July 18, 1933. C. BOOTH 1,919,144

GRINDING MACHINE

Filed Nov. 18, 1931 3 Sheets-Sheet 1

Fig. 1

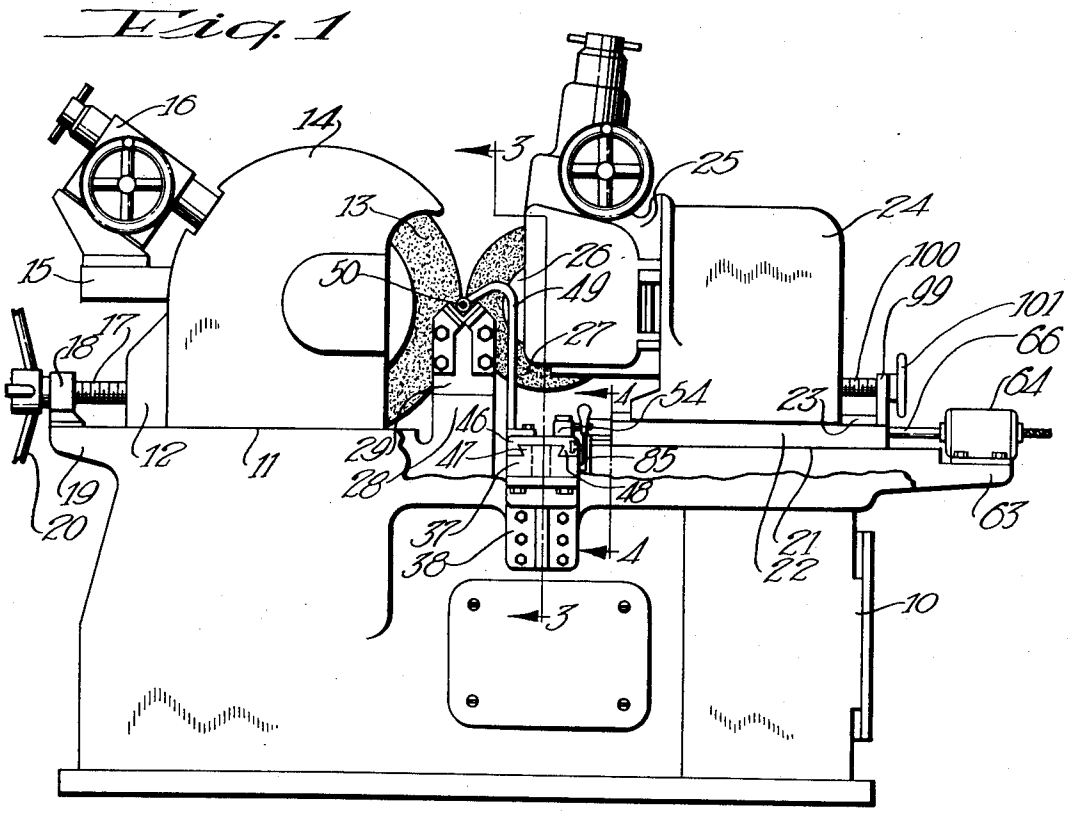


Fig. 4

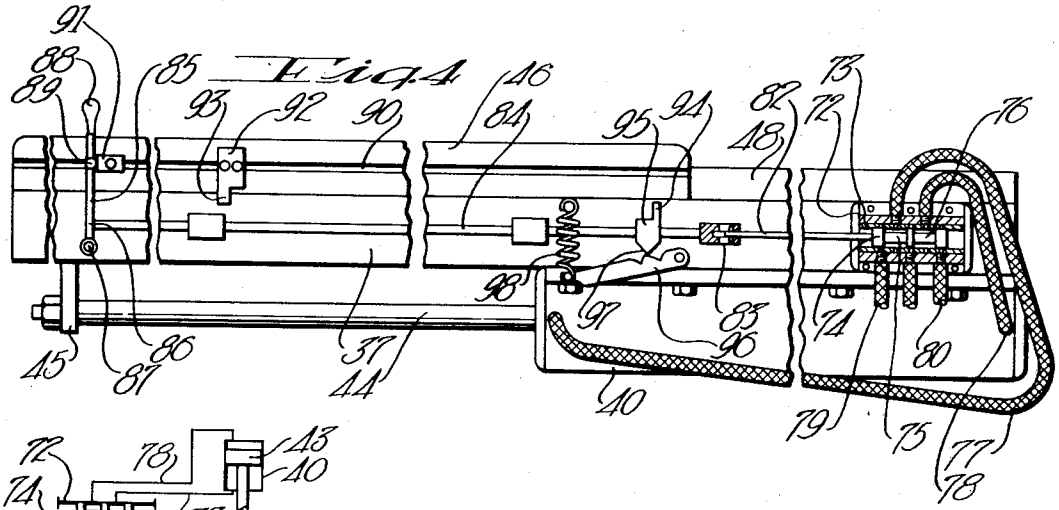
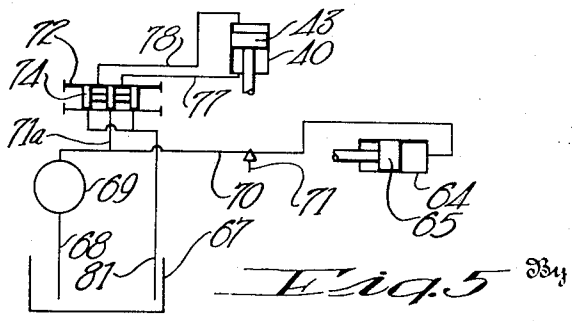


