S. S. SHIELDS & W. E. WINE.

VALVE GRINDING AND FITTING MACHINE.

APPLICATION FILED FEB. 21, 1911.

1,042,614. Patented Oct. 29, 1912.

5 SHEETS—SHEET 1.

FIG. 1.

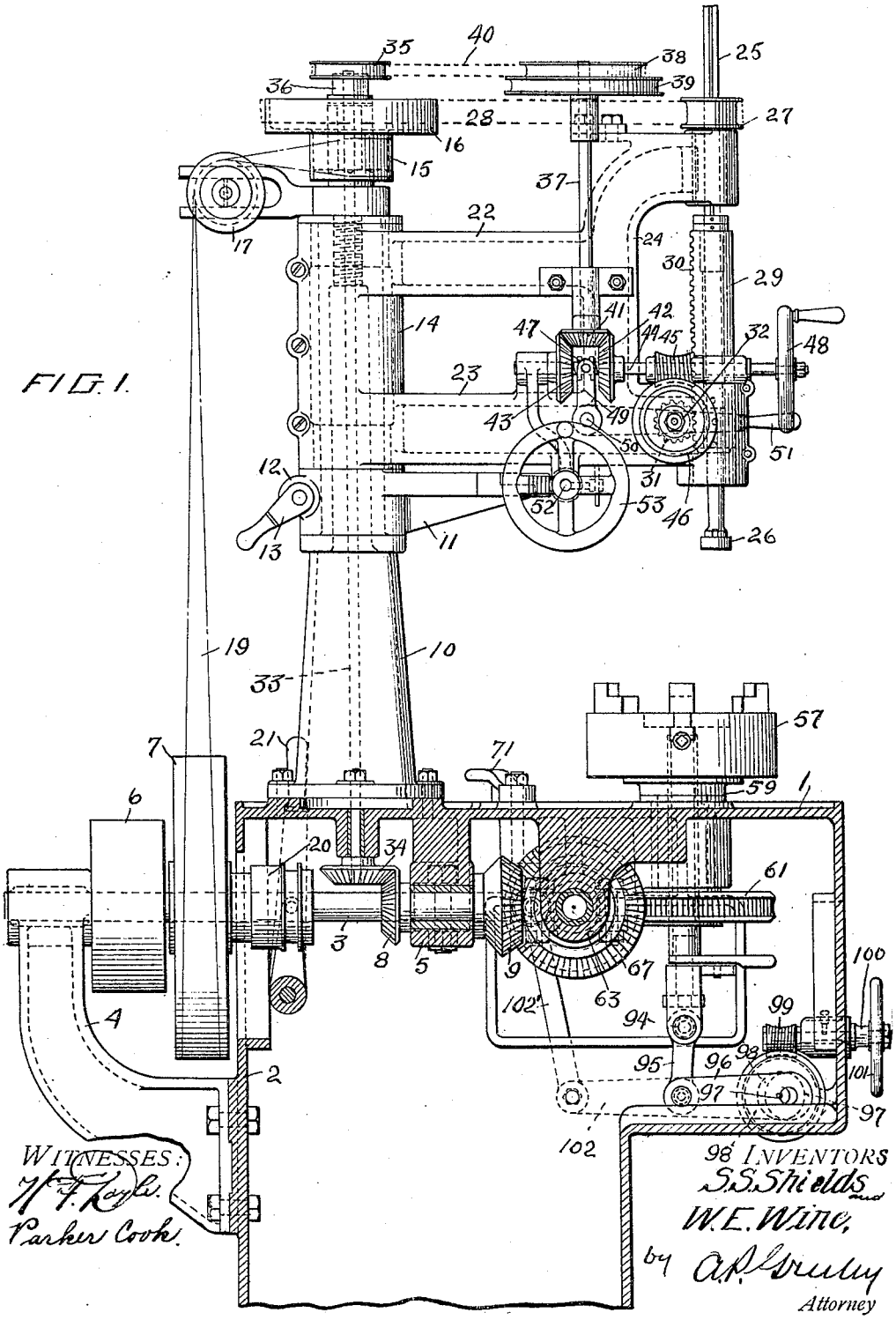

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FIG. 2.

