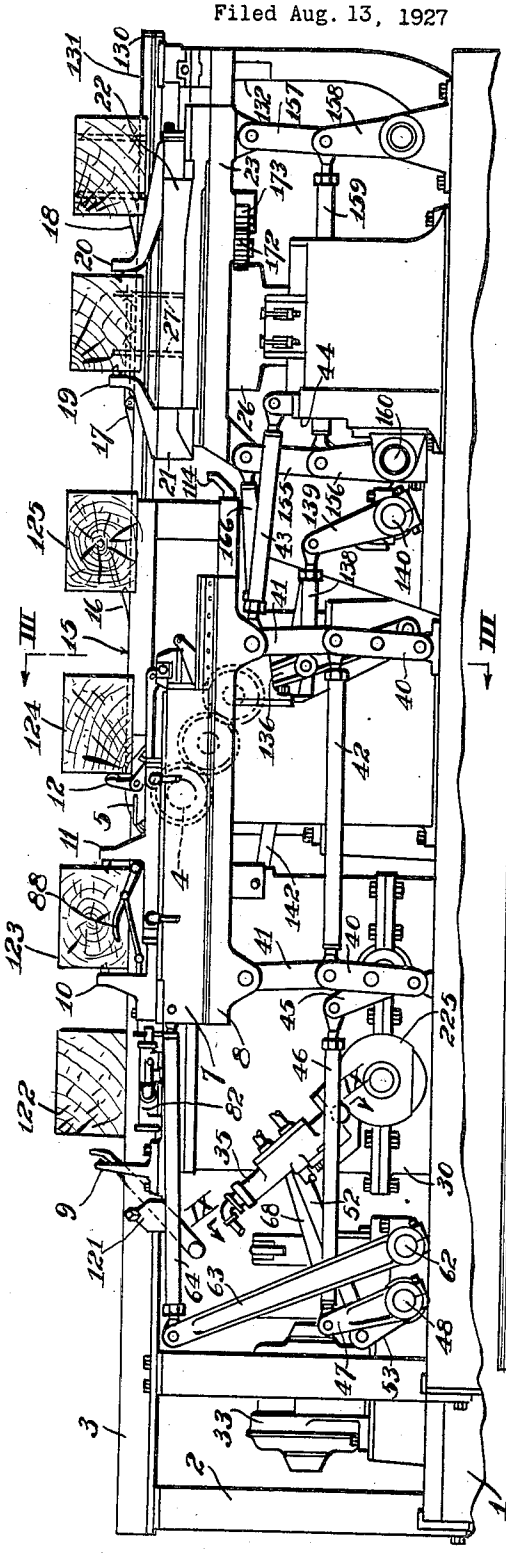


Fig. 2.

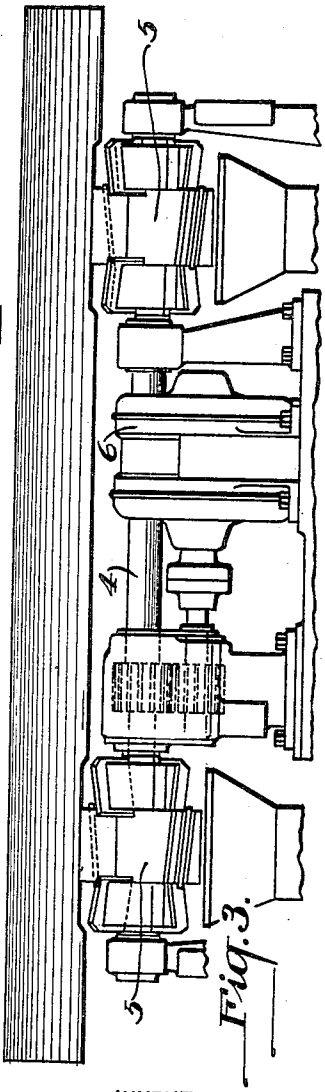


Fig. 3.

WITNESSES

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ADZING AND BORING MACHINE

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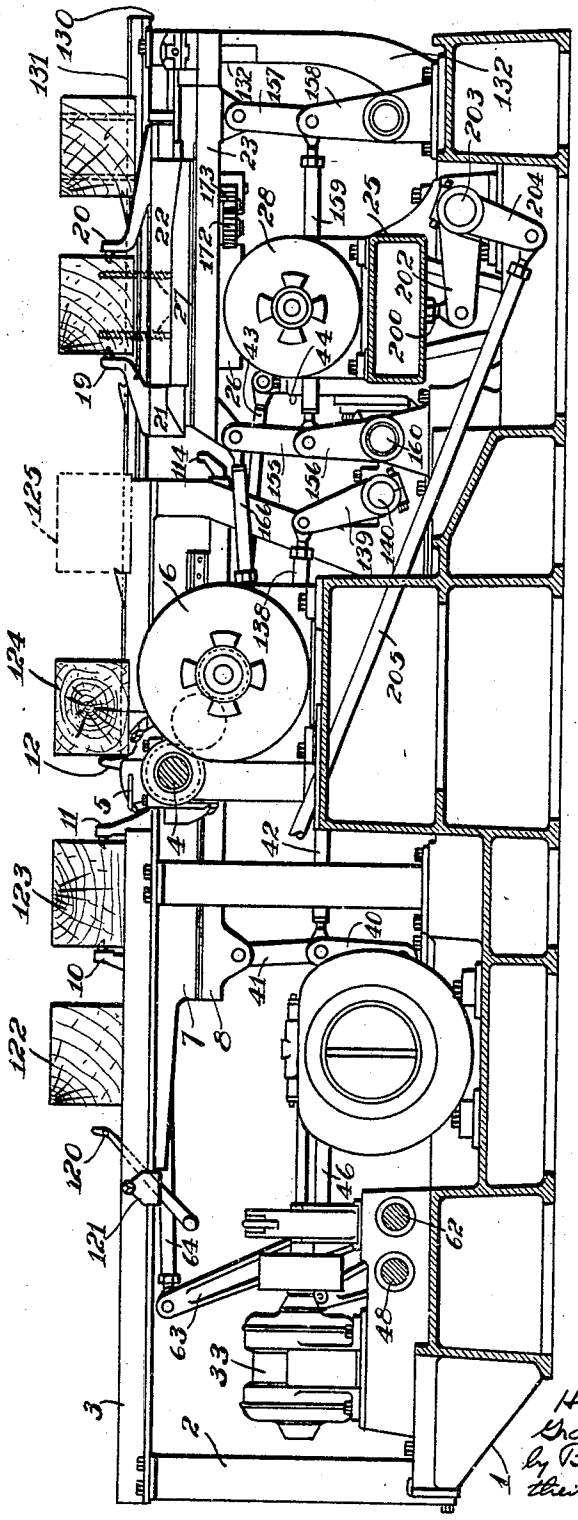


Fig. 4.

WITNESSES

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March 5, 1929. H. ALINDER ET AL 1,704,273

ADZING AND BORING MACHINE

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Fig. 6.

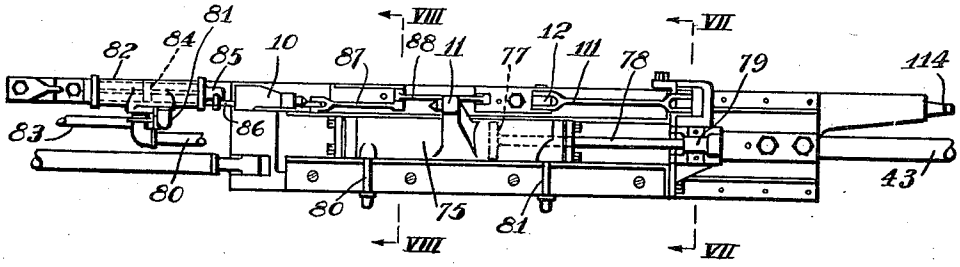
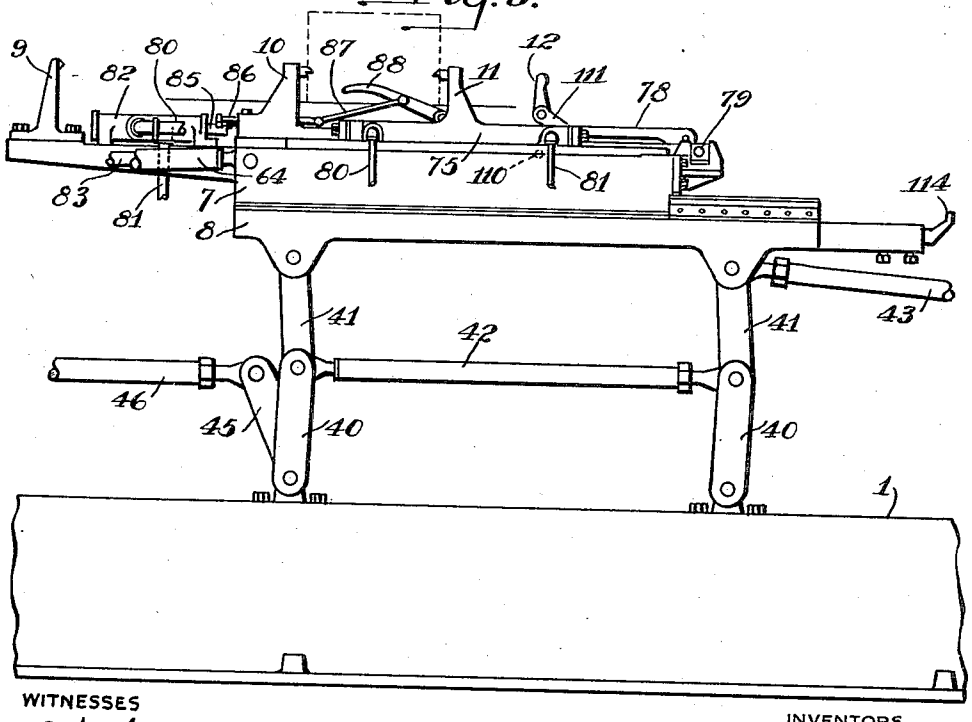


Fig. 5.



WITNESSES

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ADZING AND BORING MACHINE

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Fig. 7.