Fig. 5



Inventor
CLEMENT BOOTH

By H. K. Parsons

Attorney

July 18, 1933. C. BOOTH 1,919,144

GRINDING MACHINE

Filed Nov. 18, 1931 3 Sheets-Sheet 2

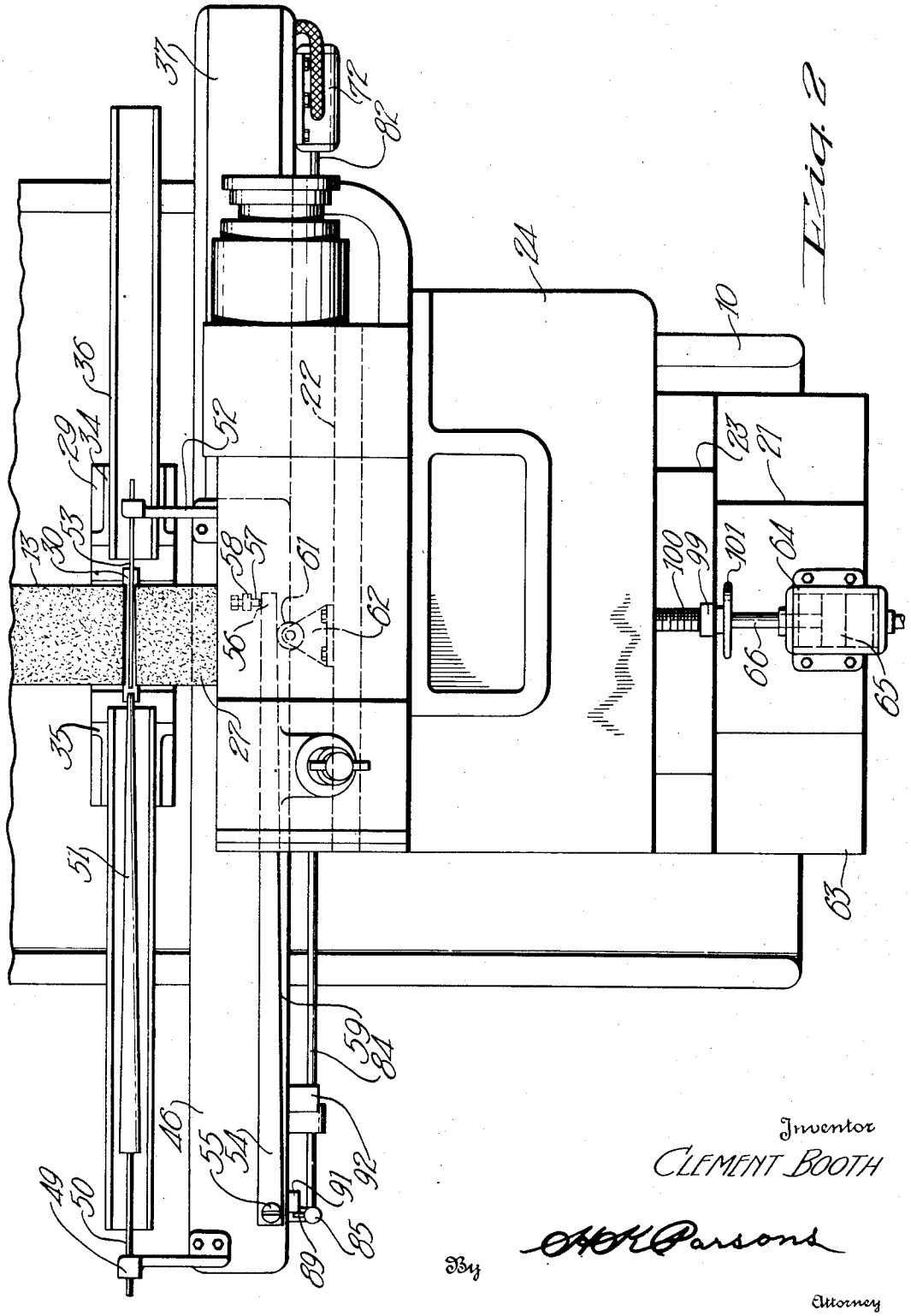


Fig. 2

Inventor
CLEMENT BOOTH

By H. H. Parsons

Attorney

July 18, 1933. C. BOOTH 1,919,144

GRINDING MACHINE

Filed Nov. 18, 1931 3 Sheets-Sheet 3

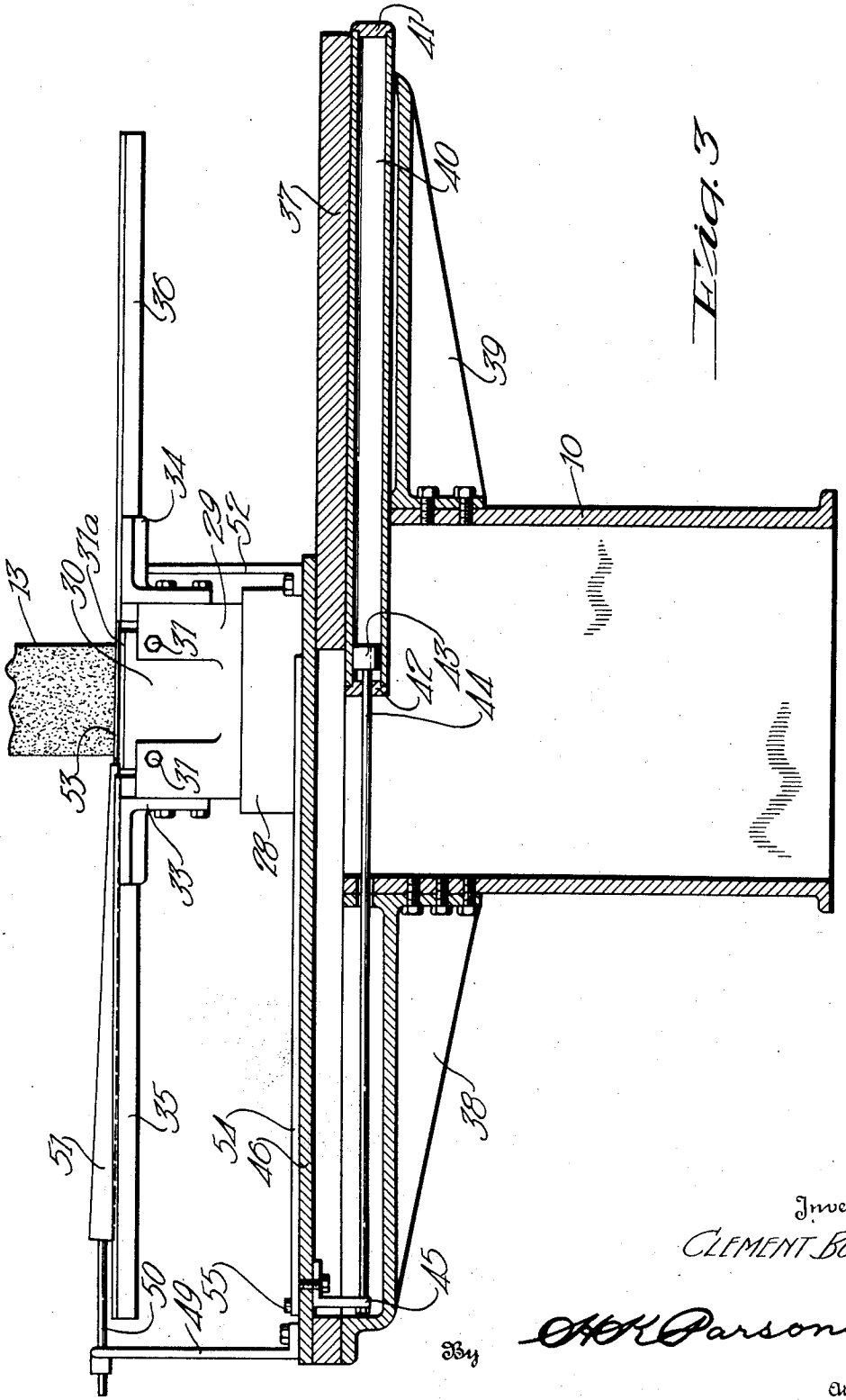


Fig. 3

Inventor
CLEMENT BOOTH

By O. K. Parsons

Attorney

Patented July 18, 1933 1,919,144

UNITED STATES PATENT OFFICE

CLEMENT BOOTH, OF CINCINNATI, OHIO, ASSIGNOR TO CINCINNATI GRINDERS INCORPORATED, OF CINCINNATI, OHIO, A CORPORATION OF OHIO

GRINDING MACHINE

Application filed November 18, 1931. Serial No. 575,868.

This invention relates to improvements in grinding machines and especially to improvements in centerless grinders.

An object of the invention is the provision of a grinding machine for grinding long, tapered, cylindrical articles.

Another object of the invention is the provision of a centerless grinder adapted to automatically enlarge the throat of the grinder as the work piece is passed therethrough to generate a contour on the work in accordance with the constantly varying width of the grinding throat.

A further object of the invention is the provision of a centerless grinder for accomplishing the purposes set forth above that is automatically controlled, preferably by hydraulic pressures and that may be adjusted for varying the results of the machine.

