April 13, 1926. 1,580,343

U. STEINER

GRINDING MACHINE

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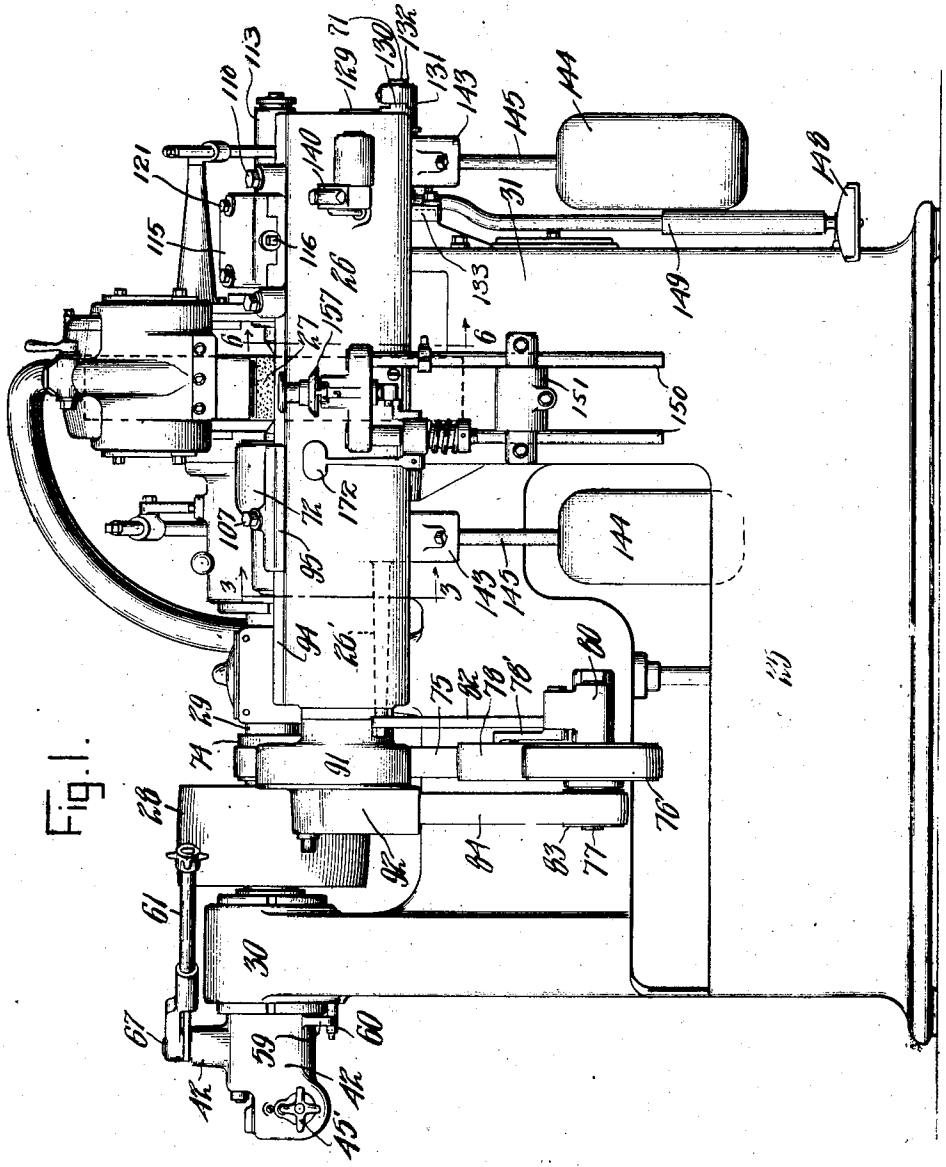


Fig. 1.

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By
Attorney

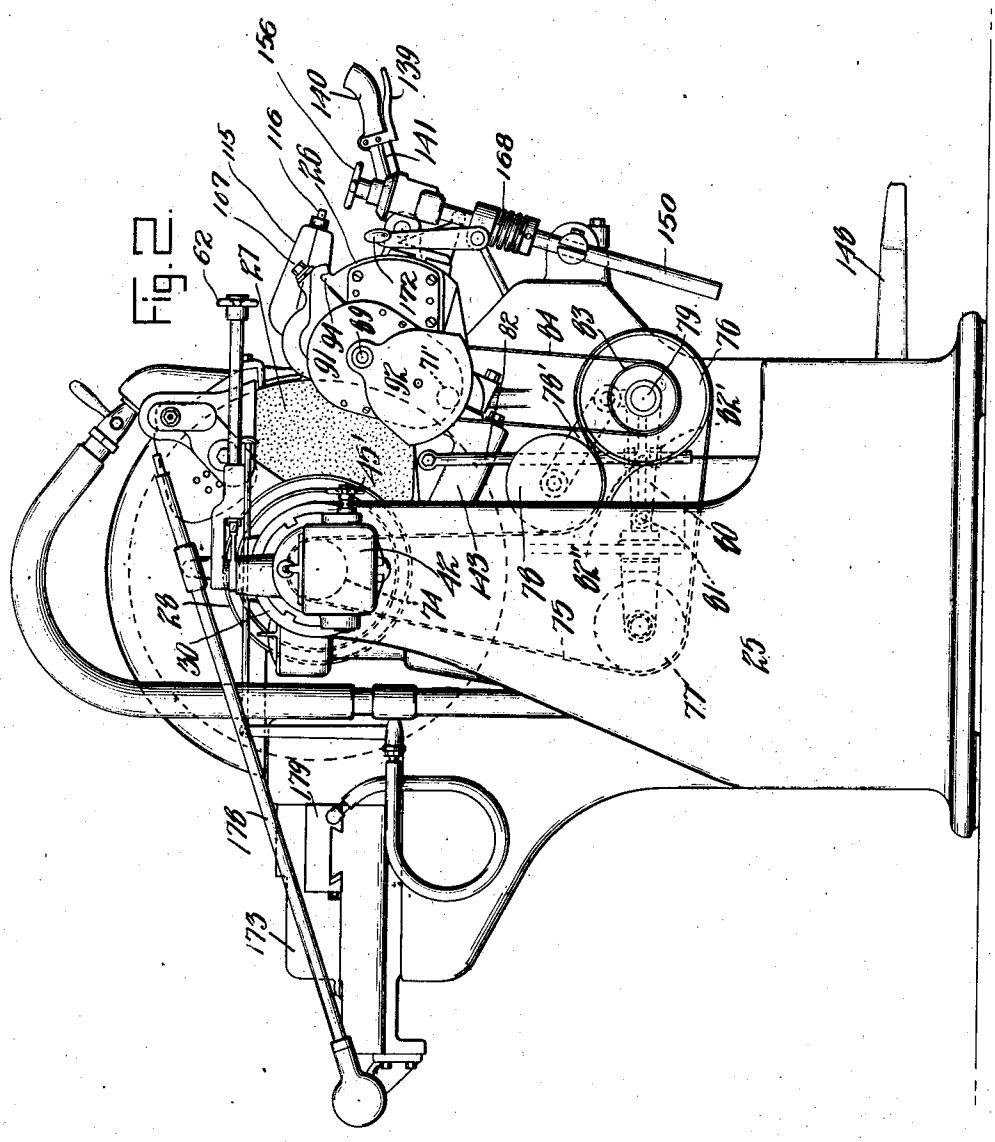
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U. STEINER

GRINDING MACHINE

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Fig. 2.



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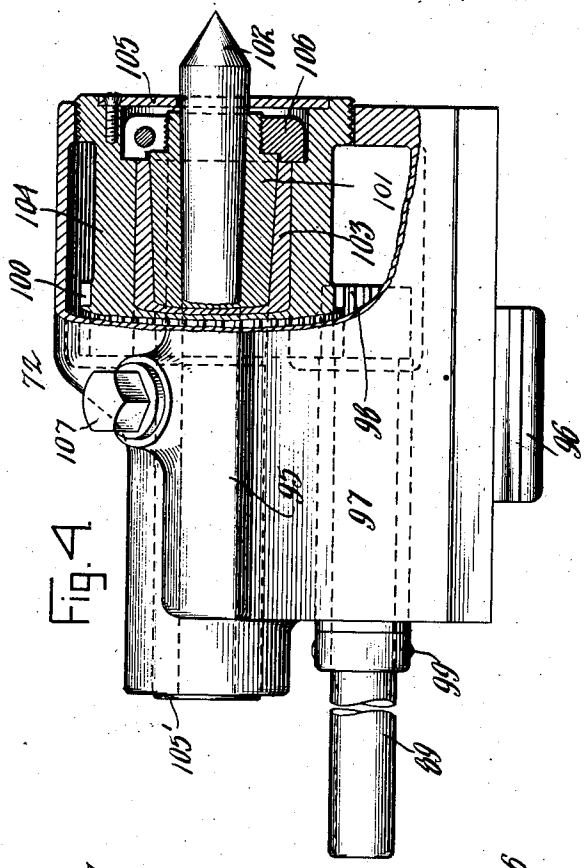


Fig. 4.