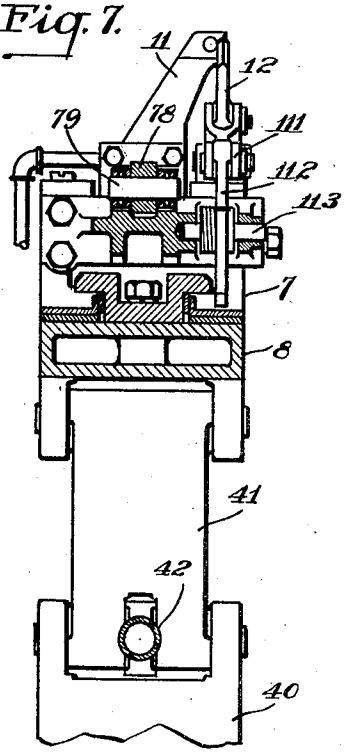


Fig. 8.

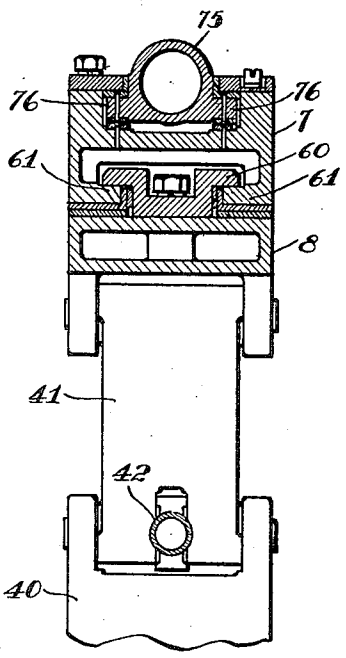
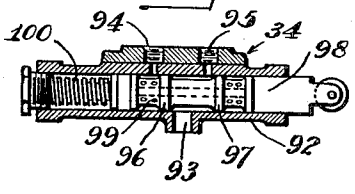


Fig. 9.



WITNESSES

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ADZING AND BORING MACHINE

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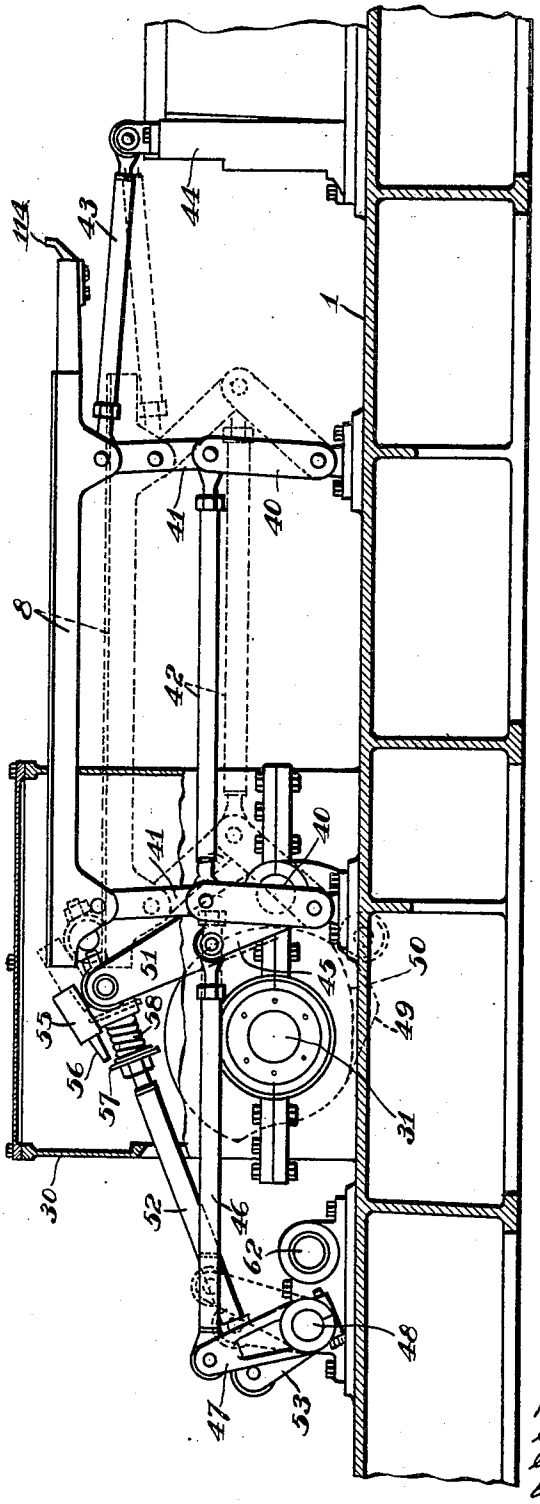


Fig. 10.

WITNESSES

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ADZING AND BORING MACHINE

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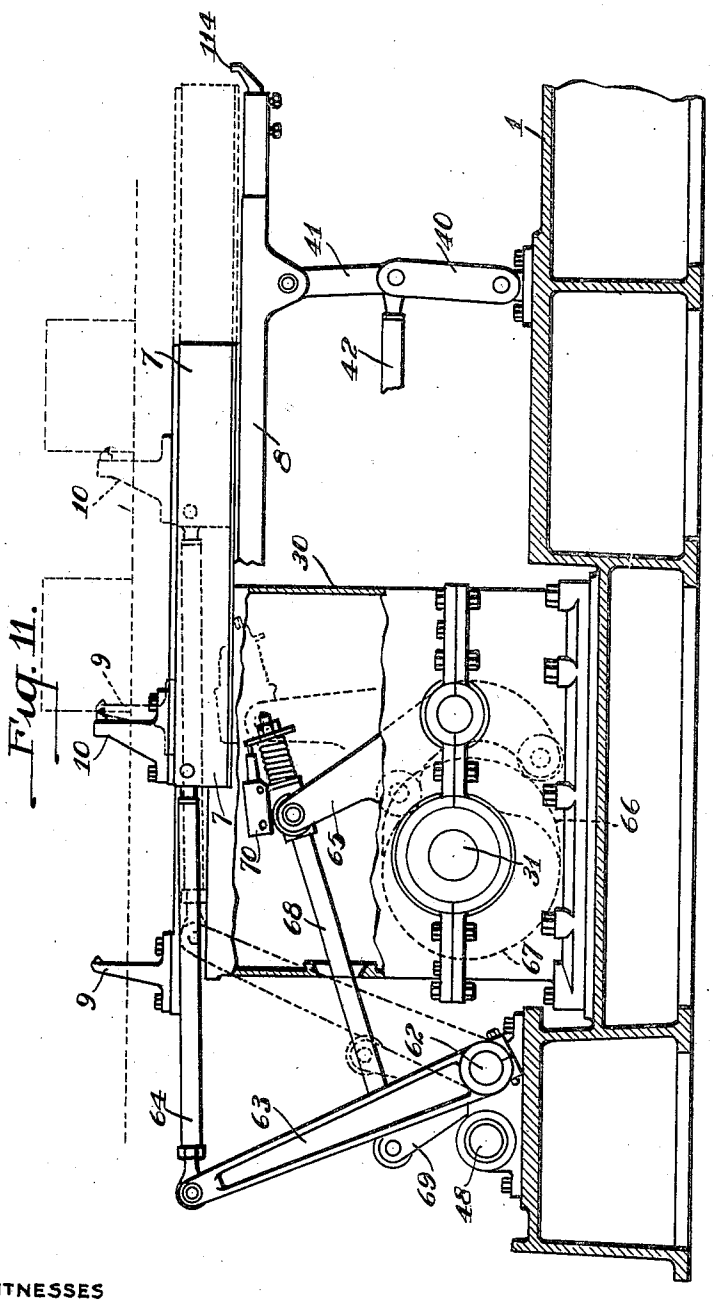


Fig. 11.

WITNESSES

A. B. Wallace.

INVENTORS

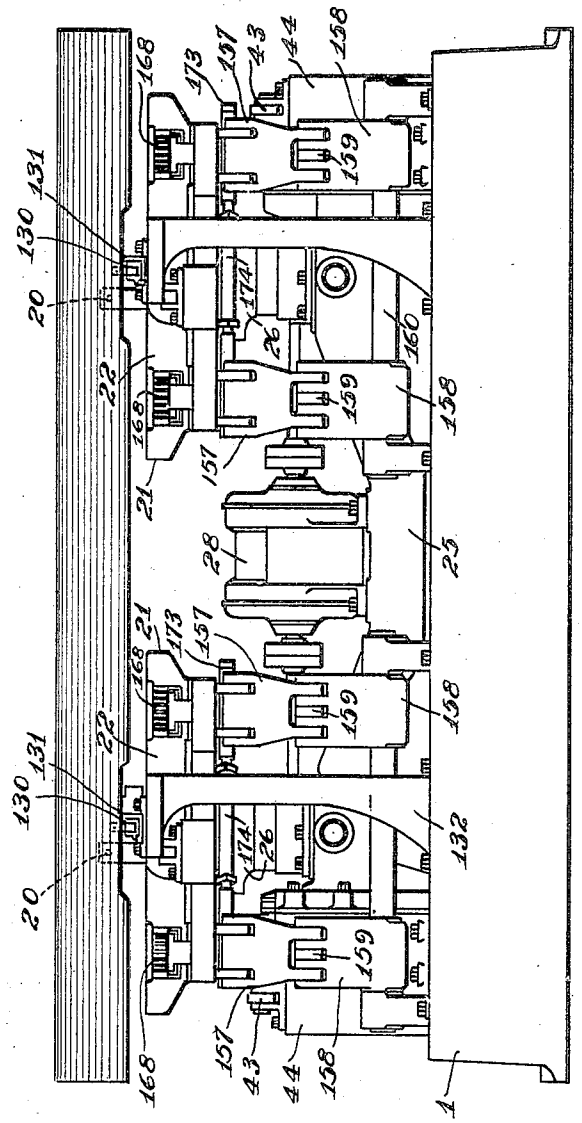
Henry Alinder, +
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Fig. 12.