A still further object of the invention is the provision of a centerless grinder in which the work piece is fed through the grinding throat to effect the desired stock removal therefrom and in which the work is reversely actuated through the throat to return it to its initial position.

These and other objects are obtained by the means described herein and illustrated in the accompanying drawings forming a part thereof and it is to be understood that any modifications may be made in the exact structural details shown and described within the scope of the appended claims without departing from or exceeding the spirit of the invention.

In the drawings:

Figure 1 is a front elevation of a centerless grinder embodying the improvements of this invention.

Figure 2 is a fragmentary top plan view of certain parts shown in Figure 1.

Figure 3 is a sectional view taken on line 3—3 of Figure 1, certain parts being removed to further illustrate the invention.

Figure 4 is a fragmentary elevational view, certain parts being shown in cross section, as seen from line 4—4 of Figure 1.

Figure 5 is a diagrammatic view illustrating the hydraulic circuits involved in the invention.

Throughout the several views of the drawings similar reference characters are employed to denote the same or similar parts.

This invention pertains primarily to a machine for grinding steel fishing rods, wooden billiard cues, automobile gear shift levers, and similar articles which have a taper or conical construction from one end to the other. It is desired to produce a comparatively fine finish on such articles and to produce same at as high a rate of speed as possible to thereby hold down the cost thereof.

A machine for generating and finishing these articles may comprise a bed 10 having formed on its upper surface guideways 11 for a grinding wheel carriage 12 which has rotatably mounted therein a spindle for the grinding wheel 13. The grinding wheel and its spindle are rotated at a high rate of speed in a clockwise direction. The wheel 13 is enclosed within a suitable housing 14 secured to the carriage 12. Secured to the housing or guard 14 is a bracket 15 supporting a trueing mechanism 16 adapted to be actuated laterally of the grinding wheel to true the active face thereof. The slide 12 has threadedly connected therewith an adjusting screw 17 journaled at its outer end in a bracket or bearing 18 secured to an extension 19 of the bed 10. Secured to the screw 17 beyond the bearing 18 is a pilot or hand wheel 20 whereby the grinding wheel carriage is actuated longitudinally of the bed 10.