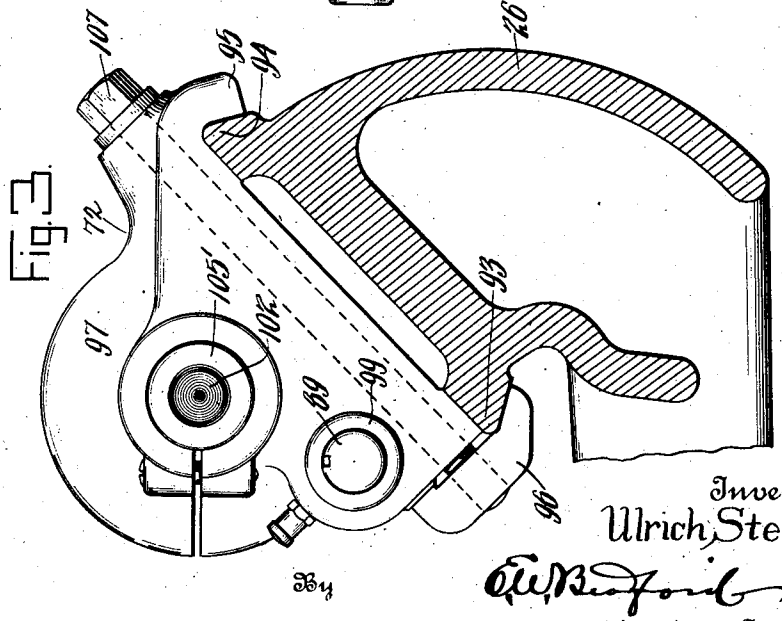


Fig. 3.

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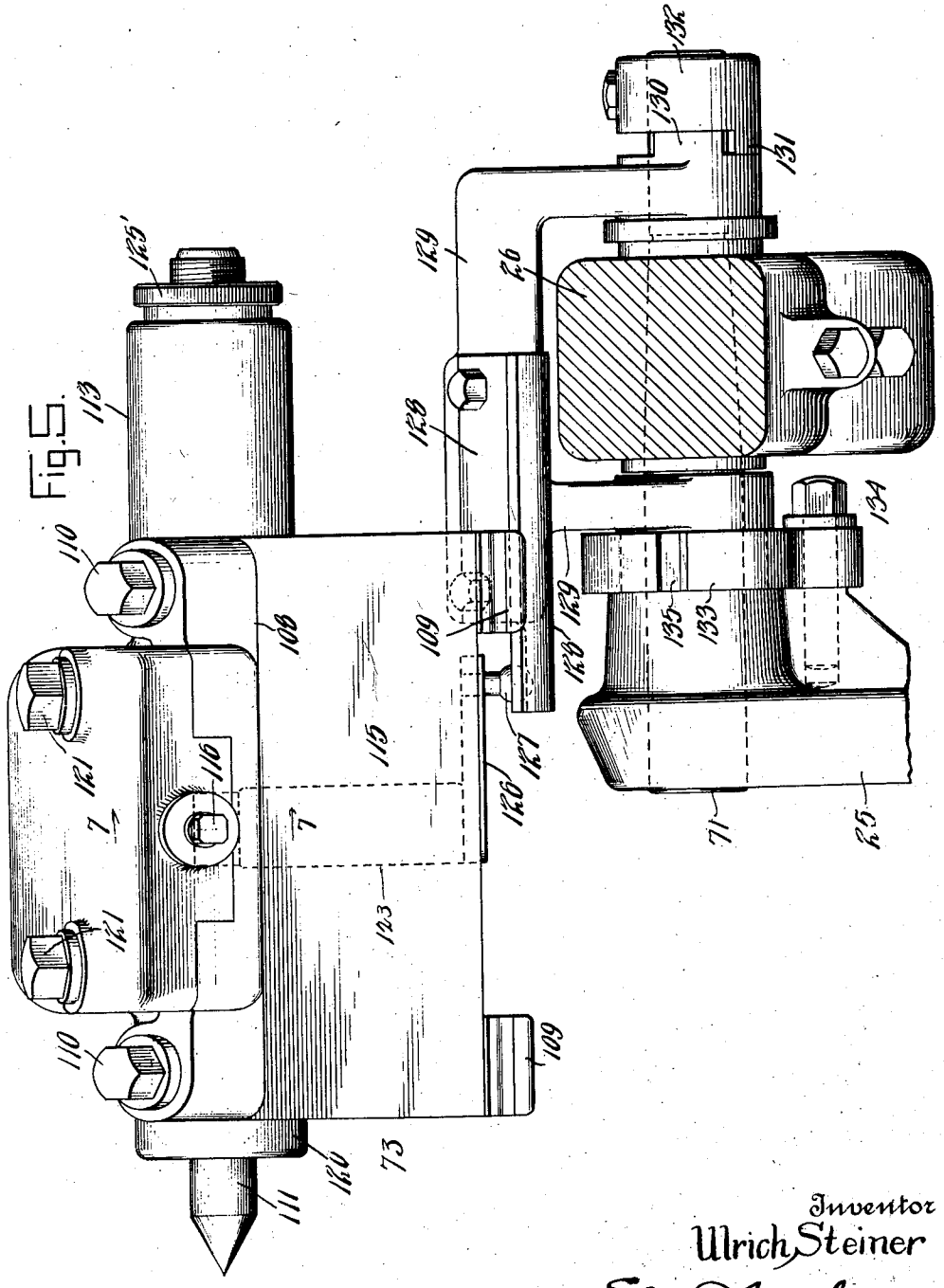
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U. STEINER

GRINDING MACHINE

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Fig. 5.



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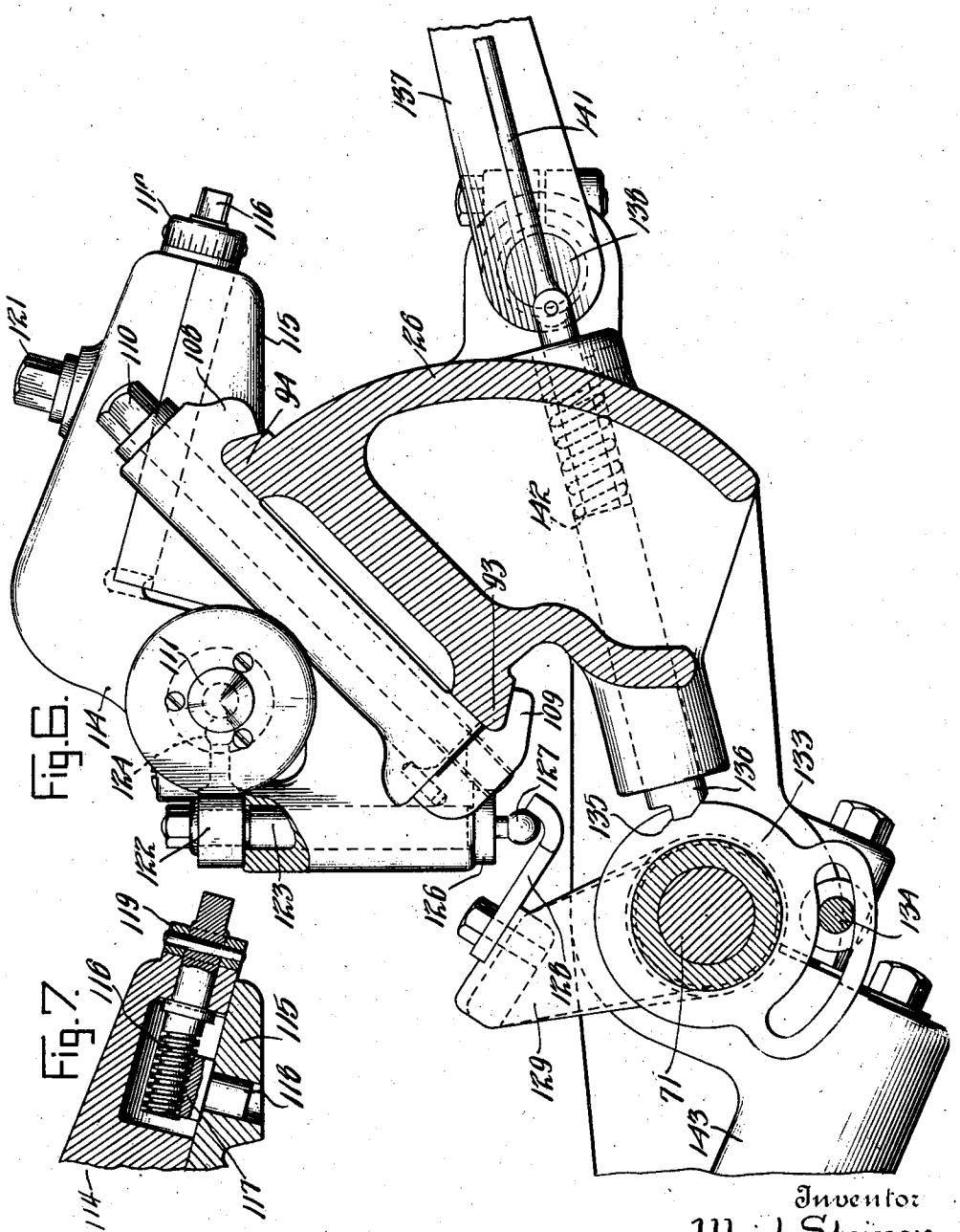


Fig. 6.

Fig. 7.

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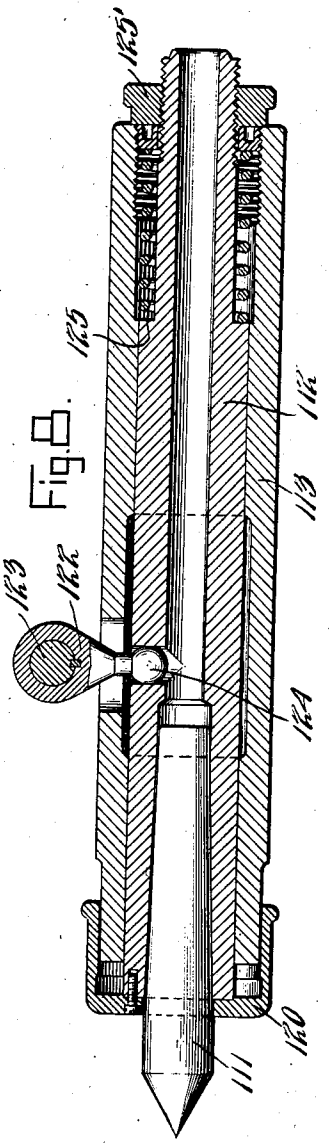
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U. STEINER

GRINDING MACHINE

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Fig. 8.