WITNESSES

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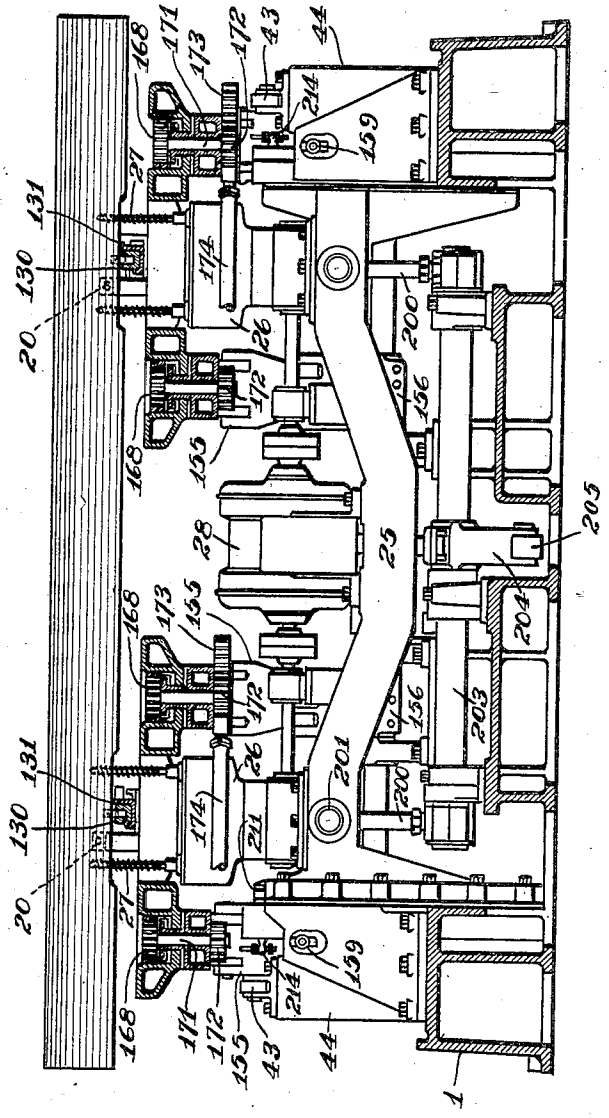
Henry Alinder &
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Fig. 13.



WITNESSES

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ADZING AND BORING MACHINE

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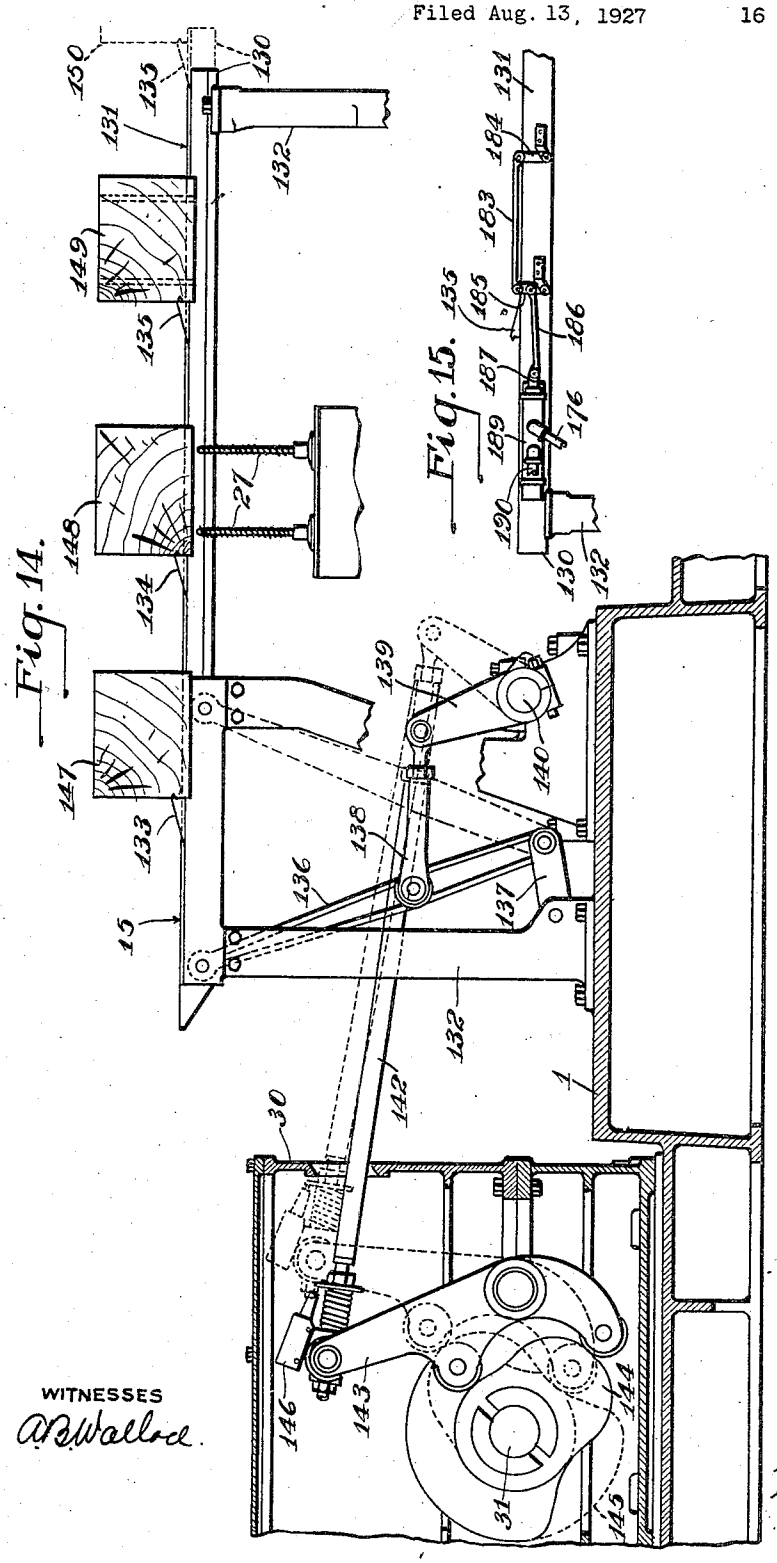


Fig. 14.

Fig. 15.

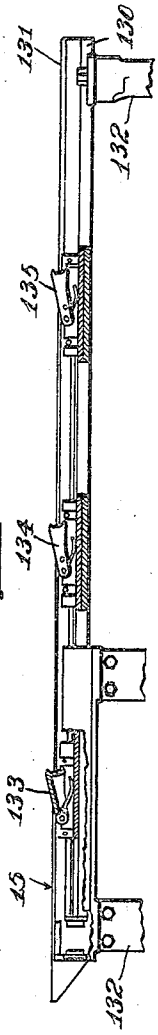


Fig. 16.

WITNESSES

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March 5, 1929. H. ALINDER ET AL 1,704,273

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Fig. 18.

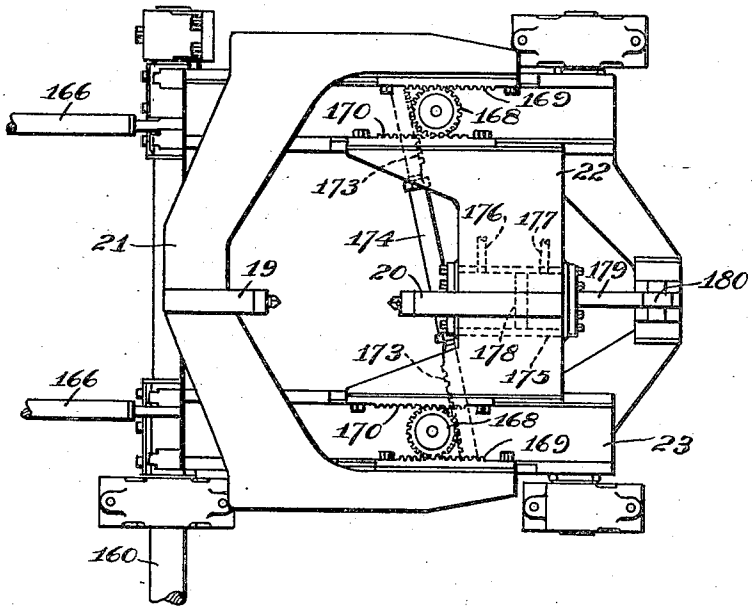
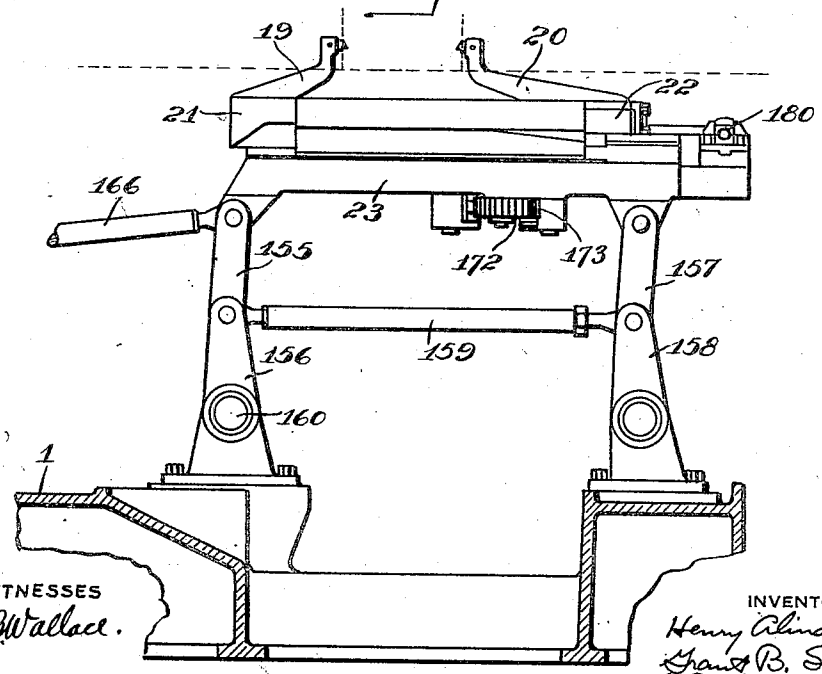


Fig. 17.