The bed 10 is further provided on its upper surface with guideways 21 for a slide 22 which is in turn provided with guideways 23 for a second slide or housing 24. The housing 24 has pivoted thereto the head 25 in which is journaled a spindle 26 for a regulating wheel 27. The spindle 26 and regulating wheel 27 are rotated at a comparatively slow rate of speed in a clockwise direction for effectively controlling the rate of rotation of the work piece being operated upon by the grinding wheel.

The operative faces of the grinding and regulating wheels are spaced from one another a distance to form a grinding throat beneath which there is provided a rib 28 integral with or secured to the bed 10. The

rib 28 carries a block 29 in which is adjustably clamped by means of clamp screws 31, a work rest blade 30. The work rest blade 30 has an inclined operative surface 31A inclining in the general direction of the operative face of the regulating wheel 27. The block 29 has secured to its opposite vertical ends an angle iron or bracket 33 and 34 respectively supporting a work trough 35 and 36 which are V-shaped in cross section. The trough 35 on the forward side of the machine supports the work while being actuated relative thereto into and through the grinding throat while the trough 36 receives the work as it passes off the blade 30 from the said grinding throat.

The bed 10 has secured to it at a point between the rib 28 and slide 22 a guide 37, which extends beyond both sides of the bed, as shown in Figure 3. The overhanging portion of the guide is supported by brackets 38 and 39 attached respectively to the forward and rear surfaces of the bed 10. The bracket 39 forms a support for a cylinder 40 closed on one end by a head 41 and on the other end by an apertured head 42. A piston 43 is inclosed within the cylinder 40 for movement therein and relative thereto. A piston rod 44 extends from the piston 43 through the apertured head 42 and has secured to its free end an abutment lug 45. The lug 45 is secured to the under surface of a slide 46 slidable on the guide 37 which has a dove-tailed guideway 47 formed therein receiving a correspondingly shaped guide rib 48 extending upwardly from the slide guide 37. To the upper surface of the slide 46 is secured a pusher arm 49 having an adjustable pin 50 carried by its upper end for abutting the adjacent end of the work piece 51. The slide 46 is provided on its other end with an arm 52 likewise carrying an adjustable pin 53 for engaging the end of the work adjacent thereto for returning the work to its initial or loading position.

The slide 46 is further provided with a sine bar 54 pivoted as at 55 to the said slide 46. The other end 56 of the sine bar 50 abuts an adjustable abutment 57 carried by a lug 58 integral with the slide 46. Adjustment of the abutment 57, which is in the nature of a screw, varies the angular relationship of the operative face 59 of the bar with respect to the line of travel of the slide 46. By reference to Figure 2 it will be noted that the operative face 59 of the sine bar 54 is at an angle substantially double to the angle of the work piece 51. The sine bar 54 is engaged by a roller 61 rotatably carried by a bracket 62 bolted or otherwise secured to the lower slide 22. The bed 10 has secured to an extension 63 a cylinder 64 which encloses a piston 65 having projecting from it a rod 66. The piston rod 66 is secured to the end of the slide 22 opposite to the end which carries the roller bracket 62. The hydraulic pressure within the cylinder 64 maintains proper contact between the roller 61 and face 59 of the sine bar.

From the foregoing it will be noted that as the slide 46 is actuated transversely of the bed the sine bar 54 will force the lower slide 22 rearwardly carrying with it the regulating wheel 27 and enlarging the grinding throat as the larger portions of the work are fed therethrough. By this construction a uniform taper is generated and finished throughout the length of the work piece. It is to be noted however that the sine bar may be so formed as to generate a variable taper as well as other contours of cylindrical cross-section.

There is provided either interiorly of the bed 10 or in close proximity thereto a tank or sump 67 containing an hydraulic medium, preferably oil, which is utilized for actuating the pistons 43 and 65 relative to their cylinders. The hydraulic medium is drawn from the tank 67 through a pipe or conduit 68 by a suitable pump 69 and forced under pressure into a pipe or conduit 70. This pipe may terminate at one end of the cylinder 64 for maintaining a constant forward pressure against the piston 65. An adjustable pressure control valve 71 is provided in this conduit whereby the forward pressure on the piston 65 may be properly controlled.