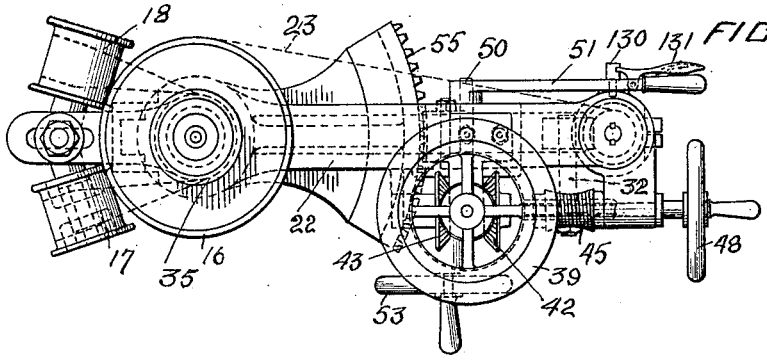
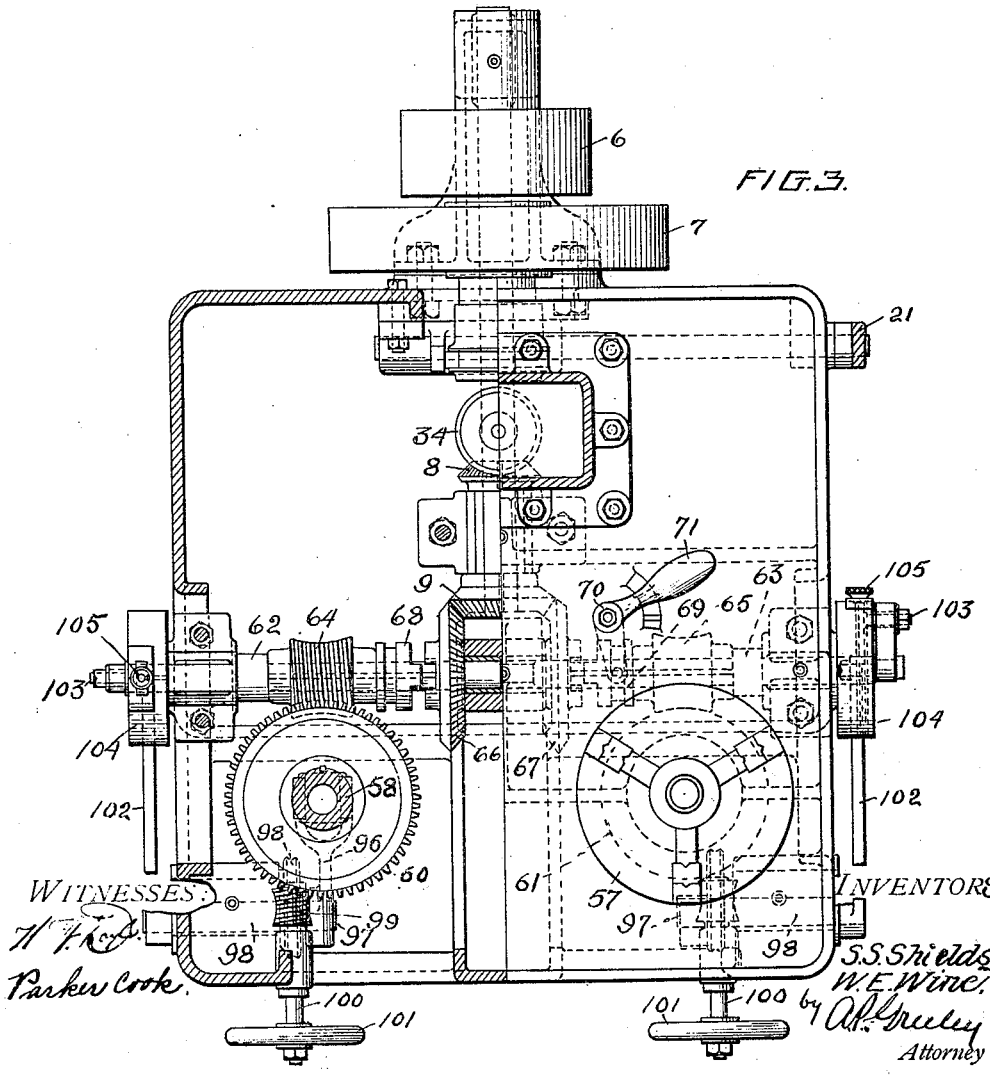


FIG. 3.



WITNESSES:

H. F. A. Parker Cook.

INVENTORS

S. S. Shields,
W. E. Wine.
by A. H. Greeley
Attorney

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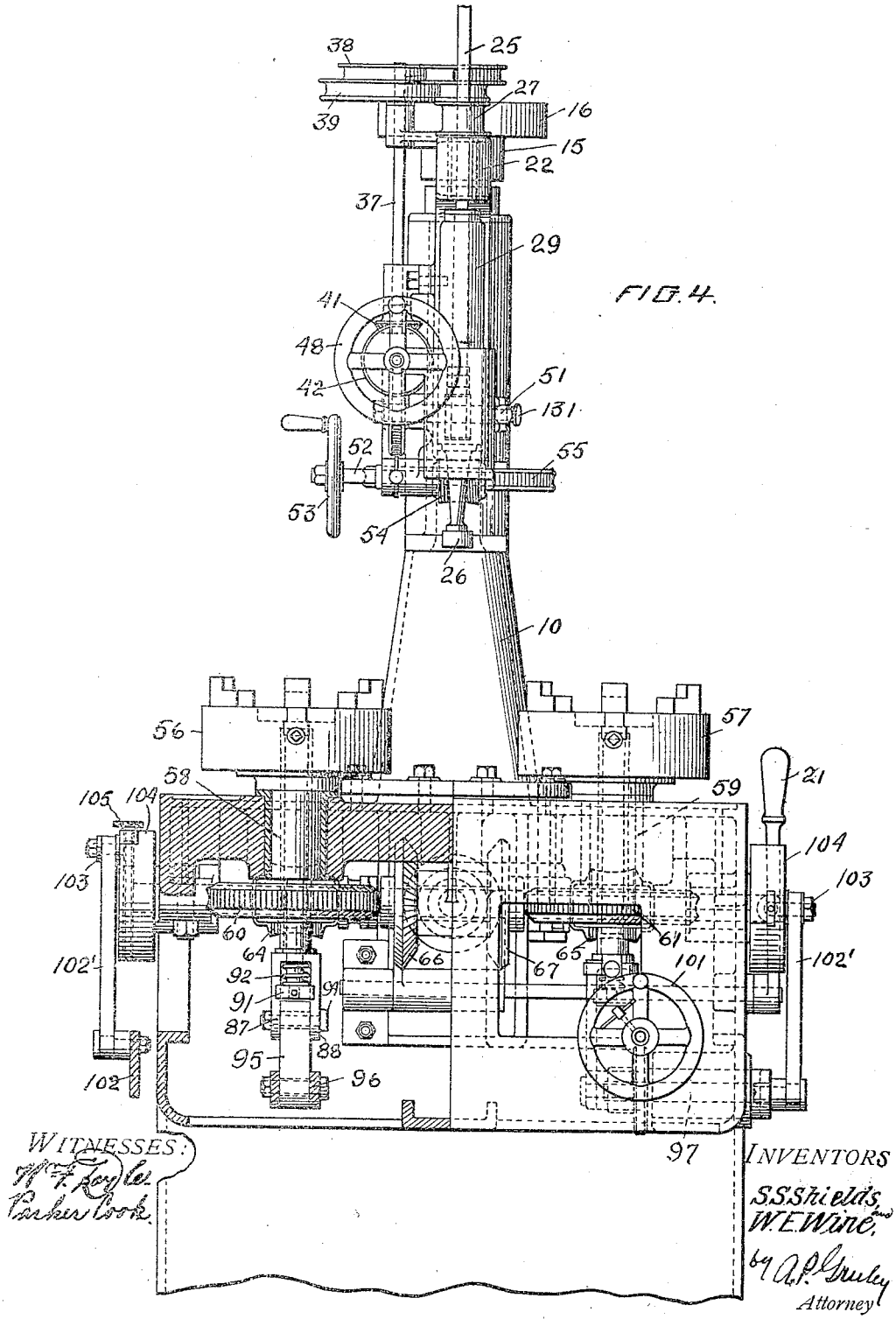

FIG. 4.