WITNESSES

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ADZING AND BORING MACHINE

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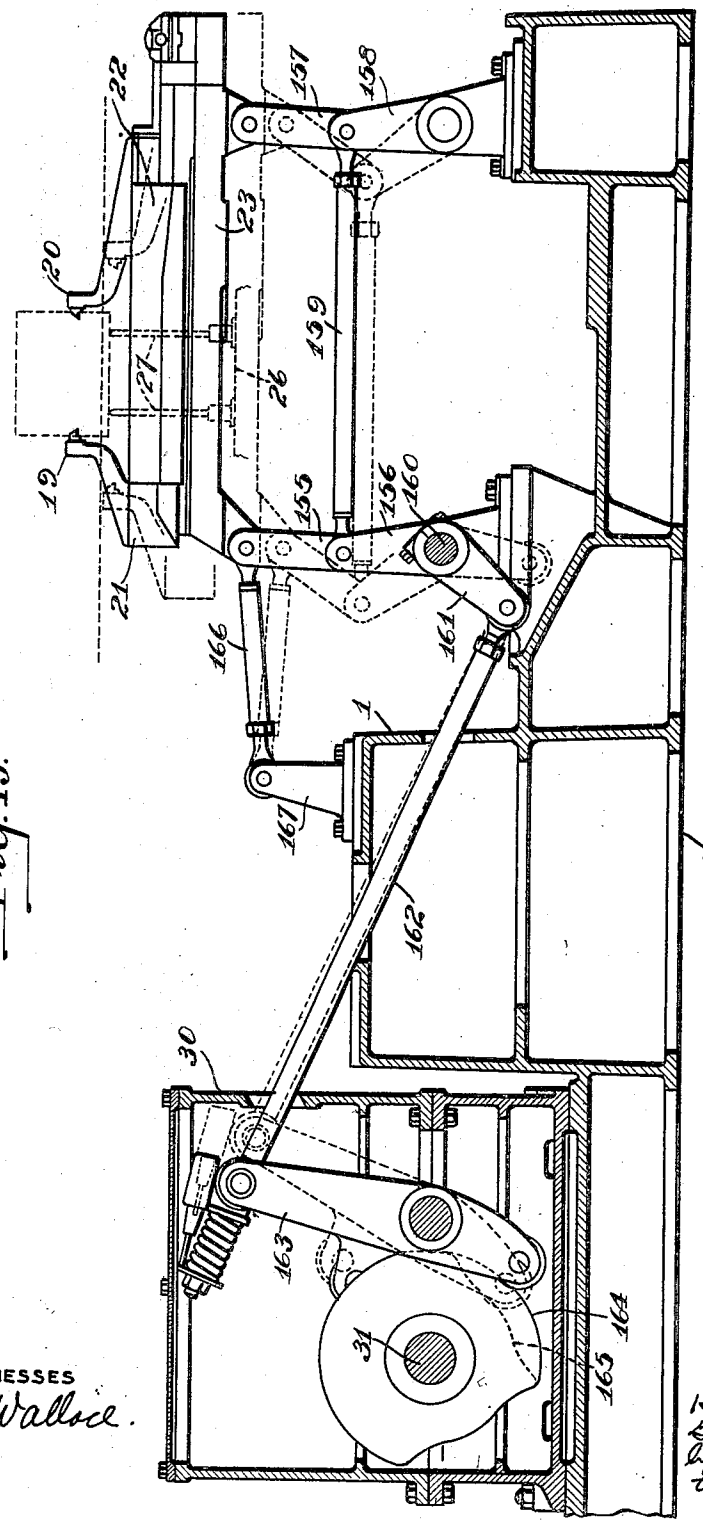


Fig. 19.

WITNESSES
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March 5, 1929. H. ALINDER ET AL 1,704,273

ADZING AND BORING MACHINE

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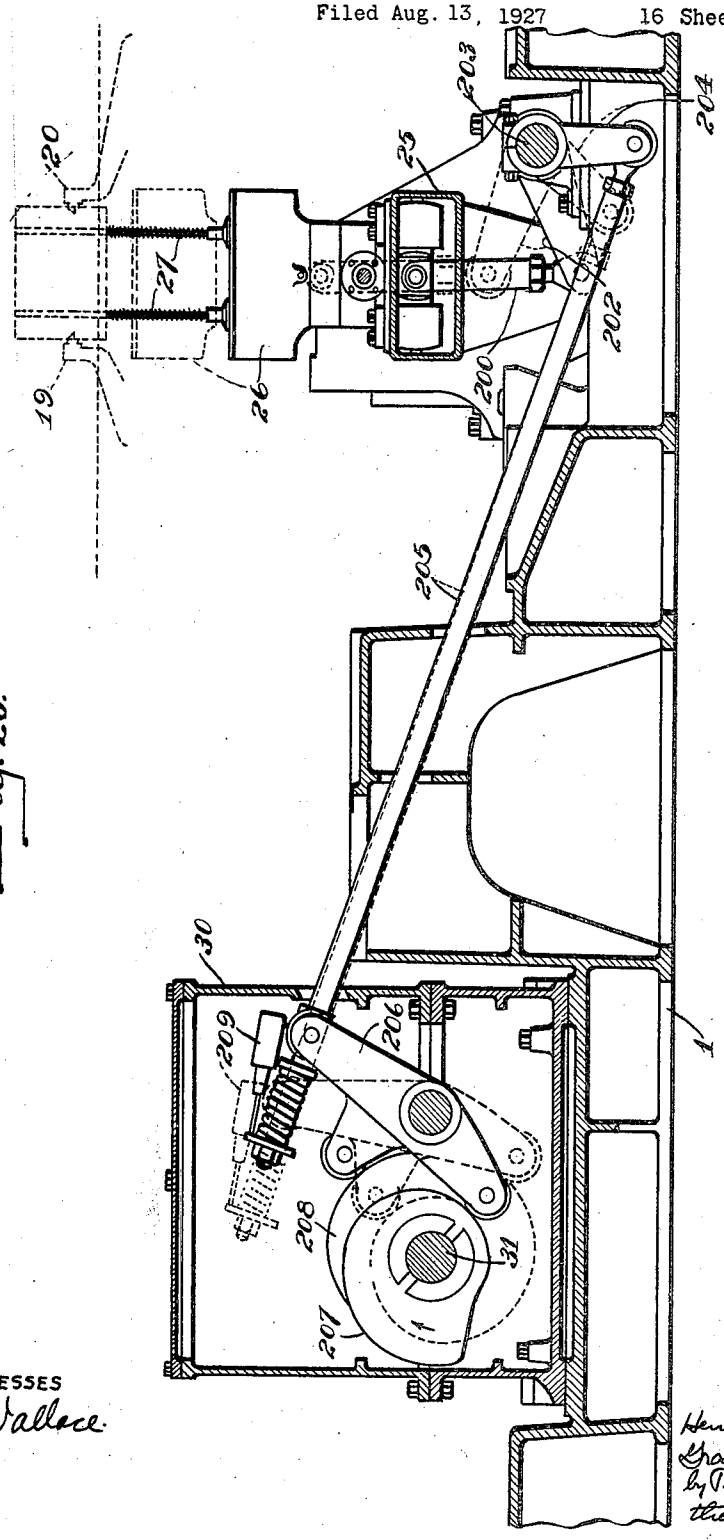


Fig. 20.

WITNESSES
A. B. Wallace.

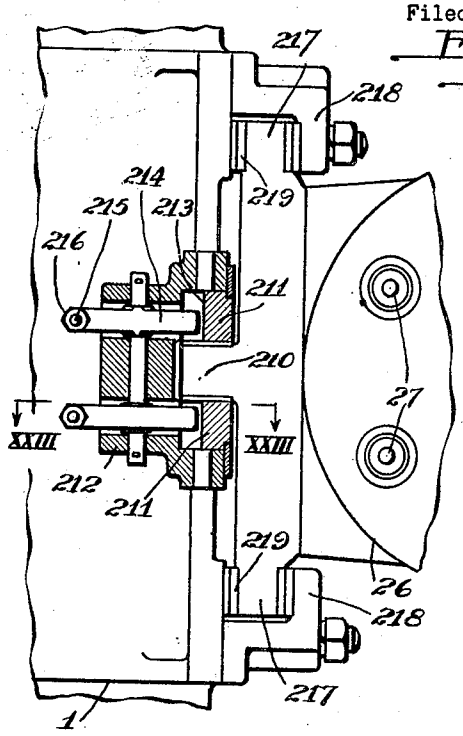
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March 5, 1929. H. ALINDER ET AL 1,704,273

ADZING AND BORING MACHINE

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Fig. 21.



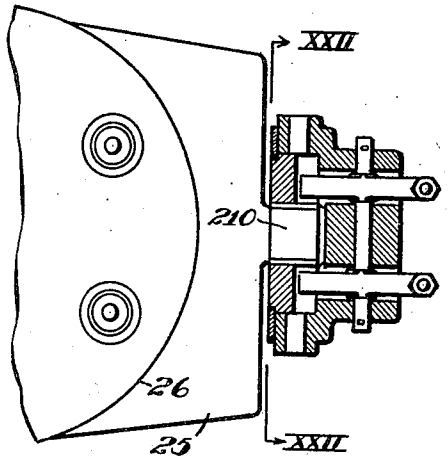


Fig. 22.

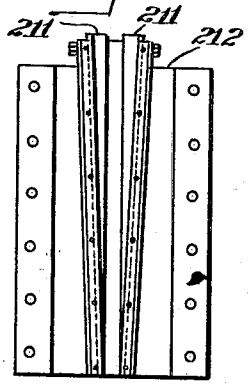
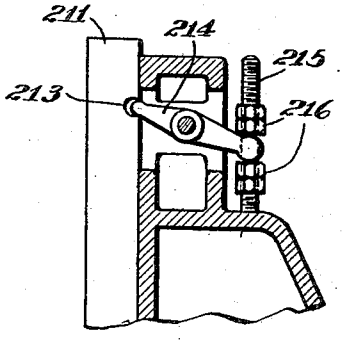


Fig. 23.