Extending from the conduit 70 is a branch pressure line 71A which terminates in a valve casing 72. The valve casing 72 encloses a valve sleeve 73 having suitable ports therein and a slide valve 74. As shown structurally in Figure 4 and diagrammatically in Figure 5, the valve 74 has cannelures 75 and 76 for directing the pressure from the conduit 71A to one or the other conduits 77 and 78 which respectively terminate adjacent the forward and rear end of the piston cylinder 40. The hydraulic medium held in the piston 43 is alternately expelled through the conduits 77 and 78 and connected by the cannelures 75 and 76 with either of branch return conduits 79 and 80, which connect with the common discharge conduit 81, extending to the tank or sump 67. The valve 74 has extending from it a valve rod 82 having a lost motion connection as at 83, through a pin and slot joint, with the valve actuating rod 84. The rod 84 is mounted in suitable bearings extending from the slide guide 37 for sliding movement relative thereto. A lever 85 has a pivoted connection at 86 with the rod 84 and the lever is pivotally secured as at 87 to the slide guide 37. The lever 85 is further provided at its free end with an operating handle 88 and intermediate its end with a projection or lug 89. The slide 46 is provided with a T-slot 90 whereby dogs 91 and 92 are adjustably secured thereto for movement therewith. The dog 91 is adapted to engage the projec-

tion on the lever 85 for shifting it and the valve 74 to a neutral position for stopping the movement of the slide 46 toward the operator's station. The dog 92 has projecting from it a lug 93 adapted to engage a lug 94 extending from the dog 95 secured to the slide rod 84, for shifting the valve to a reverse position and effecting the reverse movement of the slide 46. To insure proper shifting of the valve 74 from a forward to a reverse position there is provided a load and fire mechanism in the nature of a detent plate 96 having cam notches formed therein and co-operating with the cammed end 97 of the dog 95. A load and fire spring 98 is provided having one end secured to the detent plate 96 and the other end secured to the slide guide 37.

The operation of the mechanism is as follows:

Assuming a work piece to be mounted in the trough 35, the handle 85 is manually shifted about its pivot 87 in a counter-clockwise direction as seen in Figure 4, for forwardly shifting the valve 74 and connecting the hydraulic pressure with the forward end of the cylinder 40. This effects a movement of the slide 46 to the right which through the arm 49 and pin 50 axially shifts the work 51 through the grinding throat. At the same time the slide 46 through the inter-engagement of the roller 61 and cam bar 54, continuously opens the grinding throat against the hydraulic pressure within the cylinder 64 until the work has passed entirely through the grinding throat. After the work has passed the grinding wheel, the lug 93 of the dog 92 engages the lug 94 of the dog 95 and shifts the valve 74 to its reverse position whereupon the hydraulic pressure is connected with the rear end of the cylinder 40. As the slide 46 is returned to its initial position, the arm 52 and pin 53 reversally shift the work through the grinding throat to its initial position, the hydraulic pressure within the cylinder 64 causing the regulating wheel to approach its initial position. Near the end of the return movement of the slide 46, the dog 91 thereon engages the lug or abutment 89 of the lever 85 and gradually shifts it to a vertical position thereby gradually slowing down the movement of the slide 46 until the valve reaches its neutral position, whereupon the movement of the slide is arrested.

In order to adjust the grinding throat for different sizes of work and to take care of wheel wear on the regulating wheel 27, the lower slide 22 has extending from it a bearing 99 in which is rotatably journaled an adjusting screw 100 having threaded engagement with the housing 24. The screw is operated by a hand wheel 101 secured thereto beyond the bearing 99.

What is claimed is:

1. In a grinding machine for generating and grinding long, cylindrical, contoured articles the combination of a bed, a pair of opposed grinding and regulating wheels carried by the bed and forming a grinding throat therebetween, the grinding wheel effecting a stock removal from the work while the regulating wheel effects and controls the rotation thereof, a work rest blade subtending the grinding throat, and means for actuating the work axially of the throat and simultaneously shifting one of the wheels relative to the other for generating the contour on the work.

2. In a grinding machine for generating and grinding long, cylindrical, contoured articles the combination of a bed, a pair of opposed grinding and regulating wheels carried by the bed and forming a grinding throat therebetween, a work rest blade subtending the grinding throat, means for actuating the work axially of the throat and simultaneously shifting one of the wheels relative to the other for generating the contour on the work, said means comprising a slide carried by the bed and movable in a plane parallel with the plane of movement of the work, and means on the slide engaging both the work and one of the wheels for effecting said relative shifting thereof.