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Fig. 9.

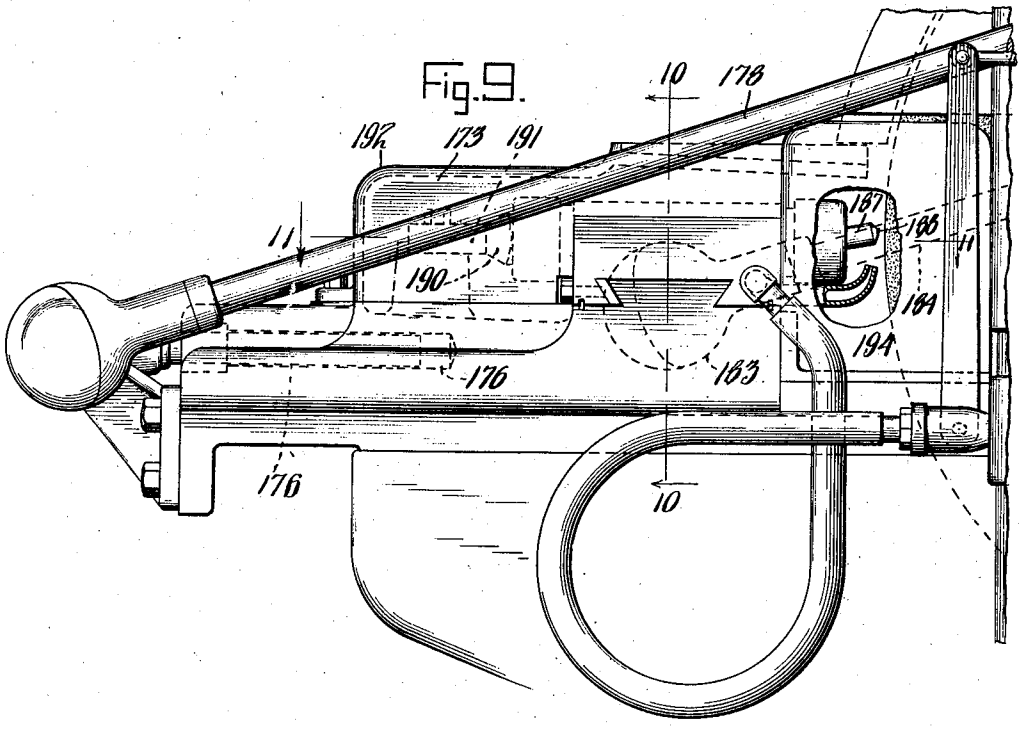
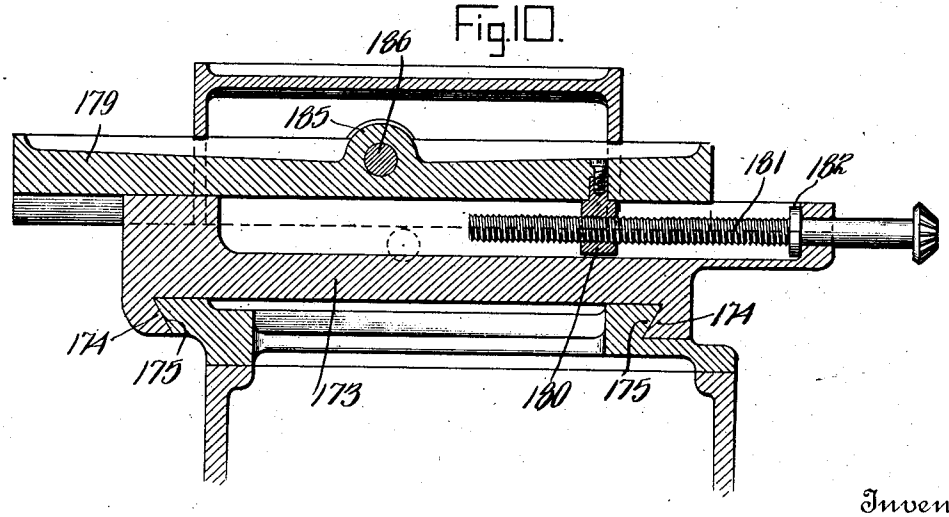


Fig. 10.



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April 13, 1926.

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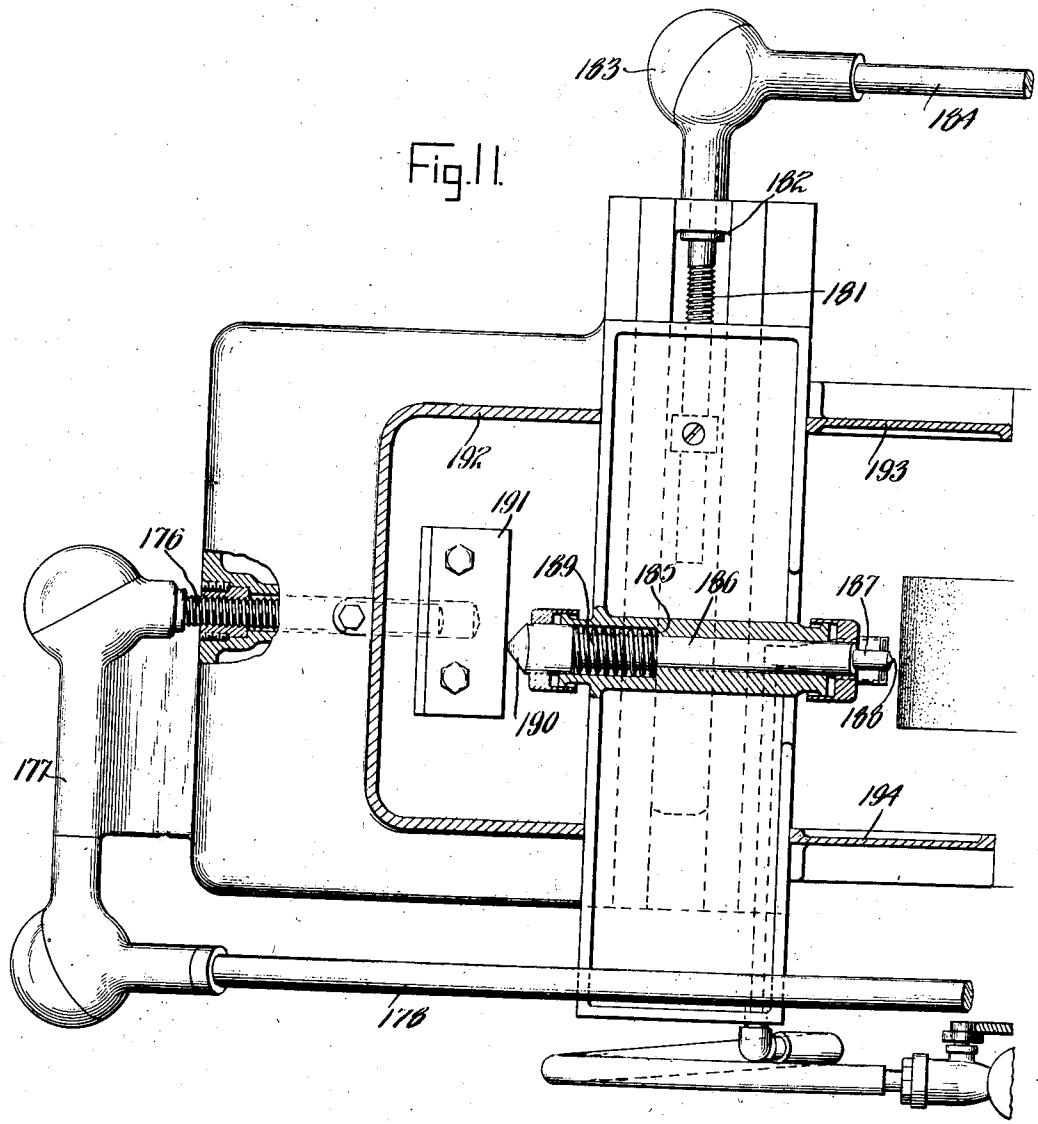
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Fig. 11.