WITNESSES:
H. F. Keyser
Parker Cook.

INVENTORS
S. S. Shields,
W. E. Wine,
by A. P. Gurley
Attorney

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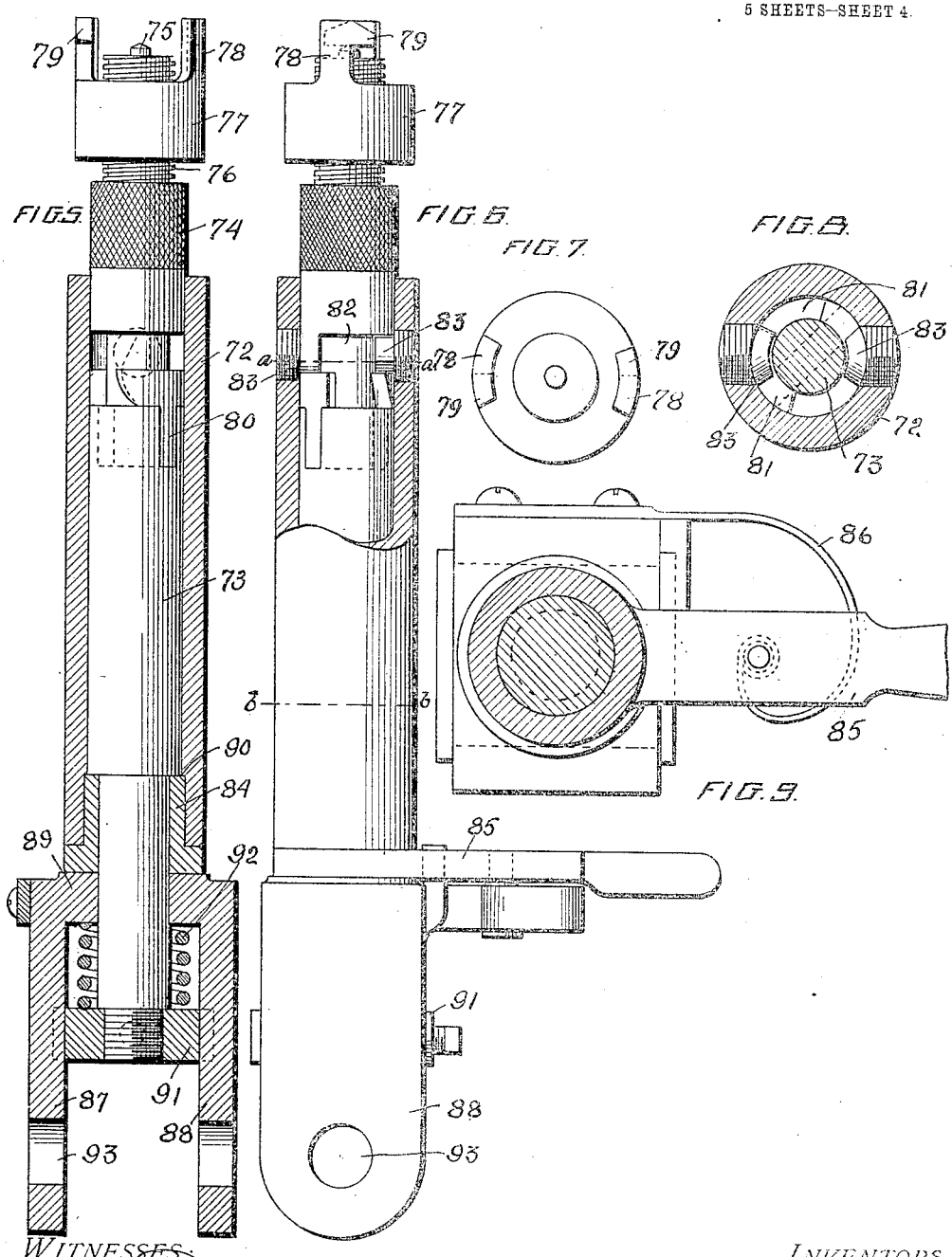
5 SHEETS—SHEET 4.



WITNESSES:
M. F. Doyle.
Parker Cook.

INVENTORS
S. S. Shields and
W. E. Wine,

BY
A. P. Greeley
Attorney

S. S. SHIELDS & W. E. WINE.

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5 SHEETS—SHEET 5.

FIG. 10.

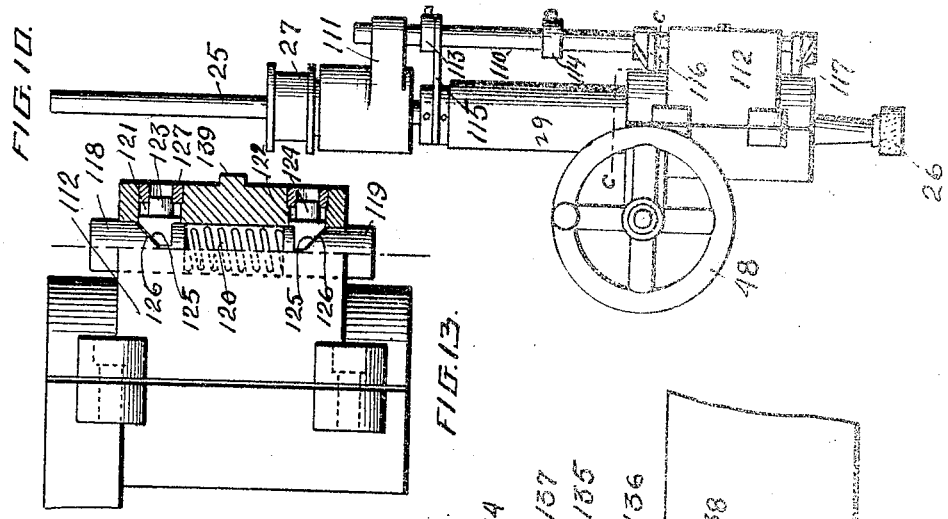


FIG. 13.