3. In a machine of the class described for generating long, cylindrical, taper articles the combination of a bed, a grinding wheel and a regulating wheel rotatably mounted thereon forming a grinding throat therebetween, the grinding wheel effecting a stock removal from the work while the regulating wheel effects and controls the rotation thereof, a work support adjacent the grinding wheel, means for traversing a work piece past the grinding wheel, and an adjustable sine bar for shifting the regulating wheel from the grinding wheel to vary the width of the grinding throat as the work passes therethrough.

4. In a machine of the class described for generating long, cylindrical, taper articles the combination of a bed, a grinding wheel and a regulating wheel rotatably mounted thereon forming a grinding throat therebetween, a work support adjacent the grinding wheel, means for traversing a work piece past the grinding wheel, an adjustable sine bar for shifting the regulating wheel from the grinding wheel to vary the width of the grinding throat as the work passes therethrough, hydraulic means for shifting the work and sine bar, and additional hydraulic means for maintaining contact between the regulating wheel and sine bar.

5. In a machine of the class described for generating long, cylindrical, taper articles the combination of a bed, a grinding wheel and a regulating wheel rotatably mounted thereon forming a grinding throat therebetween, a

work support adjacent the grinding wheel, means for traversing a work piece past the grinding wheel, an adjustable sine bar for shifting the regulating wheel from the grinding wheel to vary the width of the grinding throat as the work passes therethrough, hydraulic means for shifting the work and sine bar, additional hydraulic means for maintaining contact between the regulating wheel and sine bar, and means for automatically reversing the hydraulic actuation of the work and sine bar.

6. In a centerless grinder for generating long, cylindrical, tapered articles the combination of a bed, a grinding wheel rotatably mounted thereon, a regulating wheel opposed to the grinding wheel and forming a grinding throat therebetween, the grinding wheel effecting a stock removal from the work while the regulating wheel effects and controls the rotation thereof, a slide for one of the wheels, means for axially shifting the work through the grinding throat, and an adjustable sine bar for engaging the slide and shifting the same relative to the bed to vary the width of the grinding throat as the work is progressed therethrough.

7. In a centerless grinder for generating long, cylindrical, tapered articles the combination of a bed, a grinding wheel rotatably mounted thereon, a regulating wheel opposed to the grinding wheel and forming a grinding throat therebetween, the grinding wheel effecting a stock removal from the work while the regulating wheel effects and controls the rotation thereof, a slide for one of the wheels, means for axially shifting the work through the grinding throat, an adjustable sine bar for engaging the slide and shifting the same relative to the bed to vary the width of the grinding throat as the work is progressed therethrough, and means for adjusting the angular position of the sine bar to vary the taper produced.

8. In a centerless grinder for generating long, cylindrical, tapered articles the combination of a bed, a grinding wheel rotatably mounted thereon, a regulating wheel opposed to the grinding wheel and forming a grinding throat therebetween, a slide for one of the wheels, means for axially shifting the work through the grinding throat, an adjustable sine bar for engaging the slide and shifting the same relative to the bed to vary the width of the grinding throat as the work is progressed therethrough, means for adjusting the angular position of the sine bar to vary the taper produced, hydraulic means for maintaining contact between the wheel slide and sine bar, and additional hydraulic means for actuating the work pushing means and sine bar.

9. In a grinding machine of the class described the combination of a bed, a pair of opposed grinding and regulating wheels forming a grinding throat therebetween, the grinding wheel effecting a stock removal from the work while the regulating wheel effects and controls the rotation thereof, a slide for one of the wheels, a work support in the grinding throat, an adjustable sine bar for engagement with the slide to shift the same relative to the bed in accordance with its angle of inclination, and means for simultaneously actuating the work and sine bar transversely of the machine for varying the width of the grinding throat and generating the taper on the work.

10. In a grinding machine of the class described the combination of a bed, a pair of opposed grinding and regulating wheels forming a grinding throat therebetween, a slide for one of the wheels, a work support in the grinding throat, an adjustable sine bar for engagement with the slide to shift the same relative to the bed in accordance with its angle of inclination, means for simultaneously actuating the work and sine bar transversely of the machine for varying the width of the grinding throat and generating the taper on the work, said means comprising a reversible hydraulic motor, and a valve for controlling the direction of actuation of the motor.