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ADZING AND BORING MACHINE

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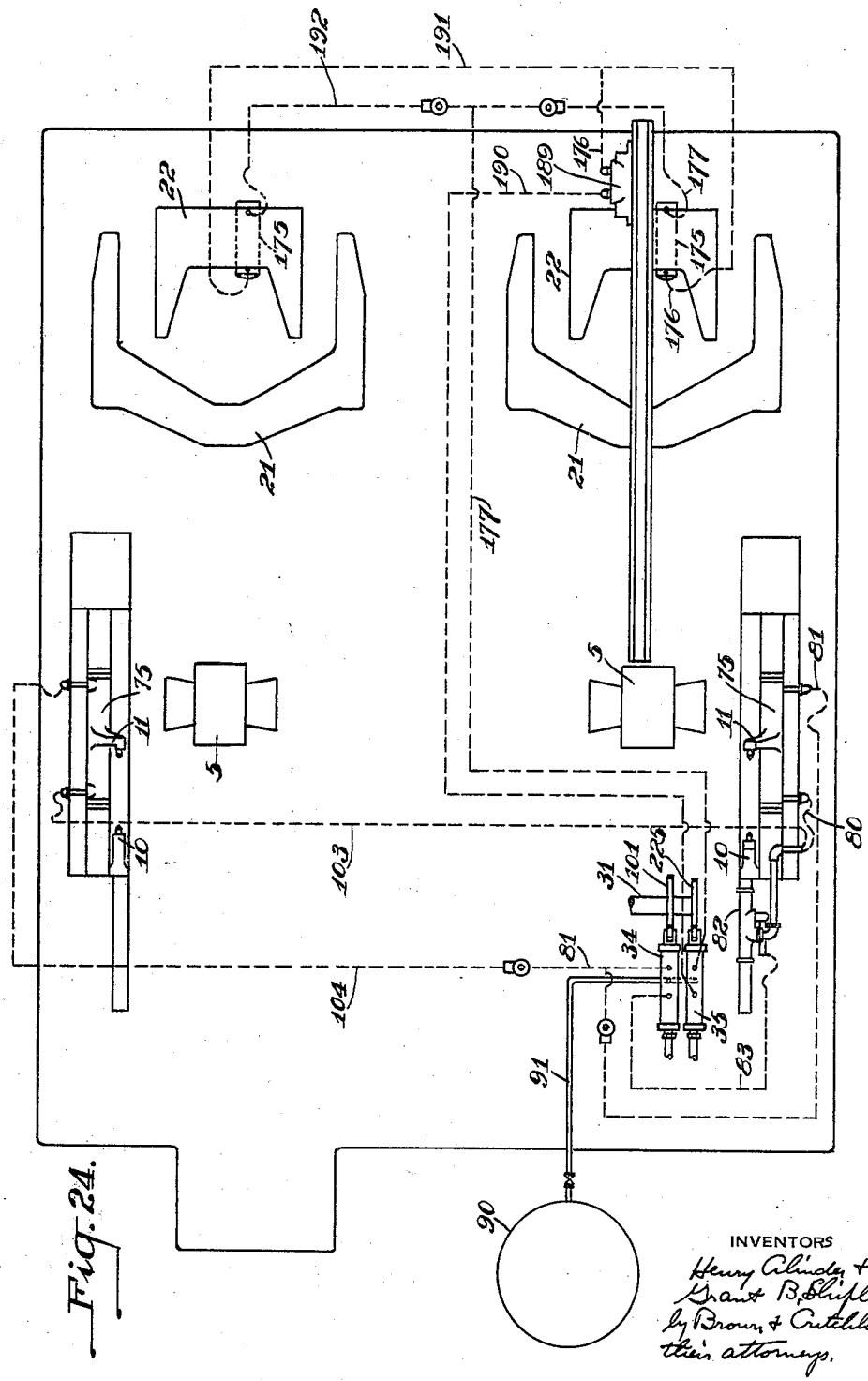


Fig. 24.

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ADZING AND BORING MACHINE

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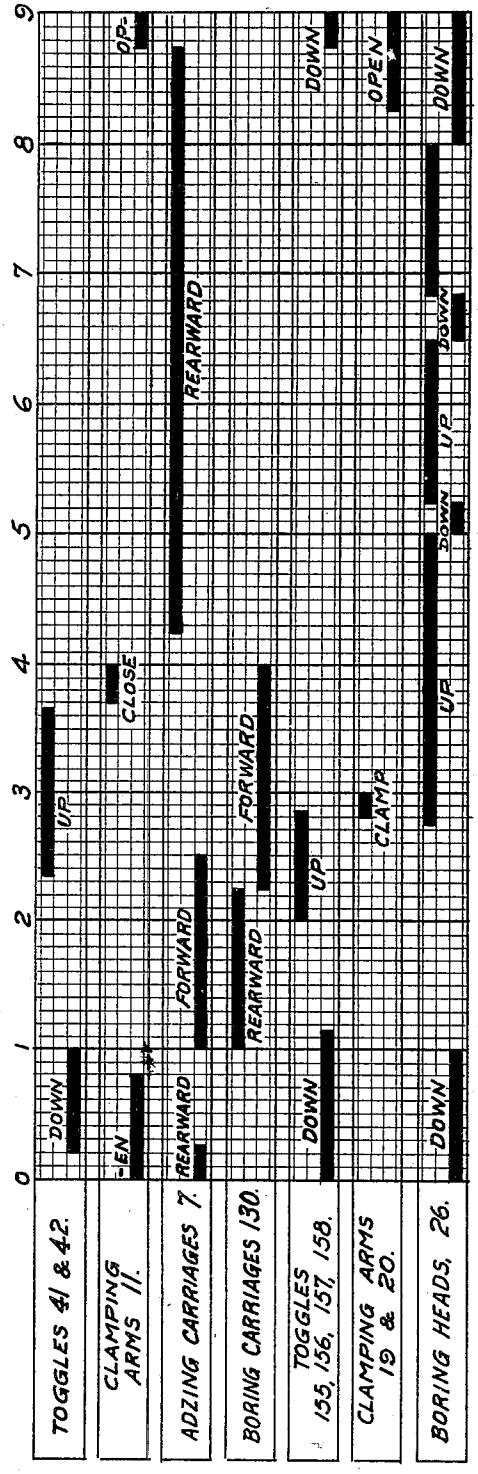


Fig. 25.

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Patented Mar. 5, 1929. 1,704,273

UNITED STATES PATENT OFFICE.

HENRY ALINDER AND GRANT B. SHIPLEY, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO THE OHIO WOOD PRESERVING COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF OHIO.

ADZING AND BORING MACHINE.

Application filed August 13, 1927. Serial No. 212,684.

The invention relates to combined machines for adzing and boring railroad ties, the object being to improve the construction and operation of such machines to the end that ties may be properly held in tool-operating positions, and be rapidly and accurately adzed and bored regardless of their relative sizes and of variations in the shape and sectional dimension and areas of individual ties, and to the further end that there will be a minimum of wear upon and breakage of the elements of the machine and its tools.

The machine provided according to this invention includes a frame having tie supporting rails at its top on which, at the front of the machine, ties may be fed mechanically or positioned manually. Two feeders move the ties from the front to the rear of the machine, the first being herein designated as the adzing and the second as the boring feeder. The adzing feeder is provided with a plurality of spaced dogs to engage successive ties; is reciprocable in a horizontal plane; is also reciprocable in a vertical plane to permit its tie-engaging dogs to pass beneath ties when the feeder is moved towards the front end of the machine; and is provided with clamps which firmly engage the sides of each tie adjacent to its ends regardless of the width or variations in width of the tie. The boring feeder receives ties from the adzing feeder at the rear end of the latter, moves them to a position for being clamped for boring, and, when bored, moves them to the rear end of the machine where they may be engaged by a conveyor or otherwise removed from the machine.

When in boring position, vertically and horizontally movable clamps are provided for each end of the tie for centering and firmly holding it in proper alignment with boring heads which move upwardly to bore the tie and downwardly to remove the borings and boring bits from it. The operations of the feeders, clamps and boring mechanism are all coordinated to rapidly adz and bore ties successively fed to the machine. Preferably three motors are used for operating the machine, one for continuously rotating the adzers, another for continuously driving the boring tools, and another for operating the feeders and control for the operation of the adzing and boring clamps.

The preferred embodiment of the invention is illustrated in the accompanying drawings of which Fig. 1 is a plan view of the machine, it being here noted for the purpose of clearness in describing the machine that the front of the machine is at the left, the rear at the right, the left side at the top and the right side at the bottom of this figure. Fig. 2 is an elevation of the right side of the machine; Fig. 3 an incomplete transverse sectional view taken on the line III—III, Fig. 2, showing the adzers and motor for driving them; Fig. 4 a longitudinal sectional view taken on the broken line IV—IV, Fig. 1; Fig. 5 a detached elevation of the right side portion of the adzing feeder; Fig. 6 a plan view of the portion of the adzing feeder shown in Fig. 5; Figs. 7 and 8 vertical sectional views taken on the lines VII—VII and VIII—VIII, respectively, Fig. 6; Fig. 9 a sectional view of a fluid pressure control valve, the plane of view being indicated by the line IX—IX, Fig. 2; Fig. 10 a combined vertical section and elevation of the right side portion of the adzing feeder support showing the mechanism for vertically reciprocating it, the plane of view being indicated by the line X—X, Fig. 1; Fig. 11 a combined vertical section and elevation of the right portion of the adzing feeder showing the mechanism for reciprocating it horizontally, the plane of view being indicated by the line XI—XI, Fig. 1; Fig. 12 a rear end view of the machine; Fig. 13 a transverse sectional view taken substantially on the line XIII—XIII, Fig 1; Fig 14 a combined vertical section and elevation of the right side portion of the boring feeder, the plane of view being indicated by the broken line XIV—XIV, Fig 1; Fig. 15 an elevation of the rear of the boring feeder, the view being in reverse position of Fig. 14; Fig. 16 a longitudinal sectional view of the upper portion of a boring feeder showing the construction of its tie-engaging dogs; Fig. 17 a detached elevation of a boring tie clamp adjacent to the rear of the machine; Fig. 18 a plan view of the tie clamp of Fig. 17; Fig. 19 a combined elevation and vertical sectional view of a boring tie clamp and mechanism for effecting its vertical reciprocation, the plane of view being indicated by the line XIX—XIX, Fig. 1; Fig. 20 a combined elevation and vertical sectional view of a boring head and the mechanism for effecting its vertical reciprocation,

the plane of view being indicated by the line XX—XX, Fig. 1; Fig. 21 a plan view of a boring head beam, the central portion of it being broken away, and the bearings at its ends being shown in section; Fig. 22 a reduced scale elevation of the centering guides at the ends of the boring beam, the plane of view being indicated by the line XXII—XXII, Fig. 21; Fig. 23 a central view of means for adjusting the guides at the end of the boring beam, the plane of view being indicated by the line XXIII—XXIII, Fig. 21; Fig. 24 a diagrammatic plan view of a fluid pressure mechanism for actuating the adzing and boring tie clamps; and Fig. 25 a cam diagram.

In explaining the construction of the illustrative embodiment of the invention, the general arrangement of the machine will first be described, and thereafter the adzing feeder together with its tie clamps and mechanism for effecting its vertical and horizontal movements, the boring feeder and mechanism for effecting its horizontal movements, the boring clamps and mechanism for effecting their vertical movements, and the boring head.

As to the general construction and arrangement of the machine, it is supported and arranged upon and within a frame 1 of general rectangular form provided with posts 2 to the upper ends of which there are attached discontinuous tie-supporting rails 3. Near its center (Figs. 1–4) the machine is provided with an adzer comprising a shaft 4 provided at its ends with a pair of adzing heads 5 and adapted to be rotated by a motor 6 through a train of pinions, the arrangement being such that the driving motor may be positioned below the lower faces of ties supported on rails 3. As shown particularly in Fig. 3, each adzing head 5 is preferably provided with three series of cutters, the outer ends of the center series somewhat overlapping the inner ends of the outer series.