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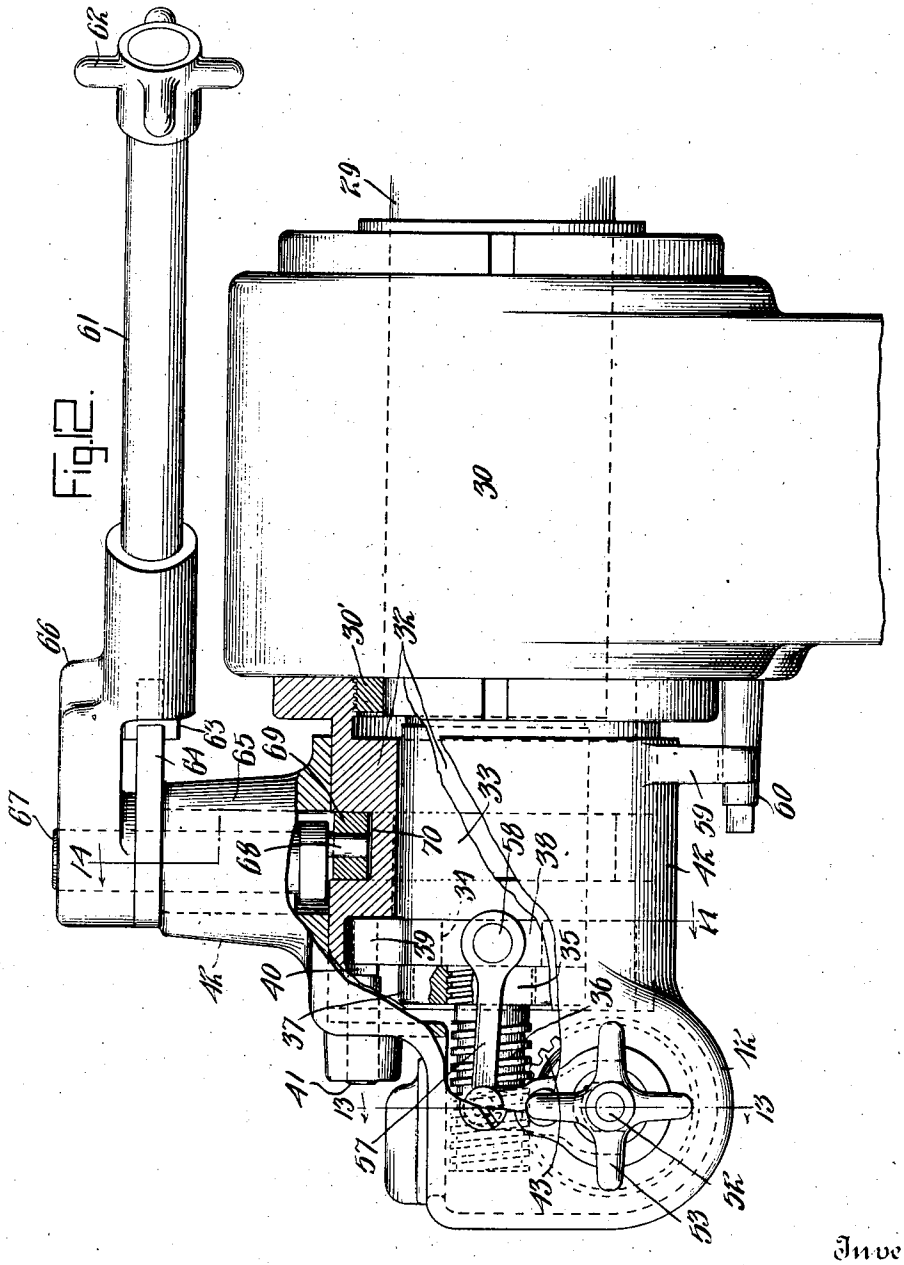
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U. STEINER

GRINDING MACHINE

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Fig. 12.



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U. STEINER

GRINDING MACHINE

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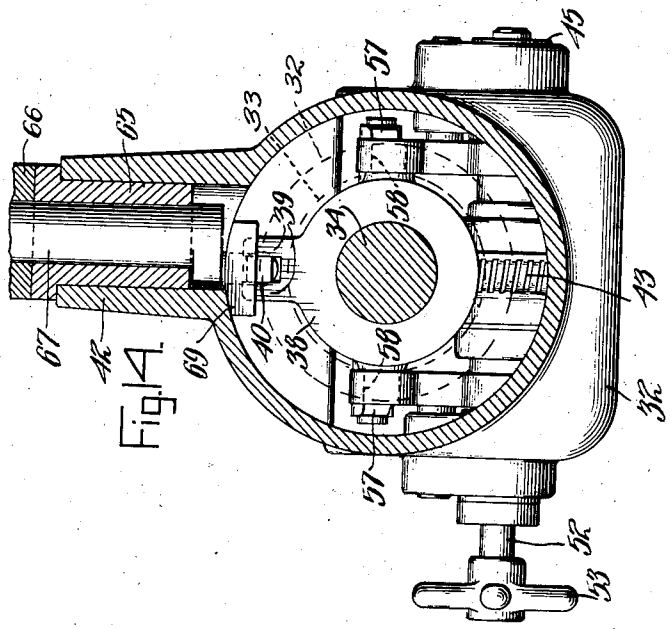


Fig. 14.

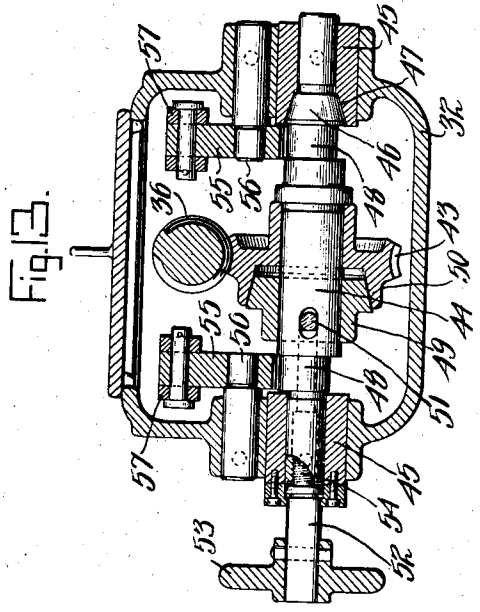


Fig. 13.

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April 13, 1926. 1,580,343

U. STEINER

GRINDING MACHINE

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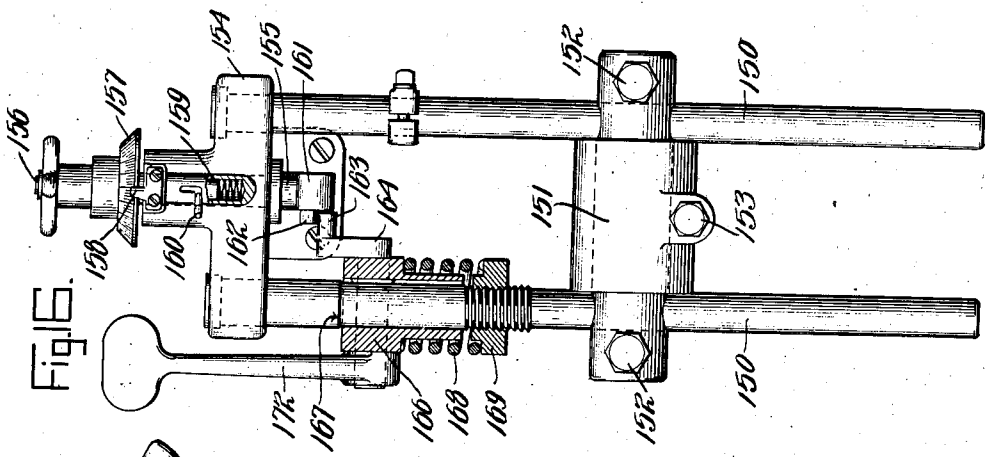


Fig. 16.

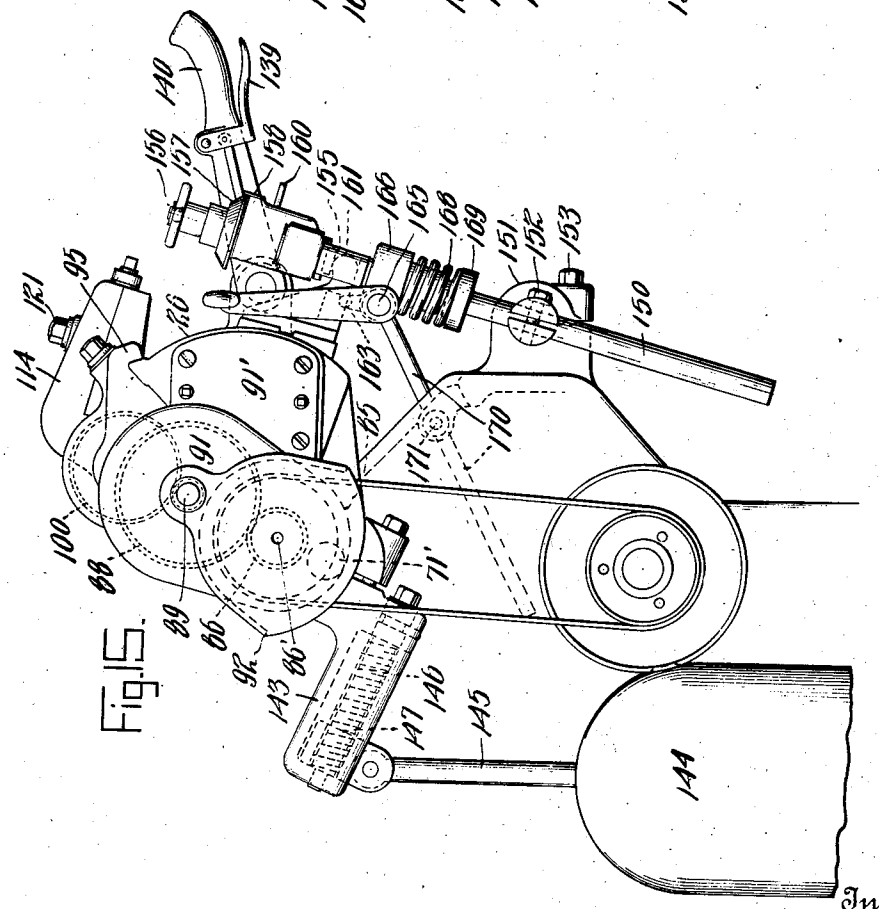


Fig. 15.