FIG. 11.

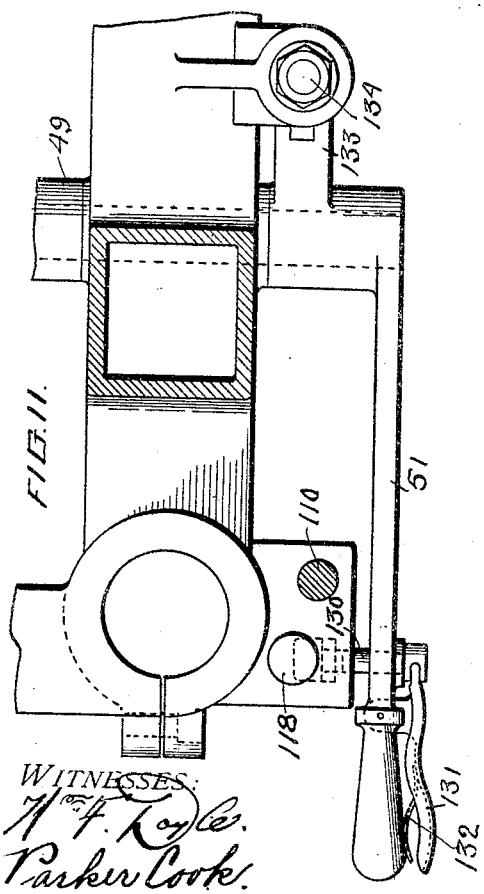
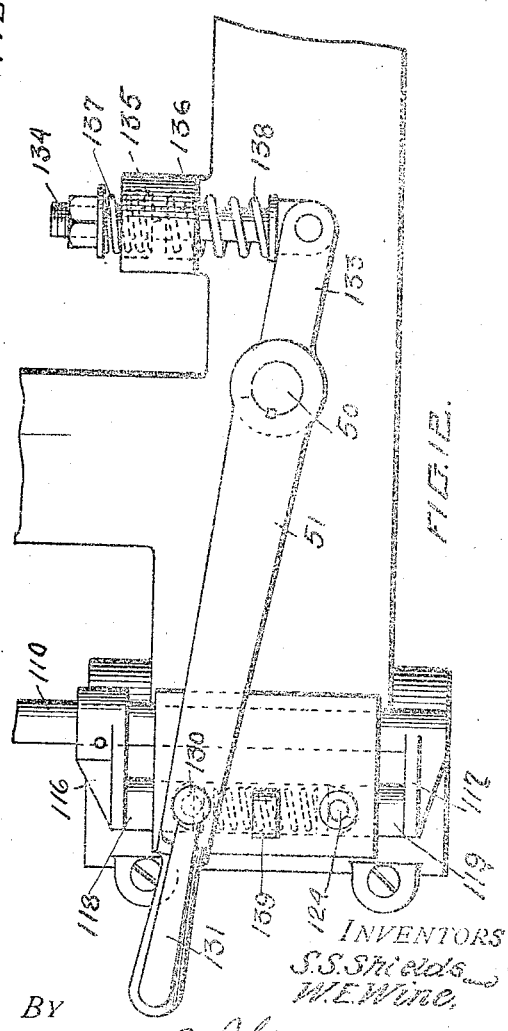


FIG. 12.



WITNESSES:

W. F. Coyle.

Parker Cooke.

INVENTORS

S. S. Shields.

W. E. Wine.

BY

A. P. Greeley

Attorney

UNITED STATES PATENT OFFICE.

SANFORD S. SHIELDS AND WILLIAM E. WINE, OF WILMINGTON, NORTH CAROLINA.

VALVE GRINDING AND FITTING MACHINE.

1,042,614. Specification of Letters Patent. Patented Oct. 29, 1912.

Application filed February 21, 1911. Serial No. 610,097.

To all whom it may concern:

Be it known that we, SANFORD S. SHIELDS and WILLIAM E. WINE, citizens of the United States, residing at Wilmington, in the county of New Hanover, State of North Carolina, have invented certain new and useful Improvements in Valve Grinding and Fitting Machines, of which the following is a description, reference being had to the accompanying drawings, forming a part hereof.

Our invention relates to machines for grinding the bushings and wearing in the packing rings of triple valves and the like and has for its object to provide a machine for this purpose in which both of these operations may be performed without unchucking the valve cylinder and in which the two operations may be simultaneously performed upon different valve cylinders.

A further object of the invention is to provide a device for grasping and holding the rod of the piston of which the packing rings are to be worn in.

A further object is to provide a stopping or reversing device for the grinding mechanism by which its operation will be automatically stopped or reversed before it grinds the bushing beyond the proper point.

With these and other objects hereinafter explained in view our invention consists in the construction and combination of elements hereinafter described and claimed.

Referring to the drawings: Figure 1 is a side elevation partly in section of the complete machine embodying our invention; Fig. 2 is a plan view of the upper part of the machine; Fig. 3 is a plan view partly broken away of the lower part of the machine; Fig. 4 is a front elevation partly broken away, of the complete machine; Fig. 5 is a vertical sectional view of the vertically movable device for reciprocating the piston of the triple valve; Fig. 6 is a side view of the same partly broken away; Fig. 7 is a plan view of the same; Fig. 8 is a cross-sectional view on line *a*—*a* of Fig. 6; Fig. 9 is a cross-sectional view on line *b*—*b* of Fig. 6; Fig. 10 is an elevation of the stopping device for the grinding mechanism; Fig. 11 is a cross-sectional view on line *c*—*c* of Fig. 10 on an enlarged scale; Fig. 12 is a side view of the mechanism shown in Fig. 11; and Fig. 13 is an end view partly broken away, of the mechanism shown in Figs. 11 and 12.

In the drawings 1 indicates a table suitably supported at a convenient height by sides 2.