11. In a grinding machine of the class described the combination of a bed, a pair of opposed grinding and regulating wheels forming a grinding throat therebetween, a slide for one of the wheels, a work support in the grinding throat, an adjustable sine bar for engagement with the slide to shift the same relative to the bed in accordance with its angle of inclination, means for simultaneously actuating the work and sine bar transversely of the machine for varying the width of the grinding throat and generating the taper on the work, said means comprising a reversible hydraulic motor, and a valve for controlling the direction of actuation of the motor, and means automatically reversing the valve at one end of the movement of the sine bar and work and for automatically stopping the movement thereof at the other end of said movement.

12. In a centerless grinder of the class described the combination of a bed, a slide mounted thereon for movement relative thereto, a grinding wheel rotatably journaled on the slide, a regulating wheel opposed to the grinding wheel and forming a grinding throat therebetween, means including a slide for adjusting the regulating wheel relative to the bed toward and from the grinding wheel to determine the initial position of the grinding throat, a work rest blade subtending the grinding throat, means for axially shifting the work through the grinding throat, means actuable simultaneously with the work shifting means and engageable by one of the wheel slides for shifting the slide

and varying the width of the grinding throat during the passage of the work therethrough, means for varying the action of the said slide shifting means, and hydraulic pressure means for resisting the movement of the slide.

13. In a centerless grinder of the class described for generating long cylindrical contoured articles the combination of a bed, a grinding wheel rotatably mounted thereon, an opposed regulating wheel forming with the grinding wheel a grinding throat, the grinding and regulating wheels being respectively operated at a high and a relatively low rate of speed for respectively effecting a stock removal from the work and for effecting and controlling the rate of rotation of the work, a work rest blade disposed within the grinding throat, means for traversing the work through the grinding throat, means for shifting one of the wheels for varying the width of the grinding throat during the traverse of the work therethrough including a sine bar operative on the said movable wheel, and means for adjusting the position of said wheel as respects the other wheel for varying the zone of operation thereof by the sine bar.

14. In a centerless grinder of the class described for generating long cylindrical contoured articles the combination of a bed, a grinding wheel rotatably mounted thereon, an opposed regulating wheel forming with the grinding wheel a grinding throat, the grinding and regulating wheels being respectively operated at a high and a relatively low rate of speed for respectively effecting a stock removal from the work and for effecting and controlling the rate of rotation of the work, a work rest blade disposed within the grinding throat, means for traversing the work through the grinding throat, means for shifting one of the wheels for varying the width of the grinding throat during the traverse of the work therethrough including a sine bar operative on the said movable wheel, means for adjusting the position of said wheel as respects the other wheel for varying the zone of operation thereof by the sine bar, and means for adjusting the position of the other wheel.

15. In a centerless grinder of the class described the combination of a bed, a pair of opposed grinding and regulating wheels forming a grinding throat between them and relatively operated at a high grinding rate of speed and a relatively slow work controlling rate of speed for respectively effecting a stock removal from the work and effecting and controlling the rotation thereof, a work rest blade within the throat for supporting the work, and means for simultaneously shifting the work and the regulating wheel for simultaneously traversing the work through the grinding throat and varying the width thereof including a slide member for the work, hydraulic means for actuating the slide, a second slide for the regulating wheel, hydraulic means for actuating the regulating wheel slide, a valve controlling the operation of said hydraulic means, a manually actuable lever for shifting said valve and initiating a movement of the parts, and automatic means for reversely shifting said valve for reversing the movement of the parts.

16. In a centerless grinder of the class described the combination of a bed, a pair of opposed grinding and regulating wheels forming a grinding throat between them and relatively operated at a high grinding rate of speed and a relatively slow work controlling rate of speed for respectively effecting a stock removal from the work and effecting and controlling the rotation thereof, a work rest blade within the throat for supporting the work, and means for simultaneously shifting the work and the regulating wheel for simultaneously traversing the work through the grinding throat and varying the width thereof including a slide member for the work, hydraulic means for actuating the slide, a second slide for the regulating wheel, hydraulic means for actuating the regulating wheel slide, a valve controlling the operation of said hydraulic means, a manually actuable lever for shifting said valve and initiating a movement of the parts, automatic means for reversely shifting said valve for reversing the movement of the parts, and a sine bar for controlling the movement of the regulating wheel by its hydraulically actuable means.

CLEMENT BOOTH.