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April 13, 1926. 1,580,343

U. STEINER

GRINDING MACHINE

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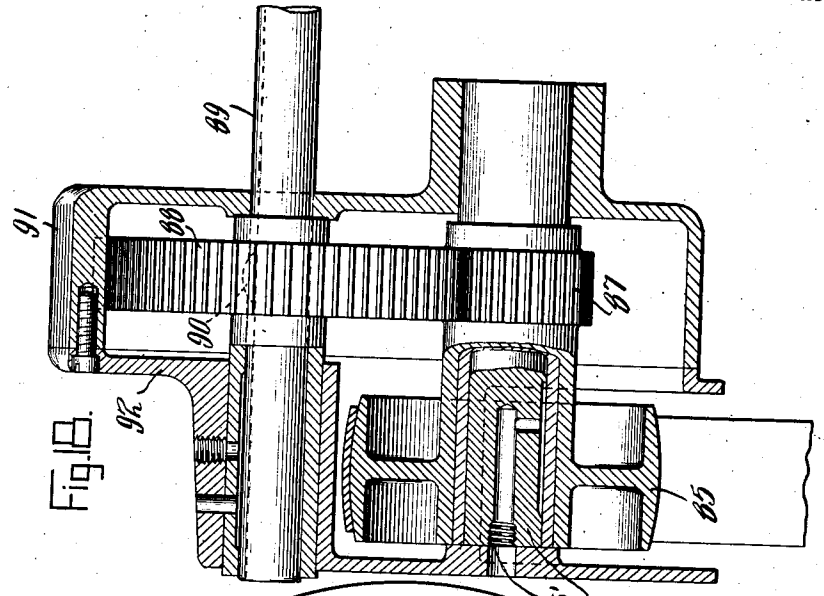


Fig. 18.

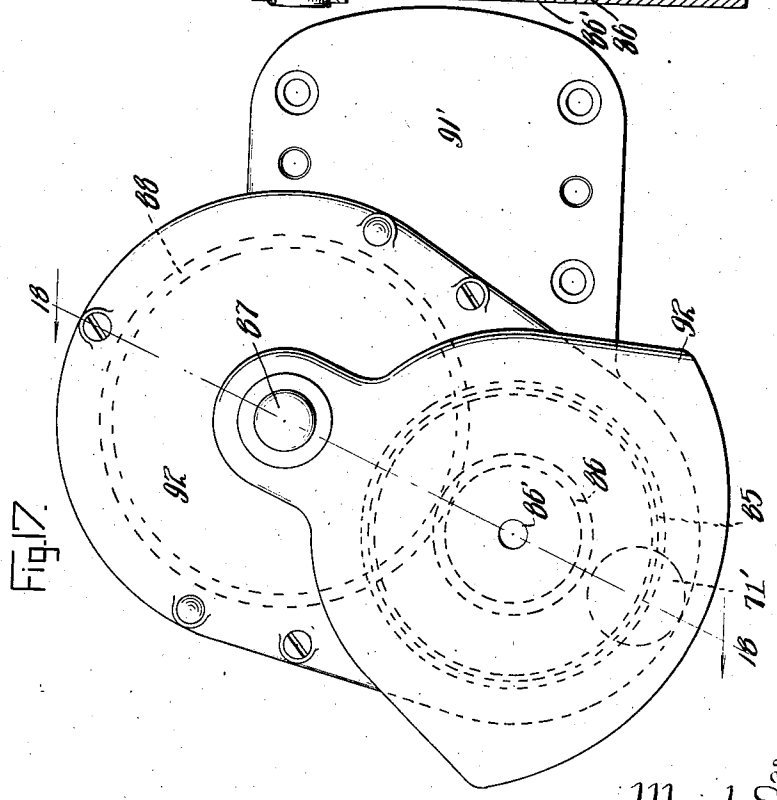


Fig. 17.

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By

Attorney

Patented Apr. 13, 1926. 1,580,343

UNITED STATES PATENT OFFICE.

ULRICH STEINER, OF LIMA, OHIO, ASSIGNOR TO LANDIS TOOL COMPANY, OF WAYNESBORO, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

GRINDING MACHINE.

Application filed December 7, 1920. Serial No. 428,951.

To all whom it may concern:

Be it known that I, ULRICH STEINER, a citizen of the United States, residing at Lima, in the county of Allen and State of Ohio, have invented certain new and useful Improvements in Grinding Machines, of which the following is a specification.

My said invention relates to grinding machines and the machine shown in the drawings is intended more particularly for special work, such as the facing of belt pulleys or pistons and the grinding of handles or knobs in a single operation.

One of the objects of my invention is to provide a machine in which all the parts are assembled in compact form and in which all the changes of operation can be determined from the front of the machine.

Another object of the invention is to provide an improved device for truing the grinding wheel.

Another object is to provide means for freeing the work from its holding devices when the table on which such holding devices are mounted is moved away from the wheel.

Referring to the accompanying drawings which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a front elevation of a completed machine constructed in accordance with my invention,

Figure 2, an elevation viewed from the left end of the machine,

Figure 3, a section through the work table on line 3—3 of Figure 1 showing the head stock in end elevation,

Figure 4, a front elevation of the head stock with parts broken away,

Figure 5, a front elevation of the foot stock, showing automatic means for withdrawing its work center at certain times,

Figure 6, a section on the line 6—6 of Figure 1, showing the foot stock and associated parts in end elevation and in working position.

Figure 7, a detail section of the support for the foot stock on line 7—7 of Figure 5 showing adjusting means for aligning the work center of the foot stock with that of the head stock,

Figure 8, a longitudinal section through the work center holding spindle of the foot stock,

Figure 9, a side elevation of the truing mechanism for the grinding wheel,

Figure 10, a vertical section of the same on line 10—10 of Figure 9,

Figure 11, a horizontal section of the same on line 11—11 of Figure 9,

Figure 12, an elevation of the mechanism for traversing the grinding wheel carriage, portions thereof being broken away,

Figure 13, a vertical section of the traversing mechanism on line 13—13 of Figure 12,

Figure 14, a vertical section on line 14—14 of Figure 12 with certain parts omitted.

Figure 15, an end elevation of the work-table, looking from the left, as in Figure 2,

Figure 16, a front view of means for holding the work table in operative position, also shown on a smaller scale in Figure 1,

Figure 17, an end elevation of a housing for the work driving gearing on a larger scale than in Figures 2 and 13, and

Figure 18, a section on line 18—18 of Figure 17.

In the drawings reference character 25 indicates a fixed frame on which the parts of the machine are supported. A work table 26 is provided for supporting the device to be operated on by an abrading means, e. g., grinding wheel 27. The grinding wheel is operated by a pulley 28 connected to any suitable source of power and mounted on a grinding wheel shaft 29 rotating in bearings on standards 30 and 31 at the ends of frame 25. The grinding wheel shaft in addition to its rotary movement may have a movement of reciprocation especially on plain cylindrical work, such as engine pistons, to prevent scoring or "ringing" of the work due to minor imperfections in the abrading device. The means for reciprocating the shaft and the wheel with it is as follows (see Figures 12, 13 and 14):

The standard 30 of the frame contains one of the bearings for shaft 29 and also has integral therewith a projecting collar 30′ to which is fixed, as by means of screw threads, a housing 32 for the projecting end

of spindle 29 which comprises a reduced portion 33, a second reduced portion 34, and a third reduced portion 35 provided at its outer end with a worm 36.

The portion 35 is screw threaded adjacent portion 34 of the shaft and carries a nut 37 which molds a yoke 38 in place on the portion 34. Rotation of this yoke is prevented by engagement of a pair of fingers 39 thereon with a squared portion 40 of a rod 41 secured in a casing 42. This casing surrounds the housing 32 and is free to move thereon in a longitudinal direction. Worm 36 engages a worm wheel 43 loosely mounted on a transverse shaft 44 journaled at its ends in bearings 45 on casing 42. This shaft carries a conical member 46 at one end, this member engaging a socket 47 of one of the bearings 45, and has between its ends a pair of eccentrics 48 and a cone member 49 for engagement with a cup member 50 on the worm wheel. The cone is keyed to the shaft at 51 and has operating means comprising a rod 52 with a hand wheel 53 thereon said rod being threaded at 54 to a sleeve fixed in the bearing 45. This rod at its inner end passes through a bore of shaft 44 and engages the key 51 to move the cone 49 into driving engagement with the worm wheel. When the shaft 44 is thus driven eccentrics 48 operate levers 55 pivoted at 56 and connected at their further ends to links 57. These links are adapted to move the yoke 38 by engagement with pins 58 projecting from said yoke and it will be seen that on rotation of the shaft 29 the worm 36 will act, if the clutch members 49 and 50 are in engagement with each other, through the worm wheel and its shaft 44 to slide the yoke back and forth in the housing 32, thus moving the shaft 29 longitudinally of itself and also moving the grinding wheel to avoid scoring of the work, as above set forth. If the clutch members are disengaged the worm wheel 43 will merely ride loosely on shaft 44.

The casing 42 is held against rotation by engagement of a lug 59 thereon with a finger 60 projecting from the standard 30, but it is adapted to slide longitudinally of the housing, the engagement between the members 59 and 60 and between the rod 41 and connected parts permitting such movement. This capacity for movement is given to the casing to permit adjustment of the position of the stroke of the grinding wheel 27 and the adjusting means comprises a shaft 61 with a hand wheel 62 for moving the friction device 63 into and out of engagement with a segment 64 fast to a sleeve 65 which is driven into an opening at the top of casing 42. A bracket 66 holds the rod 61 and is fixed to a shaft 67 journaled in sleeve 65, this shaft having at its lower end an eccentric pin 68. This pin engages an opening in a block 69 located in an annular groove 70 of housing 32. It will be seen that rotation of shaft 67 will move the casing 42 and the parts carried by the casing toward and from standard 30 and will thus change the longitudinal position of shaft 29 and the throw of the grinding wheel.