3 is a driving shaft arranged beneath the table having a bearing at its outer end in a bracket 4 secured to the side 2 of the table and having a bearing near its inner end in a hanger 5 depending from the table. The shaft 3 carries a fixed pulley 6 to which power is applied from any convenient source, and it also carries a loose pulley 7, a bevel gear 8 in rear of the hanger 5 and a bevel gear 9 at its inner end.

A hollow standard 10 is securely bolted to the upper face of the table directly over the driving shaft 3. On the standard 10 at a suitable distance above the upper face of the table is mounted a bracket 11 adapted to swing on the standard 10 and to be clamped to the standard by a cam 12 operated by handle 13. Above and resting on the bracket 11 and also mounted to swing on the standard 10 is a tool carrying head 14.

Near its upper end the hollow standard 10 is reduced in diameter to form a bearing for a pulley comprising a portion 15 of relatively small diameter and a portion 16 of relatively large diameter. A bracket secured to the standard below the bearing on which the pulley 15, 16, is mounted extends rearward and is forked as shown to carry two guide pulleys 17, 18. A belt 19 passes from the pulley 7 over guide pulley 17 around portion 15 of pulley 15, 16 back over guide pulley 18 and down to pulley 7. Pulley 7 is arranged to be clutched to the driving shaft 3 by clutch 20 operated by lever 21.

The tool carrying head comprises horizontal forwardly extending arms 22, 23 connected at their forward ends by upright 24 the upper and lower ends of which extend forward to support a vertically movable ro-

tary spindle 25 which carries at its lower end a grinding wheel or roller 26.

The upper end of the upright 24 is provided with a bearing for a pulley 27 through which the spindle 25 is vertically movable the spindle being splined to the pulley so as to be rotated by it. The pulley 27 is driven by belt 28 from portion 16 of pulley 15, 16. Through the lower forwardly extending end of upright 24 sleeve 29 is arranged to be vertically movable, the vertical spindle 25 extending through this sleeve and being arranged to rotate within it and to be movable vertically with it. The sleeve 29 carrying with it the spindle 25 is moved up and down by means of a rack 30 on the sleeve and a gear 31 on a horizontal shaft 32.

A shaft 33 extends upward through the standard 10 and through the pulley 15, 16 and has on its lower end a bevel gear 34 in mesh with bevel gear 8 on shaft 3. At its upper end the shaft 33 has a double pulley 35, 36. Near the upright 24 the tool carrying head is provided with vertical shaft 37 having on its upper end double pulley 38, 39 adapted to be connected with pulley 35, 36, by belt 40 so as to be driven by it. At its lower end shaft 37 is provided with bevel gear 41 which is in mesh with two bevel gears 42 and 43 which are loose on horizontal shaft 44 which is provided with a worm 45 which meshes with and drives a worm gear 46 on shaft 32. Between the bevel gears 42 and 43 is a sliding clutch member 47 which is movable into and out of engagement with either bevel gear 42 or 43 and is so arranged that when midway between the two gears it will be out of engagement with either bevel gear.

From the above description it will be clear that when the pulley 7 is clutched to shaft 3 and the latter is driven by pulley 6 the pulley 15, 16, will be rotated through the belt 19 and through belt 28 will rotate pulley 27 and the spindle 25. By reason of the difference in diameter of the pulleys 7, 15, 16, and 27 the spindle 25 will be rotated at a much higher speed than the shaft 3. When the shaft 3 is rotated its bevel gear 8 will drive vertical shaft 33 through bevel gear 34 which through pulley 35 or 36, belt 40 and pulleys 38 or 39 will rotate shaft 37 which through bevel gear 41 will rotate bevel gears 42 and 43. If either of the bevel gears 42 or 43 is engaged by sliding clutch member 47 the rotation of shaft 37 will rotate shaft 44 and, through worm 45 and worm wheel 46, will rotate shaft 32 and through gear 31 and rack 30 will raise or lower spindle 25.

The shaft 44 carries at its forward end a hand wheel 48 by which the shaft may be rotated when the clutch member is midway between the two bevel gears 42 and 43 so as to raise or lower the spindle 25 into proper position preliminary to the operation of the machine.

The sliding clutch member 47 is moved by an arm 49 carried by a rock shaft 50 which is provided at one end with a hand lever 51.

Carried in bearings on the lower arm 23 of the tool carrying head 14 is a shaft 52 having at one end a hand wheel 53 and carrying intermediate its ends a worm 54 which engages worm teeth 55 formed on the arc shaped forward end of the bracket 11. By rotating the shaft 52 the tool carrying head may be swung relative to the bracket 11.

Journaled in the table 1 on vertical axes are chucks 56 and 57, the axes of the chucks being in line with the arc on which the spindle 25 swings when the tool carrying head is swung on the standard 10, so that the grinding wheel or roller 26 may be brought into position to operate on an article carried by either of the chucks. The chucks are carried by hollow shafts 58 and 59 respectively and on these hollow shafts below the table 1 are secured worm gears 60 and 61 respectively. Horizontal shafts 62 and 63 journaled in suitable bearings beneath the table carry respectively worms 64 and 65 which mesh respectively with worm gears 60 and 61. The horizontal shafts 62 and 63 are arranged in line and carry on their inner ends respectively bevel gears 66 and 67 which are loose on the respective shafts and are both in mesh with bevel gear 9 on shaft 3. Clutches 68 and 69 serve to connect bevel gears 66 and 67 with their respective shafts, the sliding members of these clutches being movable into or out of engaging position by suitable means such as a rock shaft 70 and handle 71. It will thus be seen that when the shaft 3 is rotated it will rotate one or both of the chucks 56, 57 if the bevel gears 66 and 67 are one or both clutched to their respective shafts.