The adzing feeders for moving ties to, over and beyond the adzers comprises a pair of carriages 7 arranged one at each side of the machine and mounted for like horizontal movements upon a pair of vertically movable tables 8 which are adapted to be moved vertically. Each of these carriages is provided at its front end with a tie-engaging dog 9, at its central portion with a pair of tie-clamping arms 10 and 11, and adjacent to its rear end with a tie-engaging dog 12, the arrangement being such that the horizontal movements of the carriages 7 move ties certain intervals towards the rear of the machine, they being adzed while moved over the adzer which preferably runs continuously during the operation of the machine. While there are two tables and carriages, there is in effect but a single table and carriage divided into sections the movements of which are simultaneous and identical.

Arranged to receive ties moved rearwardly by the adzing feeder there is a boring feeder comprising a pair of horizontally movable carriages 15, each provided with a series of spring pressed dogs or fingers 16, 17 and 18 (Fig. 2) for engaging ties. Near the rear of the machine there are two pairs of arms 19 and 20 for clamping the ties in boring positions, these arms being mounted, respectively, on horizontally movable carriages 21 and 22 (Figs. 17 and 18) supported by vertically movable tables 23. Here again, while there are two tables and carriages, there is in effect but a single table and carriage divided into sections the movements of which are simultaneous and identical.

Mounted for vertical movements in alignment with clamping arms 19 and 20 there is a boring beam 25 (Figs. 4 and 13) having boring heads 26 at its ends, which heads are provided with the desired number of boring bits 27 adapted to be driven by a motor 28 mounted upon beam 25 and preferably run continuously during the operation of the machine.

The horizontal and vertical movements of the adzing feeder, the horizontal movements of the boring feeder, and the vertical movements of the boring clamps and boring beam are preferably effected by connections extending from cams arranged in a cam housing 30 (Fig. 1) and mounted upon a shaft 31 rotated by connections extending from a motor 33 which is continuously driven during the operation of the machine. The movements of the adzing and boring clamps are preferably effected by compressed air controlled by valves 34 and 35 which are actuated by cams also attached to shaft 31, valve 34 controlling the horizontal movements of adzing clamp arms 11, and valve 35 the movements of boring clamp arms 19 and 20. The timings of the operations of such units of a machine as require timing are thus effected by the construction and positions of cams mounted on shaft 31.

Adzing feeder.

As previously explained, this feeder is in two sections, one at the right and the other at the left side of the machine, each section including a carriage 7 and a table 8. Each is the same except for an air control mechanism which is borne only by the section at the right side of the machine. The construction of the right side section of this feeder is shown particularly in Figs. 5–11 to which reference is now made.

Table 8 is supported by a pair of toggle links 40 and 41 seen particularly in Figs. 5 and 10. At their center pivot points these pairs of toggles are connected to each other by a link 42, and to hold the table against horizontal movements, its rear end is connected by a link 43 to a post 44 secured to

frame 1. In Fig. 10 table 8 is shown in full lines in its uppermost position and in dotted lines in its lowermost position, toggles 40 and 41 being broken or partially closed in the latter position. For so moving the toggles to lower and raise the table, front toggle link 40 is connected through a lug 45 and a link 46 to an arm 47 attached to a rock shaft 48 which extends transversely of the machine at its front. The rocking of this shaft is effected by a pair of companion cams 49 and 50, the peripheries of which engage rollers mounted upon a pivoted cam lever 51, the upper end of which is connected by a link 52 to an arm 53 attached to shaft 48.

To avoid breakage of these connections in case there should be abnormal resistance to the upward movement of table 8, the connections preferably include a cut-out for controlling the circuit through motor 33. As shown in Fig. 10, this cut-out may comprise an electric switch 55 having a movable circuit controlling arm 56 lying in the path of a dog 57 attached to link 52. Rather than being connected directly to the upper end of cam lever 51, link 52 is connected to it through a spring, which, in case of abnormal resistance to the rearward movement of link 52 to raise the table, will become compressed sufficiently to cause dog 57 to engage arm 58 and throw switch 55.

For slidably mounting carriage 7 upon table 8, the carriage is provided centrally with a T head 60 (Fig 8) which engages inwardly turned flanges 61 formed on the lower portion of the carriage. The horizontal movements of the carriage are effected by a rock shaft 62 (Figs. 1 and 11) to which there is connected an arm 63, the upper end of which is attached to the front of the carriage by a link 64. This shaft is rocked by a pivoted cam lever 65 provided with rollers which bear upon the periphery of a pair of companion cams 66 and 67, lever 65 being attached at its upper end by a link 68 to an arm 69 connected to shaft 62. For the purpose explained with reference to the electric switch 55 of Fig. 10, link 68 is similarly attached to cam lever 65 for operating a motor controlling switch 70. In Fig. 11 carriage 7 is shown in full lines at its position nearest the front of the machine, and in dotted lines in its rearmost position, as are also the driving connections which have been described.

Clamp arm 10 of carriage 7 is directly connected to the carriage, while provision is made for moving clamping arm 11 towards and from arm 10. For this purpose arm 11 is preferably securely attached to or formed integrally with a cylinder 75, which, as shown in Fig. 8, is provided with laterally extending flanges 76 slidably engaged by the upper portion of the carriage. Within cylinder 75 there is a piston 77 (Fig. 6) attached to a piston rod 78, the outer end of which is pivotally anchored at 79 to carriage 7. Compressed air and exhaust are carried to and from the cylinder 75 through pipes 80 and 81, it being understood that when compressed air is led into the cylinder through pipe 80 the cylinder will be moved to the left as viewed in Fig. 6 to close the clamp, and that when it is introduced through pipe 81 the cylinder will be moved to the right to open the clamp.

Provision is made for so controlling the flow of air to cylinder 75 through pipe 80 that cylinder 75 will not be moved towards clamping arm 10 unless a tie rests upon rails 3 between arms 10 and 11. To this end there is attached to the front of carriage 7 a valve casing 82 (Figs. 5 and 6) having ports connecting it to pipe 80 and to a pipe 83, these ports being controlled by a sliding valve 84 attached to a stem 85, the outer end of which is engaged by a sliding rod 86. This rod is connected by a link 87 to a pivoted finger 88 the outer end of which is yieldingly urged upwardly to a position above the plane of tie-supporting rails 3 at the right side of the machine. In the position in which it is shown in Fig. 5, finger 88, through link 87, rod 86, and stem 85, holds valve 84 in a position to prevent flow of air through casing 82 from pipe 83 into pipe 80. When a tie is between arms 10 and 11 it presses finger 88 downwardly to move valve 84 so that air may flow from pipe 83 through casing 82 and pipe 80 to cylinder 75 to cause it and its attached arm 11 to move towards arm 10.

In Fig. 24, there is diagrammatically illustrated the pipe connections for controlling flow of air to cylinders 75 on each side of the machine. Air supply from a suitable source 90 flows through a pipe 91 to valve mechanism 34, the construction of which is illustrated in Fig. 9. This valve includes a casing 92 having an inlet port 93, and outlet ports 94 and 95. These ports are controlled by valves 96 and 97 borne by a sliding stem 98, there being exhaust ports 99 adjacent to the valves as indicated. Stem 98 is yieldingly urged outwardly in casing 92 by a spring 100, and its outer end bears against the periphery of a cam 101 attached to shaft 31. Outlet port 94 of valve casing 92 is connected to pipe 83, and outlet port 95 to a pipe 81. Pipe 80 is provided with a branch 103 leading to the front end of cylinder 75 at the left side of the machine, and pipe 81 with a branch 104 leading to the rear of cylinder 75 at the left side of the machine. Thus when valve stem 98 is moved by cam 101 to move valve 96 so that inlet 93 is in communication with outlet 94, and when a tie is in position between clamping arms 10 and 11 to open valve 84 in the manner previously explained, air may flow directly to the front end of cylinders 75 to move the cylinders and their attached clamping arms 11 towards clamping

arms 10. At this time, valve 97 closes communication between inlet 93 and outlet 95, and places the latter in communication with the exhaust passage through valve stem 98. In a similar manner, the reverse position of valve stem 98 causes compressed air to flow to the rear ends of cylinders 75 and affords a passage for exhaust from their front ends.

In addition to dogs 9 and clamping arms 10 and 11, adzing feeder carriages 7 are provided with dogs 12, the construction of which is identical for each carriage and is shown in Figs. 5, 6 and 7. Each dog 12 is preferably so constructed that when the carriage approaches its rearmost position it will kick forwardly a tie which it engages. To such end the dog is pivotally mounted on carriage 7 at 110 and is engaged intermediate of its ends by a link 111, the forward end of which is attached to a finger 112 (Fig. 7) pivotally mounted on the carriage at 113 and having its lower end lying in the path of an adjustable trip 114. Thus when the lower end of finger 112 engages trip 114, link 111 is pulled forwardly to move dog 12 forwardly and advance a tie engaged by it into a position to be subsequently engaged by the boring feeder.

Operation of adzing feeder.

When ties are fed to the machine manually, they are placed upon rails 3 at the front of the machine and each is slid rearwardly until it is in position for engagement by dogs 9 of feeder carriages 7. This position of the ties is preferably visually indicated by weighted levers 120 (Figs. 1, 2 and 4) attached by clamps 121 to rails 3. When a tie is moved along the rails it depresses the upper ends of these levers, and when it is in proper position for engagement by arms 10 it will be somewhat beyond the lever so that their upper ends will swing forwardly to show workmen that the tie is properly positioned. A tie in such position is indicated in Figs. 2 and 4 at 122. Assuming tie 122 in this position, and carriages 7 in their forwardmost positions indicated in full lines in Fig. 11, and also assuming carriage-supporting tables 8 to be in their uppermost positions as indicated in Figs. 10 and 11, the rotation of cam shaft 31 by motor 30 moves the carriages towards the rear of the machine. This movement is effected through companion cams 66 and 67 on shaft 31, cam lever 65, link 68, rock shaft 69 arms 63 and links 64. Through dogs 9 this movement of carriages 7 slides the tie along rails 3 to a position slightly in advance of the tie indicated at 123 in Figs. 2 and 4.

Assuming now that a tie previously moved by dogs 9 is in the position of tie 123, and that the upward movement of tables 8 had brought lever 88 against the bottom of the tie to depress it, valve 84 (Figs. 6) is then in a position to place pipe 83 in communication with pipe 80 through valve casing 82. The rotation of cam shaft 31 then causes cam 101 (Figs. 1 and 24) to operate valve mechanism 34 so that air then flows through pipes 80 and 103 to the forward ends of cylinders 75 to move them and their clamping arms 11 to firmly engage a tie between arms 10 and 11. The rearward movement of carriages 7 carries the tie over adzer heads 5 at the proper rate to permit such heads to groove or adz the lower face of the tie. It is noted that by reason of the fact that clamping arms 11 are moved by compressed air they may move different relative amounts to firmly clamp the tie regardless of its width or the variation in its width. Furthermore, these clamps firmly hold the tie downwardly while passing over the adzers.