The work table 26 is pivoted to the front of the machine at 71, 71′ (Figures 5 and 6 respectively) for movement toward and from the grinding wheel and carries a head stock 72 and a foot stock 73 for supporting the work to be operated on. The driving means for the head stock comprises a pulley 74 on the shaft 29. This pulley drives a belt 75 which in turn actuates pulley 76, the belt being guided and held taut by idle pulleys 77 and 78, the latter mounted on an arm 78′ pivoted on a swinging bracket 80. Pulley 76 is fast on a shaft 79 journaled in the bracket 80 which is pivoted at 81 and connected by a link 82 to a bracket 26′ on the pivoted work table. The bracket is adjusted by a nut 82′ and locked in position by a nut 82″ (Figures 1 and 2). The shaft 79 also carries a pulley 83 over which a belt 84 passes to another pulley 85 mounted on a stub 86 and having integral therewith a pinion 87 (Figures 15 and 18) for driving the head stock on the tilting work-table. This pinion 87 is in mesh with a gear for driving a shaft 89 to which it is connected by a slidable key 90. The shaft 89 may thus slide through the gear and its housing to permit of adjustment of the head stock longitudinally of the work table. The parts just enumerated are enclosed in a housing 91 having attached thereto, as by screws, an end portion 92 with an enlargement to cover the pulley 85, and secured to the work table by a flange 91′. The stub shaft 86 is fixed at one end in housing 91 and held in position at the other end by a screw extending through housing member 92 which screw also closes an oil hole 86′ for the pulley.

The table 26 has longitudinal flanges 93 and 94 and the head stock 72 (Figures 3 and 4) is adjustably supported thereon near one end by an overhanging flange 95 and a separate lug 96 clamped in place by a bolt 107. The shaft 89 extends into the main casting 97 of the head stock and is held therein by a pinion 98 and a collar 99. The pinion 98 is adapted to drive a gear 100 on the face plate sleeve 104. This sleeve carries a cover plate 105 through which projects a work center 102 and the sleeve revolves about a spindle 101 clamped in place in main casting 97. Spindle 101 carries work center 102 and a bushing 103 and has a nut 106 threaded on its free end to hold sleeve 104 in place.

The foot stock 73 (Figures 5 and 8) is fastened adjustably at the other end of the work table by means of an overhanging flange 108 engaging flange 94 of the work

table and an adjustable lug 109 engaging the flange 93 of the table and clamped in adjusted position by a bolt 110. The foot stock has a work center 111 mounted in a hollow spindle 112, this spindle being slidable in a sleeve 113. The sleeve 113 has at its forward end a collar 120 to prevent access of dirt to the bearings. The sleeve 113 is clamped in an adjustable bracket 114 slidably mounted in transverse ways on the main casting 115 of the foot stock and adjustable by means of a screw 116 engaging a nut 117 fast to a stud 118 mounted in an orifice of the body 115. The head 119 of the screw is calibrated for convenience in adjusting the bracket, this adjustment being for the purpose of aligning the work centers of the head stock and the foot stock. The bracket 114 is held in adjusted position by means of screws 121 engaging the body 115.

A rock arm 122 on a rock shaft 123 engages as by a ball 124 a slot in the sleeve 112 and serves to withdraw the work center from the work. A spring 125 normally holds the work center in engaging position and its action is limited by a nut 125′ on the spindle 112. The rock shaft has an arm 126 carrying a ball 127 for engagement by an actuating member 128. This actuating member is in the form of an elongated channel member fast on a yoke 129 mounted to rock on the stub shaft 71 which constitutes one of the pivots for the work table. The yoke 129 has a lug 130 cooperating with a lug 131 on an adjustable collar 132 clamped to the stub shaft, the engagement of lugs 130 and 131 acting to limit the rocking movement of the yoke which is free to move on shaft 71 to a limited extent. A collar 133 on the stub shaft is adjustably secured to the fixed frame of the machine by a bolt 134 passing through a slot in the collar and having threaded engagement with an opening in one of the end standards of the frame. This collar has a notch 135 for engagement by a plunger 136 carried by a hand lever 137 (Figure 6) clamped at 138 on the machine frame. Lever 137 has a thumb latch 139 adjacent a hand piece 140, the thumb latch being connected by a link 141 to the plunger 136 for withdrawing it from engagement with the collar. A spring 142 normally moves the plunger in the opposite direction. This hand lever when moved downwardly from the position shown in Figure 6 serves to bring the work table out of working relation with the grinding wheel and as it moves toward the idle position the ball 127 of rock shaft 123 will be retarded by the member 128 and will swing the rock shaft to retract the sleeve 112 and thus withdraw the work center 111 from the work. The engagement of plunger 136 in notch 135 serves to prevent accidental contact of the work table with the grinding wheel, when there is no work on the table.

The work table has rearwardly projecting arms 143 to which are attached weights 144 by links 145 and these weights are adjustable so as to counterbalance the weight of the table and its associated parts, such adjustment being had by means of screws 146 engaging blocks 147 movable in slots in the arms 143 to vary their distance from the pivots 71 and 71′ (Figure 15).

As a second means for moving the work table away from the work in addition to the hand lever 140 just described I may provide a pedal 148 (Figure 1) having an adjustable connecting rod 149 extending upwardly therefrom and pivoted to the work table in advance of the line of the pivots 71 and 71′ whereby the table may be drawn away from the work to withdraw the plunger 136 from the notch 135.

To limit the movement of the work table toward the grinding wheel accurately I may provide a yoke consisting of a pair of rods 150, (Figs. 1, 2, 15 and 16), adjustably mounted on a forward projection 151 of the fixed frame as by passing them through the slitted ends of a pivot bolt 151′ wherein they are clamped by screws 152, the bolt in turn being clamped in place by a screw 153 on the machine frame. At their upper end the rods have a cross head 154 and this cross-head carries an adjustable head 155 screw-threaded therein and adapted to be adjusted by means of a hand wheel 156 having a calibrated annular projection 157 cooperating with a pointer 158 to indicate the correct position of adjustment. A spring-pressed rod 159 movable in a boss on the crosshead 154 acts as a brake on the annular projection to prevent accidental revolution of the head 155. This rod may be held in retracted position by means of a pin 160 movable in a bayonet slot. A projection 161 on the table is at a distance from the head 155 when the machine starts grinding on a piece of work, but approaches it as grinding continues and finally engages it just as the work gets down to size, thus preventing excessive grinding. The head has at one side an extension 162 with a notch in which a pin 163 may engage. This pin is formed on an arm 164 of a rock shaft 165 mounted in a sleeve 166 on one of the standards 150. The sleeve 166 is loose on the standard and is normally forced upwardly against a shoulder 167 by a spring 168 held in place by an adjustable screw 169. The spring 168 serves to hold the work yieldably against the grinding wheel and the degree of pressure of the spring may be varied by means of the nut 169. Rotation of the sleeve 166 on the standard is prevented by means of a rod 170 attached to the rear side of the

collar 166 and extending through a hole in a rod 171 pivotally mounted in the frame 25. A thumb latch 172 on the end of shaft 165 serves as a means to release the holding pin 162.

The wheel truing device (Figures 9 to 11) comprises a base 173 having flanges 174 slidably engaging flanges 175 on a member fixed to the frame of the machine. The frame 173 is manually adjustable by means of a screw 176 engaging a threaded collar fixed in the frame, said screw being connected by means of a shaft and two sets of bevelled gearing in the gear casing 177 to a shaft 178 extending toward the front of the machine and having a crank with a handle adapted to be turned by the operator standing at the front of the machine, to adjust the truing device backward and forward. A head 179 is mounted on the base 173 for lateral adjustment of the truing device and this head is reciprocated by means of a nut 180 having a screw 181. This screw is held against longitudinal movement by a collar 182 and a gear casing 173 and is connected by beveled gears to a shaft 184 also extending toward the front of the machine and adapted for manual operation in the same manner as shaft 178 to reciprocate the truing device across the grinding wheel. In an enlargement 185 of the frame 179 is mounted a rod 186 carrying at one end a diamond holder 187 for holding the diamond 188 and spring pressed by a spring 189 away from the wheel. This rod 186 has at its rear end a pointed portion 190 in engagement with a pattern block 191 carried by the adjustable frame 173. This block may have its forward side straight as shown when used with a wheel having a straight grinding surface or it may have a concave or convex face or any other form desired according to the shape or curvature to be imparted to the face of the wheel. Preferably the truing device is covered by a hood 192 having panels 193 and 194 for access to the diamond.

In the operation of the machine, it being considered that the table has no work on it the position of parts may be as shown in Figure 6, the latch 136 determining the nearest approach of the table to the grinding wheel and preventing it from moving so close as to cause damage to the wheel or table or both. The operator will now adjust the head 155 in accordance with the size to which the work is to be reduced, by turning hand wheel 156 until the proper mark on skirt 157 registers with pointer 158 and will then release the pin 160 from the bayonet slot in the boss on cross head 154 so that brake 159 may hold the head in adjusted position. The operator will also adjust the nut 169, (Fig. 16) to provide the proper amount of pressure between the work and the grinding wheel. In exceptional cases it may also be necessary to change the adjustment of the standards 150 as by moving them up or down or by rocking the bolt 151.

To bring the work table down to a convenient position for placing a piece of work thereon it may now be swung down on its pivots 71 by operation either of the hand lever 137 or the pedal 148. Thereupon the workman will place a piece of work against work center 102 and move the table toward the wheel as by pressing his body against it. The rock shaft 123 being released, as the table moves upward, from the action of the channel member 128 the work center 111 will be moved into engaging position with the work by its spring 125. The grinding may now proceed until the projection 161 engages the head 155 to stop the action of the wheel. The operator will now move thumb-piece 172 to release projection 161 and will swing the work table away from the grinding wheel preferably by means either of the pedal or the hand lever when the work center 111 will be retracted and the completed piece of work may be replaced by another when the machine is ready to go through the same cycle again.