Through the hollow shafts 58 and 59 of the chucks extend vertical rods provided with clutches at their upper ends and arranged to be reciprocated vertically. As these rods and the mechanisms for reciprocating them are the same for both chucks 56 and 57, the description of one will be sufficient. This vertically reciprocating rod comprises an outer cylinder 72 and a cylindrical rod 73 fitting within it and carrying at its upper end a separable chuck 74. The chuck has at its upper end a center point 75 and has an exterior screw thread 76 formed on its upper portion. On the screw threaded portion fits an interiorly screw threaded member 77 having upward extensions 78 provided at their upper ends with laterally extending lugs 79. The lower portion of the chuck fits within the upper end of the cylinder 72 and has at its lower end projections 80 which fit into corresponding recesses in the upper end of the rod 73 so that

the chuck is held against rotation. In order to insure the chuck against separation from the rod 73 its lower portion which fits within the cylinder 72 is provided at its lower end with opposite vertical recesses 81 each communicating with laterally extending recesses 82 and the cylinder 72 is provided with inwardly extending pins 83 adapted to enter the recesses 81 and 82. The cylinder 72 is secured at its lower end to a collar 84 which extends upward into the lower end of the cylinder and has secured to it a lever 85 by which it may be rotated to bring the pins 83 into line with the recesses 81 so that the chuck 74 may be inserted in place or removed. A spring 86 holds the lever 85 normally in such position that the pins 83 will be in the lateral recesses 82 thus locking the chuck to the cylinder.

Below the lower end of the collar 85 is a pair of arms 87, 88 connected at their upper ends by a cross bar 89 through which the lower portion of the rod 73 passes, this portion of the rod being of reduced diameter, the shoulder 90 formed at the point where the reduced portion of the rod joins the main portion, resting on the upper end of the collar 84. The rod 73 has secured to it at its lower end a cross head 91 which fits between the arms 87, 88. A spring 92 is coiled about the lower portion of the rod bearing at one end against the cross head 91 and at the other end against the cross bar 89.

The arms 87, 88 are each provided with an opening 93 to receive the pin 94 of a link 95 by which they are connected to a lever arm 96 by which the rod is reciprocated. This lever arm 96 is carried by a rock shaft 97 which is journaled eccentrically in a cylinder 98 which is itself journaled in a suitable bearing formed below the table near the front of the machine. The cylinder 98 is provided with a worm gear which is engaged by a worm 99 on a horizontal shaft 100 provided with a hand wheel 101. By rotating the cylinder 98 through the worm 99 the position of the rock shaft 97 may be adjusted to vary the position of the axis of the lever arm. The rock shaft 97 is provided on its outer end with a lever arm 102 which at its free end is connected by a pitman 102′ with a crank pin 103 carried by a disk 104 on the end of shaft 62 (and shaft 63). The crank pin 103 is made adjustable by means of a screw 105 so as to vary the throw of the lever arm 102.

When the machine is to be used to grind or finish the bushings of triple valves and to wear in the packing rings of their pistons, a triple valve is placed in one of the chucks 56, 57, with its smaller portion downward and firmly secured in place. The tool carrying head 14 with the bracket 11 is then swung to bring the spindle 25 into proper position above the chuck and the bracket 11 is locked in position by the clamps 12. The spindle 25 is then lowered by rotating the hand wheel 48 until the grinding wheel or roller 26 is in position. Any lateral movement necessary to adjust the grinding wheel or roller to its work may be effected by rotating the hand wheel 53 to cause the tool carrying head to swing relative to the bracket 11. When the machine is set in motion with the pulley 7 clutched to shaft 3 and the bevel gear 66 (or 67) clutched to its shaft, the triple valve will be rotated by the chuck and the grinding wheel or roller 26 will operate upon it as it rotates, the grinding wheel or roller being fed gradually downward by the rotation of shaft 44.

In order to prevent the grinding wheel or roller from being fed down too far the feeding mechanism is preferably provided with an automatic stop device. For this purpose a vertical rod 110 is arranged to be vertically movable in brackets 111 and 112 on the upper and lower forwardly extending ends of the upright 24. The rod 110 is provided with adjustable stops 113 and 114 and the sleeve 29 is provided with an arm 115 engaging the rod 110 between the stops 113 and 114. Near its lower end the vertical rod 110 is provided with a horizontal arm 116 above the bracket 112 and with a corresponding horizontal arm 117 below the bracket. A vertical opening is formed in the bracket in which are located upper and lower slides 118 and 119. These slides are normally pressed apart by a spring 120 between them. In the side of the bracket 112 in line with the vertical opening in which the slides 118 and 119 and the spring 120 are located, are formed horizontal openings 121 and 122 in which are located pins 123 and 124 each having a cam 125 on its inner end. The slides 118 and 119 are each provided with a recess 126 to receive the inner end of a pin 123 or 124, the inner face of the recess being formed on an incline corresponding to the cam on the inner end of the pin. Bushing 127 in the outer ends of the openings 121 and 122 retain the pins in the openings. When the arm 115 strikes the stop 113 and moves the rod 110 upward its horizontal arm 117 strikes the lower slide 119 pushing it upward and forcing the pin 124 outward. In the same way when the stop 114 is struck by the arm 115 and the rod forced downward the horizontal arm 116 will push the slide 118 downward forcing the pin 123 outward.

The lever 51 is provided with a pin 130 extending laterally through it near its handle end and adapted to enter the openings 121 and 122. This pin 130 is controlled by a small lever 131 pivoted on the lever 51 in position to be grasped by the hand when the handle of the lever is grasped. A spring 132 presses the lever 131 away from the

handle of the lever 51 so as to normally press the pin 130 inward. When the lever is raised to cause the sliding clutch member 47 to engage bevel gear 43 the pin 130 will enter the upper opening 121, thus retaining the lever in position and holding the sliding clutch member in position. The lever 51 has in rear of the rock shaft 50 an arm 133 to which is pivoted a rod 134 extending through a plate 135 formed in a lug 136 and having a nut at its upper end. A spring 137 between the nut and plate 135 tends to force the rod 134 upward and through the arm 133 tends to force the handle end of lever 51 downward. A corresponding spring 138 between plate 135 and the end of arm 133 tends to force the end of the arm downward and thus to raise the handle end of lever 51. Midway between the openings 121 and 122 the bracket 112 is provided with a lug 139. When the pin 123 is forced outward as above described it will push the pin 130 out of the opening and spring 137 being under compression will act to swing the handle end of the lever downward until it is stopped by the pin 130 striking the lug 139. This movement of the lever will move the clutch member 47 into position midway between the bevel gears 42 and 43 thus stopping the rotation of shaft 44 and stopping the feed of the spindle 25.