At the end of the rearward movements of carriages 7, and after the completion of an adzing operation, air is caused to flow through pipes 81 and 104 to the rear ends of cylinders 75 to cause them and their attached clamping arms 11 to move rearwardly to unclamp the tie. The carriage is then caused to move forwardly a small amount to release the clamping arms 10 from the tie. Thereafter table-supporting toggles 40—41 are broken to lower the carriage to bring the dogs and clamping arms below the plane of supporting rails 3. This breaking of the toggles is effected by companion cams 49 and 50 attached to cam shaft 31, the train of connections being through cam lever 51 (Fig. 10), link 52, arm 53, rock shaft 48, arms 47 and links 46 which are attached to arms 47 and to the forward toggles 40 and 41. When the tables are thus lowered to the position indicated by dotted lines in Fig. 10, carriages 7 are moved forwardly by the connections previously described in explaining the rearward movement of the carriages. This cycle of operation is repeated, a tie when adzed being in the position of that indicated at 124 in Figs. 2 and 4, and when in such position is engaged by the rearmost dogs 12 of carriages 7 for moving it rearwardly to the position of the tie indicated in dotted lines at 125 in Figs. 2 and 4. Near the end of the rearward movement of the carriages, fingers 112 (Fig. 7) engage trips 114 (Fig. 5) and through links 111 cause dogs 12 to give the tie a rearward kick.

In the cam diagram shown in Fig. 25, there is indicated the timing for operating toggles 41—42, clamping arms 11 and carriages 7. The movements of the toggles are indicated by the shadings marked "Down" and "Up", those of clamping arms 11 by the shadings marked "Closed" and "Open", and those of the carriages 7 by the shadings marked "Rearward" and "Forward".

Boring feeder.

This comprises a pair of carriages 130 (Figs. 1, 13 and 15) mounted for horizontal movements upon tables 131 supported by posts

132 attached to frame 1, the upper edges of which tables form the rear portions of tracks 3. Except for an air control mechanism attached to the carriage at the right side of the machine, both carriages of the boring feeder are the same, and accordingly the description of them will be confined to the carriage at the right side of the machine which is shown in Figs. 15 and 16. The carriage is provided with three dogs 133, 134 and 135, each of which is spring-pressed upwardly, and is so constructed that when the carriage is moved towards the front of the machine the dogs will be pressed downwardly by ties resting upon tables 131.

In Fig. 14, carriage 130 is indicated in full lines in its position nearest the front of the machine, and in dotted lines in its position nearest the rear of the machine, the mechanism for moving it being similarly indicated in these alternate positions. Pivotally connected at its upper end to the front end of carriage 130 there is a floating lever 136, the lower end of which is pivotally connected to a link 137, which in turn is pivotally attached to the forward table-supporting post 132. Intermediate of its ends lever 136 is pivotally connected to one end of a link 138, the other end of which is pivotally connected to an arm 139 attached to rock shaft 140. In alignment with arms 139 (there being one of these arms for each carriage 130) there is a third arm 141 (Fig. 1) attached to rock shaft 140 and to a link 142 extending to the outer end of cam lever 143 provided with rollers which bear upon the peripheries of companion cams 144 and 145 attached to cam shaft 31. Link 142 is connected to cam lever 143 in a manner similar to that explained with reference to Fig. 10, a cut-out switch 146 being provided for controlling cam shaft driving motor 33 in case there is abnormal resistance to the rearward movement of the boring feeder. It will be understood that the rearward movements of carriages 130 slides a tie upon table 131 from the position of that indicated at 147 to those indicated at 148, 149 and 150 (Fig. 15). Tie 147 is in the position to which it is finally moved by the adzing feeder, tie 148 is in boring position, tie 149 beyond the boring position, and tie 150 further beyond boring position and in a position to be moved from the machine manually or by a suitable conveyor.

In its boring position a tie is firmly clamped in proper alignment with the boring heads. The boring clamp mechanism, which operates boring clamps 19 and 20 is illustrated particularly in Figs. 17, 18 and 19. As previously explained, each pair of boring clamps (there being one pair at each side of the machine) comprises carriages 21 and 22 slidably mounted upon a vertically movable table 23. This table is supported by two pairs of forward toggles 155 and 156 and two pairs of rear toggles 157 and 158. At their center pivot points, toggles 155 and 156 are connected by a link 159 to toggles 157 and 158, and the lower ends of toggles 156 are securely attached to a rock shaft 160. To this shaft there is attached an arm 161 connected at its outer end by a link 162 to the outer end of a cam lever 163 provided with rollers which bear upon the peripheries of companion cams 164 and 165, mounted on cam shaft 31. The construction and arrangement here is in all essential respects the same as that explained with reference to the adzing feeder table 8 shown particularly in Fig. 10, the boring clamp table 23 being held against horizontal movements by links 166 which connect it with brackets 167 attached to frame 1.

Provision is made for horizontally moving carriages 21 and 22 towards and from each other at a uniform rate to clamp a tie in proper alignment with the boring tools, and to later release it. For equalizing these movements, table 23 is provided with a pair of pinions 168, and carriages 21 and 22 with racks 169 and 170, respectively, which mesh with the opposite sides of these pinions. In a manner presently to be explained, power is applied to move carriage 22 horizontally, and any such movement of this carriage becomes effective through its racks 170, pinions 168 and racks 169 attached to carriage 21 to move the latter uniformly in the opposite direction. To prevent the two carriages from binding upon table 23 when they are thus moved, pinions 168 are interconnected in such a manner as to cause them to rotate uniformly. For this purpose, each pinion 168 is connected to the upper end of a shaft 171 (Fig. 13), to the lower end of which there is attached a pinion 172. Meshing with pinions 172 there are racks 173 formed on the ends of a rod 174 mounted on the table 23 for longitudinal sliding movements, racks 173 being disposed on opposite sides of pinions 168 as shown in Fig. 18. Thus any rotation of one of the pinions 168 is directly transmitted to the other of them, making it impossible for the carriages to bind by reason by unequal horizontal movements of their opposite sides.

The movements of carriages 21 and 22 are preferably effected by compressed air mechanism in a manner similar to the movements of adzing and clamping arms 11. Beneath carriage 22 there is a cylinder 175 (Fig. 18) to the opposite ends of which there are attached air supply pipes 176 and 177, and within which there is a piston 178 attached to a piston rod 179, the outer end of which is pivotally anchored at 180 to table 23.

To avoid possible injury to the boring clamps in case they should be closed when a tie is not lying between them, provision is made for controlling the flow of compressed air through pipe 176, so that it may flow only when a tie is between the boring clamps. For

this purpose the boring feeder table 131 at the right side of the machine is provided with a trip rod 183 (Fig. 15) pivotally connected through links 184 and 185 to this table. Link 185 is connected by a rod 186 to the stem 187 of a valve 189 for controlling flow from a pipe 190 to pipe 176. Trip rod 183 is normally held yieldingly in its uppermost position indicated in Fig. 15, and is adapted to be depressed by a tie when in position between clamping arms 19 and 20. When depressed air may flow through valve 189 to the forward end of cylinder 175, and through a branch pipe 191 (Fig. 24) to the forward end of corresponding cylinder of carriage 22 at the left side of the machine. As shown in Fig. 24 the flow of alternate air and exhaust through pipes 176 and 177 is controlled by valve mechanism 35 similar to the valve mechanism 34 previously explained with reference to the construction and operation of the adzing clamps, it being understood that pipe 177 is provided with a branch pipe 192 leading to the rear end of cylinder 175 on carriage 22 at the left side of the machine.

Boring mechanism.

As previously explained with reference to Fig. 13, boring heads 26 are carried by a boring beam 25 on which there is mounted a motor 28 having driving connections for turning the bits 27 projecting upwardly from the boring heads. Provision is made for raising the boring beam to feed the bits during the boring operation and for lowering it for subsequently removing the bits.

Extending downwardly from each end of beam 25 there is a link 200 (Figs. 13 and 20) which at its upper end is pivotally connected to the beam at 201 for small uniform movements, and at its lower end is pivotally connected to an arm 202 attached to a rock shaft 203. At its center this shaft is provided with an arm 204, the outer end of which is connected by a link 205 to cam lever 206 provided with rollers which bear upon the peripheries of companion cams 207 and 208 attached to cam shaft 31. The connection of link 205 to lever 206 is the same as previously explained with reference to Fig. 10, a cut-out switch 209 being provided for stopping the operation of motor 33 in case there is undue resistance to the upward movement of the boring beam.

To prevent the breaking of boring bits, as well as to maintain the bits in proper boring positions, provision is made for so guiding the ends of boring beam 25 that it will not wabble and will be otherwise properly guided in its movements. The means to this end are illustrated in Figs. 21, 22 and 23. As shown in Fig. 21, the ends of beam 25 are provided with vertical ribs 210, each of which is arranged between a pair of wedge-shaped guides 211 mounted in guide-supporting frame 212 for independent vertical adjustments. Each guide 211 is provided with a groove 213 which receives one end of a lever 214, the other end of which is bifurcated to receive a threaded rod 215 provided with adjusting nuts 216 which engage the opposite sides of the bifurcated end of the lever and hold it in any desired adjustable position. At one of its ends, beam 25 is provided with laterally extending ribs 217 which are received by guides 218 attached to frame 1 for preventing longitudinal movement of the beam. Between ribs 217 and guides 218 suitable liners 219 are placed. The other end of beam 25 is free to move longitudinally a sufficient amount to avoid binding in case of thermal elongation of the beam.

Operation of boring feeder, clamps and heads.