When it becomes necessary to true the wheel the operator will place on the form 173 a pattern block 191 of a conformation corresponding to the desired shape for the face of the wheel and will then turn the crank on shaft 178 and thus run the frame 173 up to the wheel, after which he will turn the crank on shaft 184 to traverse the diamond back and forth to remove irregularities from the wheel and bring it to the desired shape.

My machine or parts thereof will be found useful in other arts and for various purposes, and various modifications will occur to those skilled in the useful arts and I do not therefore limit myself in these respects except as set forth in the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a grinding machine, an abrading device, a worktable pivoted to move the work toward and from the abrading device, a bracket adjustable along the table, a headstock carried by the bracket, a shaft on the headstock carrying a work center, a gear splined to the shaft for movement along the same, a pulley adjacent to the center of oscillation of the table connected to drive said gear, and means for driving pulley, substantially as set forth.

2. In combination a tool holder, a work table movable toward and from the tool holder, a head stock and a foot stock on the work table, work centers on said head and foot stock and connections between the table and one of the work centers for withdraw-

ing said center from the work as the table is moved away from the workholder, substantially as set forth.

3. In combination, an abrading device, a work table pivotally mounted to move toward and from said device, a head stock and a foot stock on the work table, each having a work center and means operated by the movement of the table for retracting one of said work centers as the table is moved away from the work, substantially as set forth.

4. In a grinding machine, a grinding wheel mounted for rotation, a work table mounted to move toward and from the grinding wheel, a head stock and a foot stock on said table, a slidable work center in said foot stock, a spindle therefor and means to move the same comprising a rock shaft pivoted on the foot stock and having an arm in engagement with the spindle of the work center, a second arm on the rock shaft and means for automatically engaging the same and retracting the work center as the table moves away from the grinding wheel, substantially as set forth.

5. In a grinding machine, a grinding wheel mounted for rotation, a work table mounted to move toward and from the grinding wheel, a head stock and a foot stock on said table, a slidable work center in said foot stock, a spindle for the work center, and means to move the same longitudinally comprising a rock shaft pivoted on the foot stock having an arm to engage the spindle of the work center, a second arm on the rock shaft and means adapted to engage the same and retract the work center as the table moves away from the grinding wheel, said means comprising a yoke mounted coaxially with the table and means thereon for engagement with an arm of the rock shaft, substantially as set forth.

6. In a grinding machine, a grinding wheel mounted for rotation, a work table mounted to move toward and from the grinding wheel, a head stock and a foot stock on said table, a slidable work center in said foot stock, a spindle for the work center, and means to move the same longitudinally comprising a rock shaft pivoted on the foot stock having an arm to engage the spindle of the work center, a second arm on the rock shaft, means adapted to engage the same and retract the work center as the table moves away from the grinding wheel, said means comprising a yoke mounted coaxially with the table and having a lost motion connection with its pivot, means for varying the extent of the lost motion and means on the yoke for engagement with an arm of the rock shaft, substantially as set forth.

7. In a grinding machine, an abrading device, a work table pivotally mounted to move toward and from the abrading device, a hand lever fixed to the work table having a manually retractable plunger thereon, means engaging said plunger to limit movement of the table toward the abrading device and adjustable means for limiting the movement of the table to correspond to the desired thickness of the work, substantially as set forth.

8. In a grinding machine, an abrading device, a work table pivotally mounted for movement toward and from said device, a head stock and a foot stock on the table, counterbalancing means for the table, and means to limit the movement of the table toward the abrading device comprising a head to engage a projecting portion of the table and means for adjusting the head, substantially as set forth.

9. In a grinding machine, an abrading device, a work table pivotally mounted for movement toward and from said device, a head stock and a foot stock on the table, counterbalancing means for the table, means to limit the movement of the table toward the abrading device comprising a supporting device mounted on the machine frame, an adjustable head on the supporting device adapted to engage a projecting portion of the table and yieldable means on the supporting device to engage said projection whereby the work is yieldably held in engagement with the abrading device, substantially as set forth.

10. In combination, an abrading device, a work table pivotally movable toward and from the device, means to move the table yieldably toward the abrading device, means for quickly interrupting the connection between said table and said yieldable means and means to limit such movement of the table, substantially as set forth.

11. In combination a tool holder, a work table movable toward and from the tool holder, resilient means acting on the table whereby the work is held yieldably in engagement with the tool acting thereon, means for automatically limiting the movement of the table toward the tool holder and an auxiliary limiting means adjustable according to the desired thickness of the work, substantially as set forth.

12. In combination, an abrading device, a work holder pivotally movable toward and from the same, adjustable means to limit the movement of the table toward the abrading device, means to move the table yieldably toward the device and manual means to disengage said yieldable means quickly from the table, substantially as set forth.

13. In combination a rotary tool holder, a work table movable toward and from the tool holder, work holding means on the table, means for rotating the same comprising a pulley on the work holding means, a bracket on a fixed pivot, a pulley on said bracket, a

belt connecting said pulleys, a second pulley on the bracket driven by the first, a belt connecting said pulley to the tool holder, and means connecting the bracket to the work holder whereby the bracket is moved to slacken the latter belt when the work holder is moved out of operative position, substantially as set forth.

14. In a grinding machine, an abrading device, a shaft for rotating the same, a work table mounted to move toward and from the abrading device, work holding means on the table, a pulley on said shaft, a pulley for driving the work holding means, a pivoted bracket, a pair of pulleys on the bracket, a belt connecting the first named pulley to one of the pulleys on the bracket, a belt connecting the second pulley to the other pulley on the bracket, and a link between the bracket and the table to move the bracket and slack the second belt when the table is moved out of operative position, substantially as set forth.

15. In a grinding machine, an abrading device, means for rotating the same, a work table adapted for swinging movement toward and from the abrading device, means for rotating the work on the table comprising belt gearing connected to the rotary work and to the rotary abrading device, and a link connecting the swingable table with a gravity actuated pulley of the belt gearing to cut off the power from the rotary work when the table is moved away from the abrading device, substantially as set forth.

16. In a grinding machine, a head stock, a spindle fixed therein, a work center attached to the spindle, a face plate mounted for rotation on the spindle, and means to hold the face plate on the spindle comprising a nut threaded on the spindle and means to lock the same against rotation, substantially as set forth.

17. In combination a movable device and means for limiting its movement in one direction comprising a pair of adjustable rods, means for holding them in adjusted position, a cross head on said rods and an adjustable stop on said cross head for engaging said device, substantially as set forth.

18. In combination a movable device and means for limiting its movement in one direction comprising a pair of adjustable rods, means for holding them in adjusted position, a cross head on said rods, a stop on said cross head for engaging said device, means for giving the stop a micrometer adjustment and means for holding the same in adjusted position, substantially as set forth.

19. In combination an oscillatory device and means for limiting its movement in one direction comprising a pair of rods, means for supporting them for sliding and rocking adjustment, a stop movable up and down on one of said rods and yieldingly and adjustably supported thereon, substantially as set forth.

20. In combination a movable device and means for limiting its movement in one direction comprising a pair of rods, means supporting them for sliding and rocking adjustment, a stop movable up and down on one of said rods and yieldingly and adjustably supported thereon, and means to prevent rotation of said stop about said rod, substantially as set forth.

21. In combination a movable device and means to limit its movement comprising a pair of rods, a stop mounted on said rods, means for limiting the movement of the device in one direction, for adjusting the rods, and a yieldable stop on one of said rods adapted to engage the opposite side of said device whereby the device is held against movement in the opposite direction, substantially as set forth.

22. In combination a machine frame, a bar mounted therein for rocking adjustment, means for clamping the bar in adjusted position said bar having its ends slit and having transverse holes adjacent the slits, rods mounted in said holes and means for clamping them in place, a sleeve on one of said rods, a rock shaft journaled in the sleeve having at one end an eccentric pin and at the other a thumb piece, a spring for moving the latch upwardly against a shoulder on the rod, and a nut in engagement with said spring, substantially as set forth.

23. In combination, pivots, a work table mounted thereon and extending to one side of the axis of the pivots, arms on the table extending to the other side of said axis, said arms having slots therein, nuts traveling in said slots, screws in the slots engaging the nuts for adjustment thereof and weights depending from the nuts for counterbalancing the work table, substantially as set forth.

24. In a grinding machine, a reciprocatory abrading device, an elongated worktable mounted for movement toward and from the path of said abrading device, and separate means for limiting the movement of the table toward the abrading device when empty and supplied with work respectively, substantially as set forth.

25. In a grinding machine, a reciprocatory abrading device, an elongated worktable mounted for movement toward and from the path of said abrading device, means yieldably impelling said table toward the abrading device, and separate means for limiting the movement of the table toward the abrading device when empty and when supplied with work respectively, substantially as set forth.

26. In a grinding machine, a reciprocatory abrading device, an elongated worktable pivotally mounted for movement to-

ward and from the path of said abrading device, means for limiting the movement of the empty table toward the abrading device and independent means for limiting such movement of the table when supplied with work, substantially as set forth.

27. In a grinding machine, a reciprocatory abrading device, an elongated worktable pivotally mounted for movement toward and from the path of said abrading device, means yieldably impelling the table toward the abrading device, means for positively limiting the movement of the empty table toward the work, auxiliary means for yieldably impelling the table toward the abrading device when supplied with work, and independent means for limiting such movement, substantially as set forth.