When the feed is to be reversed the lever 51 will be swung down until the pin 130 enters the opening 122, the pin 130 being drawn back by pressure on lever 131 to permit the lever to pass the stop 139. When the spindle has been fed in the reverse direction a sufficient distance the arm 115 strikes the stop 113 raising the rod 110 and through the horizontal arm 117 and slide 119 operates the pin 124 to push the pin 130 out of opening 122 releasing the lever which is immediately swung upward by spring 138 until the pin 130 strikes the under side of the stop 139 thus moving the sliding clutch member 47 to its position midway between the bevel gears 42 and 43 and stopping the feed of the spindle 25.

While the grinding of the bushing of the triple valve first placed in a clutch is progressing as above described a second triple valve is placed in the other chuck and secured in position. When the grinding of the first triple valve is completed the spindle 25 is raised until the grinding wheel or roller 26 is free from the valve and the tool carrying head is swung over until the spindle is in proper position with reference to the second triple valve and the spindle is lowered as before and adjusted to cause the grinding wheel or roller to operate on the bushing of the second triple valve.

The piston with its packing rings in place is then inserted in the first triple valve the chuck 74 being caused to grasp the guide plate on the lower end of the piston rod the point 75 entering the centering recess in the lower end of the piston rod and the lugs 79 engaging the upper face of the guide plate, the chuck and clamping member 77 being rotated one on the other until the guide plate of the piston rod is firmly held by the chuck. As the piston is placed in position the lower portion of the chuck enters the upper end of cylinder 72 and the lever 85 being swung to one side to bring the pins 83 in line with the recesses 81, the lower portion of the chuck slips by them sufficiently to permit the projections 80 to enter the recesses in the upper end of the rod 73. On the release of the lever 85 the cylinder 72 is rotated back to normal position by the spring 86 and the pins 83 enter the lateral recesses 82 locking the chuck to the cylinder.

The horizontal shaft 62 (or 63) is then caused to rotate by clutching to it its bevel gear 66 (or 67) and rotates the chuck as before and at the same time through the crank pin 103, pitman 102′, lever arm 102, rock shaft 97, lever arm 96 and link 95, the chuck 74 is reciprocated vertically to wear in the packing rings. The extent of vertical reciprocation is regulated as above described by adjustment of the crank pin 103 and by adjustment of the bearing of the rock shaft 97 by rotating the cylinder 98 by the worm 99. If the downward movement of the arms 87, 88 should be more than is necessary to bring the piston first to the bottom of the chamber of the triple valve the spring 92 will be compressed to permit the rod 73 to remain stationary while the arms 87, 88 and cross bar 89 complete their downward movement.

When the wearing in of the piston in the triple valve first inserted is completed the valve is removed and a third one is placed in the chuck from which it is taken and, the grinding of the bushing of the second valve being completed, its piston is inserted and connected with the piston reciprocating device. It will thus be seen that not only can two triple valves be operated on at the same time, the bushing of one being ground while the packing rings of the piston of the other is being worn in, but each of the triple valves remains in the same chuck during the two operations on it, thus avoiding any changing of the center.

While the machine has been above described as operating to grind the bushing of a triple valve which is rotated during the grinding, it will of course be understood that the grinding wheel or roller may be used to operate on any other article capable of being held by the chuck, and may be used to operate on the outside of the article held by the chuck. Or if desired the grinding wheel or roller may be replaced by a drill or other tool, and the machine may be used for

grinding or otherwise finishing any article which can be held by one or both of the chucks, and is particularly adapted for use in finishing or otherwise operating on any article which requires to be subjected to two distinct operations one of which is to be effected by a vertically reciprocating movement.

It will of course be understood that we do not desire to be limited to the specific construction or arrangement of elements shown and described, as it is obvious that changes in construction and arrangement may be made without departing from the spirit of the invention.

Having thus described our invention what we claim is:

1. The combination with a plurality of chucks having their axes of rotation parallel and means for rotating them, of a tool carrying head provided with a tool carrying spindle arranged to rotate on an axis parallel with the axes of the chucks, the tool carrying head being movable to bring the tool carrying spindle into operative relation with either chuck.

2. The combination with a chuck and means for rotating it, of a tool carrying head provided with a tool carrying spindle arranged to rotate on an axis parallel with that of the chuck, the tool carrying head being movable to bring the tool carrying spindle into and out of operative relation with the chuck, and a reciprocating member extending into the chuck adapted to effect an operation upon the article held in the chuck.

3. The combination with a plurality of chucks having their axes of rotation parallel and means for rotating them, of a tool carrying head provided with a tool carrying spindle arranged to rotate on an axis parallel with the axes of the chucks, the tool carrying head being mounted to swing on an axis parallel with and equidistant from the axes of the chucks to bring the tool carrying spindle into operative relation with either of the chucks.

4. The combination with a plurality of chucks having their axes of rotation parallel, of a tool carrying head provided with a tool carrying spindle arranged to rotate on an axis parallel with the axes of the chucks, the tool carrying head being movable to bring the tool carrying spindle into operative relation with either of the chucks, a reciprocating member extending into each chuck adapted to effect an operation on the article carried by the chuck.

5. The combination with a chuck adapted to hold a hollow article, means for rotating the chuck, a tool carrying head provided with a tool carrying spindle mounted to be movable into and out of position to effect an operation on the cylinder held by the chuck, and a reciprocating member extending into the chuck provided with means for securing a piston stem thereto.

6. The combination with a chuck, means for rotating the chuck, a reciprocating member extending axially through the chuck, means for holding the stem of a piston separably connected to the reciprocating member comprising a center pin and a collar having axially extending arms provided with transversely extending lugs.