Referring first to Fig. 2, it has been previously explained that adzing feeder carriages 7 move a tie step-by-step until it reaches the position of tie 125. The position of this tie in Fig. 2 is the same as that of tie 147 in Fig. 14, or in other words, the adzing feeder moves each tie to a position to be engaged by dogs 133 of boring feeder carriage 130. With tie 147 engaged by dogs 133, carriages 130 are moved towards the rear of the machine through levers 136, links 138, arms 139, rock shaft 140, arm 141, link 142, cam lever 143 and companion cams 144 and 145 attached to cam shaft 31. The tie then being in the position indicated at 148 (Fig. 14) boring clamp tables 23 are moved upwardly from the dotted to the full line positions shown in Fig. 19. This is effected by the rotation of rock shaft 160 through arm 161, link 162, cam lever 163 and companion cams 164 and 165 attached to cam shaft 31, the turning of shaft 160 being effected to straighten out toggles 155—156 and 157—158. Movement of a tie along table 131 causes trip rod 183 (Fig. 15) to move downwardly beneath the tie to open valve 189 and thereby afford a free passage for air through such valve to cylinders 175 attached to carriages 22. Thereafter, valve 35 is moved by cam 225 (Fig. 1) to cause air to flow through pipes 176 and 191 (Fig. 24) to the forward ends of cylinders 175 which causes carriage 22 to move forwardly, and, through pinions 168 and racks 170 and 169, carriages 21 to move rearwardly to bring clamp arms 19 and 20 into engagement with the tie. Because the two pairs of clamping arms are independently moved by compressed air mechanism, the tie becomes properly and firmly engaged at its ends regardless of the width of the tie or any variation in its width. Furthermore, a tie is firmly engaged by these clamps so that it cannot move during the boring operation.

When a tie is thus clamped in boring position, boring beam 25 is raised through links

200 (Fig. 20) arms 202, rock shaft 203, arm 204, link 205, cam lever 206 and companion cams 207 and 208 attached to cam shaft 31. These cams are preferably so formed that during a boring operation the boring bits are intermittently withdrawn small amounts to clear the openings of borings. When the boring operation is completed, the boring beam 25 is lowered to entirely withdraw its bits 27 from a tie so that the subsequent movement of boring carriage 130 may move the tie rearwardly of the machine.

The timing of the several cams for effecting these operations is clearly shown in the cam diagram of Fig. 25. The movement of boring carriages 130 towards the rear of the machine is indicated by the shadings marked "Rearward" and toward the front end of the machine by the shadings marked "Forward"; the movements of toggles 155, 156 and 157, 158 to raise and lower tables 23 are indicated by the shadings marked "Up" and "Down"; the opening and closing of clamping arms 19 and 20 is indicated by the shading marked "Open" and "Clamped", and the movements of the boring heads are indicated by the shadings marked "Up" and "Down".

The operations of the several units of the machine have been explained following the descriptions of the units, and therefore the complete operation of the machine will not be here repeated. However, it is noted that through cam shaft 31 all of the operations are so coordinated that ties may be rapidly adzed and bored simultaneously, as clearly appears from the cam diagram shown in Fig. 25. This is made possible by the timed operations of the feeders, clamps and other elements of the machine. While being both adzed and bored ties are firmly held in proper positions regardless of their sizes or variations in dimensions of individual ties. Furthermore, any abnormal resistance to the movements of the several units of the machine becomes an effective step of its operation and therefore prevents injury to or breakage of any of the parts of the machine.

According to the provisions of the patent statutes, we have explained the principle and operation of our invention and have illustrated what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced by other forms of construction than specifically shown and described.

We claim as our invention:

1. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, and adzing and boring clamps each independently movable variable amounts with relation to each other for engaging the sides of the tie adjacent to each end thereof while being acted upon by the tools, said clamps being movable vertically to and from positions below said rails.

2. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, clamps for engaging the sides of a tie adjacent to the ends thereof while being acted upon by the tools, and pressure fluid mechanism for moving the said clamps variable amounts with relation to each other.

3. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, two pairs of clamps for engaging the sides of a tie adjacent to the ends thereof while being acted upon by the tools, means for raising and lowering said clamps to and from tie-engaging positions, and pressure fluid mechanism effective when said clamps are in their elevated positions for moving the elements of each pair horizontally with relation to each other.

4. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, two pairs of clamps for engaging the sides of a tie adjacent to the ends thereof, while being acted upon by the adzing tools, means for raising and lowering said clamps to and from tie-engaging positions, and separate fluid pressure mechanisms each effective when said clamps are in their elevated positions to move one element of each pair horizontally towards its other element.

5. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, clamps for engaging the sides of a tie adjacent to the ends thereof while being acted upon by the tools, pressure fluid mechanism for moving the said clamps variable amounts with relation to each other, and means for rendering said clamp-moving mechanism normally ineffective when a tie is in position for engagement by said clamps.

6. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, clamps for engaging the sides of a tie adjacent to the ends thereof while being acted upon by the tools, pressure fluid

mechanism for moving the said clamps variable amounts with relation to each other, a valve for controlling flow of said pressure fluid to said clamp-moving mechanism, and means actuated by the weight of a tie when in clamp-engaging position for opening said valve.

7. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-supporting rails, and power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails; of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a vertically movable table, a carriage mounted for horizontal movement upon said table and provided with a plurality of tie-engaging dogs, and coordinated mechanisms for moving said table vertically and said carriage horizontally on the table for causing said dogs to pass forwardly below and engage ties and move them rearwardly of the machine.

8. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-supporting rails, and power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails; of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a table, vertically disposed toggles for supporting said table, a carriage mounted for horizontal movements upon said table and provided with a plurality of tie-engaging dogs, and coordinated mechanism for opening and closing said toggles to raise and lower said table and for moving said carriage horizontally on the table for causing said dogs to pass forwardly below and engage ties and move them rearwardly of the machine.

9. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-supporting rails, and power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails; of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a vertically movable table, a carriage mounted for horizontal movements upon said table and provided with a plurality of tie-engaging dogs one of which is a clamping arm, said carriage being provided also with a second clamping arm movable upon the carriage, coordinated mechanism for moving said table vertically and said carriage horizontally on the table, and means for moving said second-named clamping arms to and from the first-named clamping arms to clamp a tie between the arms and later release it.

10. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-engaging rails, and power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails; of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a vertically movable table, a carriage mounted for horizontal movement upon said table and provided with a plurality of tie-engaging dogs, and cam-actuated driving connections for moving said table vertically and said carriage horizontally.

11. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-engaging rails, and power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails; of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a vertically movable table, a carriage mounted for horizontal movement upon said table and provided with a plurality of tie-engaging dogs, a continuously rotatable shaft, cams attached to said shaft, and driving connections extending from said cams for moving said table vertically and said carriage horizontally on the table.

12. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-engaging rails, and power actuated adzing and boring tools arranged to act successively upon ties supported by said rails, of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a vertically movable table, a carriage mounted for horizontal movement upon said table and provided with a plurality of tie-engaging dogs, a motor, connections extending from said motor for moving said table vertically and said carriage horizontally on the table, and means interposed in said connections for stopping the operation of said motor when the movements of said table and carriage encounter abnormal resistance.

13. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, an adzing feeder for moving ties supported upon the rails towards, over and beyond the adzing tools, and a boring feeder arranged telescopically of said adzing feeder for receiving ties from the latter and moving them to and beyond said boring tools.

14. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, a vertically and horizontally movable adzing feeder provided with a plurality of dogs for engaging and moving ties supported upon said rails towards, over and beyond the adzing tools, and a horizontally

movable boring feeder arranged telescopically of said adzing feeder for receiving ties from the latter, said boring feeder being provided with a plurality of dogs for engaging and moving ties to and beyond the boring tools.

15. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, an adzing feeder, a boring feeder for receiving ties from the adzing feeder, a motor, and coordinated cam actuated driving connections extending from said motor to said feeders to move them horizontally to slide ties step-by-step upon said rails towards, over and beyond said adzing tools and to and beyond said boring tools.

16. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, mechanism for moving ties upon said rails, and clamps having independent vertical and horizontal movements for firmly engaging the sides of ties and positioning them for being operated upon by said boring tools.

17. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, mechanism for moving ties upon said rails, and two pairs of clamps having independent vertical and horizontal movements for firmly engaging the sides of each tie adjacent to its ends and for positioning it for being operated upon by said boring tools.

18. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, mechanism for moving ties upon said rails, two pairs of vertically and horizontally movable clamps for firmly engaging the sides of each tie adjacent to its ends and for positioning it for being operated upon by said boring tools, and a separate fluid pressure mechanism for moving each of said pairs of clamps horizontally.

19. In a combined adzing and boring machine, the combination with a frame provided at its upper portion with tie-supporting rails, and power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails; of a feeder for moving ties towards, over and beyond said adzing tools, said feeder comprising a vertically movable table, a carriage mounted for horizontal movement upon said table and provided with a plurality of tie-engaging dogs, mechanism for moving ties upon said rails, clamping mechanism for engaging a tie when in boring position, said clamping mechanism comprising a vertically movable table, two pairs of carriages mounted for horizontal movements upon said table, each element of each pair of carriages being provided with a clamping arm, and fluid pressure mechanism for moving the elements of each pair of carriages towards and from each other.

20. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, power-actuated adzing and boring tools arranged to act successively upon ties supported by said rails, mechanism for moving ties upon said rails, clamping mechanism for engaging a tie when in boring position, said clamping mechanism comprising a table supported upon vertically disposed toggles, means for opening and closing said toggles to raise and lower said table, carriages mounted on said table and provided with tie clamping arms, and means for moving said carriages horizontally upon said table to cause said clamping arms to move towards and from each other.

21. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, adzing tools at the forward end of the machine, a motor and driving connections from it to said tools for continuously operating them, boring tools at the rear of the machine, a second motor and driving connections from it to said boring tools for continuously operating them, feeders for moving ties step-by-step upon said rails, and a third motor and driving connections from it to said feeders for moving them forwardly and rearwardly of the machine.

22. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, adzing tools at the forward end of the machine, a motor and driving connections from it to said tools for continuously operating them, boring tools at the rear of the machine, a second motor and driving connections from it to said boring tools for continuously operating them, a vertically and horizontally movable adzing feeder and tie clamp for moving ties to, over and beyond said adzing tools, a horizontally movable boring feeder for moving ties to and beyond said boring tools, and a third motor and driving connections from it to said adzing and boring feeders for moving them.

23. In a combined adzing and boring machine, the combination of a frame provided at its upper portion with tie-supporting rails, adzing tools at the forward end of the machine, a motor and driving connections from it to said tools for continuously operating them, boring tools at the rear of the machine,

a second motor and driving connections from it to said boring tools for continuously operating them, said boring tools being mounted for vertical movements, a vertically and horizontally movable adzing feeder and tie clamp for moving ties to, over and beyond said adzing tools, a horizontally movable boring feeder for moving ties to and beyond said boring tools, and a third motor and coordinated driving connections from it to said adzing and boring feeders for moving them and to said boring tools for raising and lowering them.

In testimony whereof, we hereunto sign our names.

HENRY ALINDER.
GRANT B. SHIPLEY.