28. In a grinding machine, a reciprocatory abrading device, a worktable pivotally mounted for movement toward and from the path of said abrading device, an abutment projecting rearwardly from said table, a yoke for limiting the movement of the table toward the abrading device straddling said abutment, and means carried by said yoke for yieldably impelling the table toward the abrading device, substantially as set forth.

29. In a grinding machine, a reciprocatory abrading device, a worktable pivotally mounted for movement toward and from the path of said abrading device, an abutment projecting rearwardly from said table, a yoke limiting the movement of said abutment in one direction said yoke including a pair of rods attached to the fixed frame of the machine, and means on one of said rods for yieldably impelling the table toward the abrading device, substantially as set forth.

30. In a grinding machine, a reciprocatory abrading device, a worktable pivotally mounted for movement toward and from the path of said abrading device, an abutment projecting rearwardly from said table, a yoke limiting the movement of said abutment in one direction said yoke having a pair of rods on the fixed frame of the machine for supporting it, and means on one of said rods for yieldably forcing the table toward the abrading device including a rockshaft having a rockarm at one end thereof adapted to engage said abutment and a rockarm at the other end for moving the rockshaft, substantially as set forth.

31. In a grinding machine, a reciprocatory abrading device, a worktable pivotally mounted for movement toward and from the path of said abrading device, an abutment projecting rearwardly from said table, a yoke limiting the movement of said abutment in one direction said yoke including a pair of rods attached to the fixed frame of the machine, means on one of said rods for yieldably impelling the table toward the abrading device, a sleeve on one of said rods, a spring surrounding the rod and pressing the sleeve against said abutment, and a nut threaded on the rod and adapted to adjust the spring, substantially as set forth.

32. In a grinding machine, a pivotally movable device, an abutment thereon, a crosshead having means to engage said abutment and limit such movement, a pair of rods supporting said crosshead, a spring on one of said rods for yieldably impelling said abutment toward the crosshead, a sleeve resting on the spring, a manually actuable rockshaft on the sleeve adapted to engage the abutment, and means on the sleeve engaging the fixed frame of the machine to prevent rotation of the sleeve, substantially as set forth.

33. In a grinding machine, an abrading device, a pivoted worktable, an abutment projecting rearwardly therefrom, a crosshead for engaging said abutment to limit the movement of the table, an abutment on the crosshead, means for adjusting the same toward and from the first named abutment, and means for locking said adjusting means in place, substantially as set forth.

34. In a grinding machine, a reciprocatory abrading device, a worktable pivotally mounted for movement toward and from the path of said abrading device, an abutment projecting rearwardly from said table, a yoke limiting the movement of said abutment in one direction said yoke including a pair of rods for supporting it, and clamping means carried by the fixed frame of the machine and supporting said rods to provide for adjustably determining the limit of movement of the table, substantially as set forth.

35. In a grinding machine, a reciprocatory abrading device, a worktable pivotally mounted for movement toward and from the path of said abrading device, an abutment projecting rearwardly from said table, a yoke limiting the movement of said abutment in one direction said yoke including a pair of rods for supporting it, and a pivot bolt on which said rods are adjustable vertically relatively to said abutment said bolt providing a rocking adjustment for the yoke, substantially as set forth.

36. In a grinding machine, an abrading device and a worktable having relative approaching and receding movement, a tail stock on the worktable, a work center carried by the tail stock, a rockshaft carried by the table, an arm thereon adapted to retract said work center during the receding movement, a second arm on the rockshaft, and a channeled actuating member engaging the latter rockarm, substantially as set forth.

37. In a grinding machine, an abrading device and a worktable having relative approaching and receding movement, a tail

stock adjustable longitudinally of the worktable, a work center carried by the tail stock, a rockshaft carried by the table, an arm thereon adapted to retract said work center during the receding movement, a second arm on the rockshaft, and an actuating member in engagement with said rockarm in all positions of adjustment of the tail stock, substantially as set forth.

38. In a grinding machine, an abrading device and a worktable having relative approaching and receding movement, a tail stock adjustable longitudinally and transversely of the worktable, a work center carried by the tail stock, a rockshaft carried by the table, an arm thereon adapted to retract said work center during the receding movement, a second arm on the rockshaft, and an actuating member in engagement with said rockarm in all positions of adjustment of the tail stock, substantially as set forth.

39. In a grinding machine, an abrading device, a worktable pivotally mounted for movement toward and from the abrading device, a work center on the table, an actuating member pivoted coaxially of the table for movement therewith, means to stop the rearward movement of said member before the rearward movement of the table stops, and connections from the actuating member to the work center whereby the work center is retracted when the movement of the actuating member ceases, substantially as set forth.

40. In a grinding machine, an abrading device, a pair of stub shafts adjacent thereto, a worktable pivoted on the stub shafts for movement toward and from the abrading device, a detent carried by the table, a collar on one of the stub shafts having a notch for engagement by the detent to limit the movement of the table, and a pin passing through a slot on the collar into the frame whereby the position of the collar may be varied to change the limit of movement of the table, substantially as set forth.

41. In a grinding machine, an abrading device, a worktable pivoted for movement toward and from the abrading device, a stub shaft forming one of the pivots of the table, a work center on the table, a spring to move it in one direction, a rockshaft for moving it in the other, a controlling device on the stub shaft connected to said rockshaft, means to stop the movement of the controlling device before the table stops whereby said rockshaft is caused to move the work center, and means on the stub shaft for adjustably varying the position of the stopping means, substantially as set forth.

42. In a grinding machine, an abrading device, a worktable pivoted for movement toward and from the abrading device, a stub shaft forming one of the pivots of the table, means on the stub shaft to stop the movement of the table, a work center on the table, a spring to move it in one direction, a rockshaft for moving it in the other, a controlling device on the stub shaft connected to said rockshaft, means to stop the movement of the controlling device before the table stops whereby said rockshaft is caused to move the work center, and means on the stub shaft for adjustably varying the position of each of the stopping means, substantially as set forth.

43. In combination, a holder for a rotary tool, a work table pivoted for movement toward and from the path of the tool holder, adjustable counterbalancing means for the table, yielding means for forcing the workholder toward the tool holder, and means for varying the action of such yielding means, substantially as set forth.

44. In combination, a holder for a rotary tool, a work table pivoted for movement toward and from the path of the tool holder, resilient means acting on the table to hold the work yieldingly against the tool, adjustable means to limit the movement of the work table toward the tool holder, and means for locking said limiting means in adjusted position, substantially as set forth.

45. In combination, a holder for a rotary tool, a work table pivoted for movement toward and from the path of the tool holder, means to move the table yieldably toward the abrading device, means for quickly interrupting the connection between said yieldable means and the table, and means to limit such movement of the table, substantially as set forth.

46. In combination, a holder for a rotary tool, a work table pivoted for movement toward and from the path of the tool holder, resilient means acting on the table whereby the work is held yieldably in engagement with the tool acting thereon. fixed means for limiting the movement of the table toward the tool holder by said resilient means, and an auxiliary limiting means adjustable according to the desired thickness of the work, substantially as set forth.

47. In combination, a holder for a rotary tool, a work table pivoted for movement toward and from the path of the tool holder, adjustable means to limit the movement of the table toward the abrading device, means to move the table yieldably toward the device, and manual means to disengage said yieldable means quickly from the table, substantially as set forth.

48. In a grinding machine, abrading means, a work table pivotally mounted for movement toward and from said abrading means, and means for limiting its movement in one direction comprising a pair of adjustable rods, means for holding them in adjusted position, a cross head on said rods and an adjustable stop on said cross head for

engaging said device, substantially as set forth.

49. In a grinding machine, abrading means, a work table pivotally mounted for movement toward and from said abrading means, and means for limiting its movement in one direction comprising a pair of adjustable rods, means for holding them in adjusted position, a cross head on said rods, a stop on said cross head for engaging said device, means for giving the stop a micrometer adjustment, and means for holding the stop in adjusted position, substantially as set forth.

50. In a grinding machine, abrading means, a work table pivotally mounted for movement toward and from said abrading means, and means for limiting its movement in one direction comprising a pair of rods, means for supporting them for sliding and rocking adjustment, a stop movable up and down on one of said rods and yieldingly and adjustably supported thereon, substantially as set forth.

51. In a grinding machine, abrading means, a work table pivotally mounted for movement toward and from said abrading means, and means for limiting its movement in one direction comprising a pair of rods, means for supporting them for sliding and rocking adjustment, a stop movable up and down one one of said rods and yieldingly and adjustably supported thereon, and means to prevent rotation of said stop about said rod, substantially as set forth.

52. In a grinding machine, abrading means, a work table pivotally mounted for movement toward and from said abrading means, means for limiting its movement comprising a pair of rods, a stop mounted on said rods for limiting the movement of the device in one direction, means for adjusting the rods, and a yieldable stop on one of said rods adapted to engage the opposite side of said device whereby the device is held against movement in the opposite direction, substantially as set forth.

53. In a grinding machine abrading means, a work table pivotally mounted for movement toward and from said abrading means, means to move the table toward said abrading means comprising a bar mounted for rocking adjustment, means for clamping the bar in adjusted position said bar having its ends slit and having transverse holes adjacent the slits, rods mounted in said holes and means for clamping them in place, a sleeve on one of said rods, a rock shaft journaled in the sleeve having at one end an eccentric pin and at the other a thumb piece, a spring for moving the latch upwardly against a shoulder on the rod, and a nut in engagement with said spring, substantially as set forth.

In witness whereof, I have hereunto set my hand and seal at Lima, Ohio, this 4th day of December, A. D. nineteen hundred and twenty.

ULRICH STEINER. [L. S.]