7. The combination with a chuck, means for rotating it, a reciprocating member extending axially through the chuck, means for holding the stem of a piston carried by the reciprocating member, said reciprocating member comprising a cylindrical upper portion, a cross bar below the cylindrical portion provided with arms for engaging the reciprocating means and means for yieldingly holding the cylindrical portion in contact with the cross bar.

8. The combination with a chuck and means for rotating it, of a reciprocating member extending axially through the chuck, comprising a hollow cylinder, a rod extending upward through the cylinder, a clamp adapted to hold the stem of a piston extending into the end of the cylinder and provided with means for engaging the end of the rod, and means carried by the cylinder for retaining the clamp in engagement with the end of the rod.

9. The combination with a chuck and means for rotating it, of a reciprocating member extending axially through the chuck comprising a non-rotating rod, a clamp adapted to hold the stem of a piston carried by the rod, a cross bar carried by the rod and movable therein and provided with arms for engagement with the reciprocating means, a cross bar on the rod, and a spring between the cross bar and the cross head.

10. The combination with a chuck and means for rotating it, of a reciprocating member extending axially through the chuck comprising a non-rotating rod, a clamp adapted to hold the stem of a piston detachably carried by the rod, a hollow cylinder rotatable on the rod provided with means for engaging the clamp to retain it in contact with the rod, a lever for rotating the cylinder to release the clamp engaging means and a spring normally holding the cylinder in position to retain the clamp.

11. The combination with a chuck and means for rotating it, of a reciprocating member extending axially through the chuck provided with a clamp for holding the stem of a piston, and means for reciprocating the reciprocating member comprising a rock shaft having an arm engaging the reciprocating member, a cylinder having an eccentric bearing for the rock shaft formed therein, means for rocking the rock shaft, and means for rotating the cylinder to vary the

position of the axis of the arm which engages the reciprocating member.

12. The combination with a tool carrying spindle and means for rotating and reciprocating it, of a clutch between the tool carrying spindle and the rotating means, a lever for operating the clutch, a spring arranged to swing the lever into position to disconnect the clutch, means for locking the lever in position to hold the clutch in operative position and means operated by the reciprocating movement of the spindle for releasing the lever to permit the spring to move it to disconnect the clutch.

13. The combination with a tool carrying spindle and means for rotating and reciprocating it, of a clutch between the tool carrying spindle and the rotating means, a lever for operating the clutch, a spring arranged to swing the lever into position to disconnect the clutch, means for locking the lever in position to hold the clutch in operative position comprising a spring-pressed pin on the lever and a portion of the frame provided with an opening to receive the spring-pressed pin, and means operated by the reciprocating movement of the spindle for pushing the spring-pressed pin out of the opening in the frame and thus releasing the lever.

14. The combination with a tool carrying spindle and means for rotating and reciprocating it, of a clutch between the tool carrying spindle and the rotating means, a lever for operating the clutch, a spring arranged to swing the lever into position to disconnect the clutch, means for locking the lever in position to hold the clutch in operative position comprising a spring-pressed pin on the lever and a portion of the frame provided with an opening to receive the spring-pressed pin, and means operated by the reciprocating movement of the spindle for pushing the spring-pressed pin out of the opening in the frame and thus releasing the lever comprising a pin movable in said opening and a cam for moving said pin to disengage the spring-pressed pin from said opening.

15. The combination with a tool carrying spindle and means for rotating and reciprocating it comprising a shaft having a pair of gears loose thereon driven in opposite directions, a movable clutch member on the shaft between the two gears normally adapted to engage either of said gears but normally out of engagement with either of them, of a lever for moving the movable clutch member, springs arranged to hold the lever normally in position to hold the movable clutch member in operative position, means for locking the lever in position to hold the movable clutch member in engagement with either gear and means operated by the reciprocation of the tool carrying spindle for releasing the lever.

16. The combination with a tool carrying spindle and means for rotating and reciprocating it, comprising a shaft having a pair of gears loose thereon driven in opposite directions, a movable clutch member on the shaft between the two gears normally adapted to engage either of said gears but normally out of engagement with either of them, of a lever for moving the movable clutch member, springs arranged to hold the lever normally in position to hold the movable clutch member in operative position, means for locking the lever in position to hold the movable clutch member in engagement with either gear and means operated by the reciprocation of the tool carrying spindle for releasing the lever, comprising a spring-pressed pin carried by the lever a portion of the frame of the machine provided with openings to receive the spring-pressed pin, a pin movable in each of the openings in the frame, cams adapted to act upon the pins in the openings to move them into position to disengage the spring-pressed pin, a vertically movable rod provided with means for operating the cams, stops on the vertically movable rod and means movable with the tool carrying spindle adapted to strike said stops and operate the vertically movable rod.

17. The combination with a tool carrying head mounted to swing on a vertical axis and provided at its free end with a tool carrying spindle, of a horizontal driving shaft having a pulley thereon, a pulley concentric with the axis on which the tool carrying head swings, a bracket carried by the tool carrying head provided with a pair of loose pulleys, a belt running from the pulley of the driving shaft over one of the loose pulleys around the pulley concentric with the axis of the tool carrying head, over the second loose pulley and back to the pulley on the driving shaft, and means driven by the pulley concentric with the axis on which the tool carrying head swings for rotating the tool carrying spindle.

18. The combination with a tool carrying head mounted to swing on a vertical axis and provided at its free end with a tool carrying spindle, of a driving shaft, a vertical shaft concentric with the axis on which the tool carrying head swings and arranged to be driven by the driving shaft, a pulley on said vertical shaft, means for reciprocating the tool carrying spindle driven by said pulley, a second pulley carried by the tool carrying head concentric with said vertical shaft, means for driving said second pulley from the driving shaft, and means for rotating the tool carrying spindle from said second pulley.

19. The combination with a chuck carried by a hollow shaft, of a worm gear mounted on the hollow shaft, a counter shaft provided with a worm engaging said worm gear, a reciprocating member extending into the hollow shaft and means operated by the counter shaft for reciprocating the reciprocating member.

This specification signed and witnessed this thirtieth day of January A. D. 1911.

SANFORD S. SHIELDS.
WILLIAM E. WINE.

In the presence of—
C. L. MEISTER,
G. L. ALLEN.