Dec. 27, 1927. 1,654,236

G. W. BINNS

ROLL GRINDING MACHINE

Filed June 9, 1927 2 Sheets-Sheet 1

Fig. 1

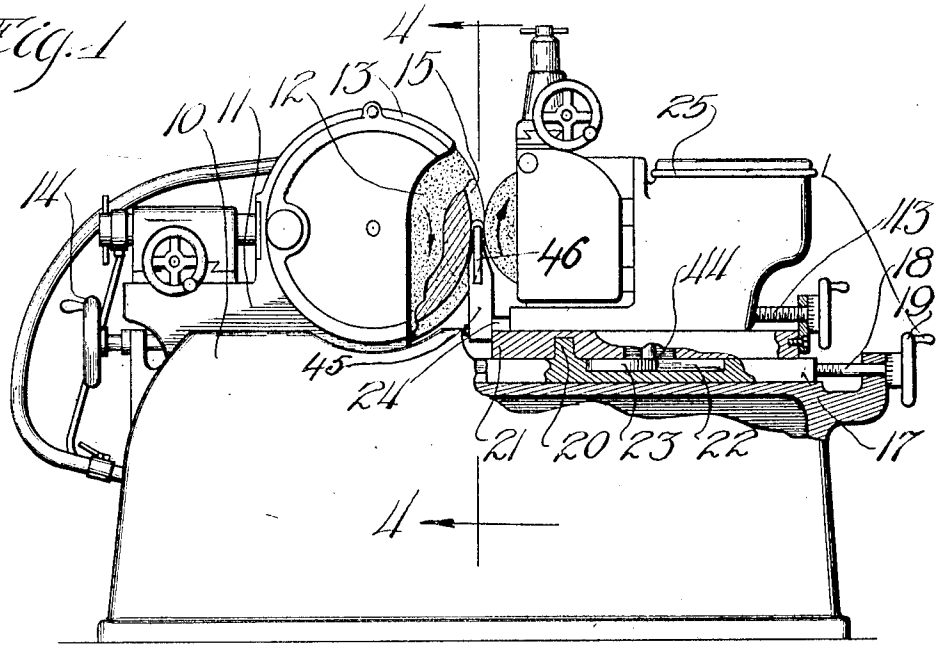
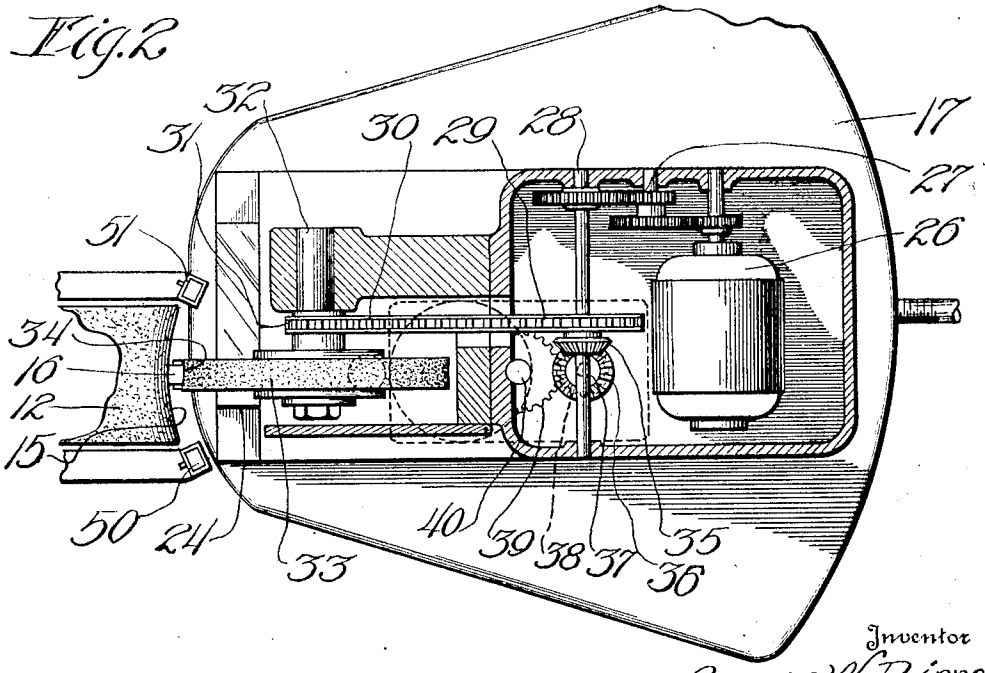


Fig. 2



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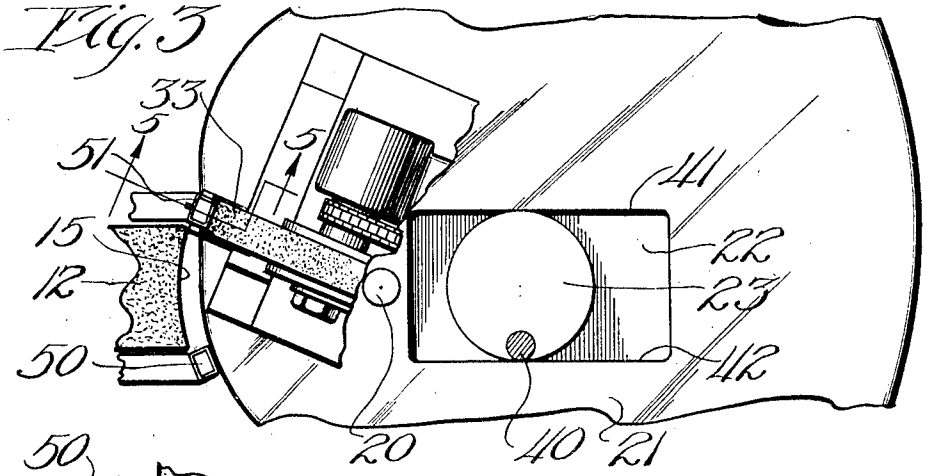
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Filed June 9, 1927 2 Sheets-Sheet 2

Fig. 3



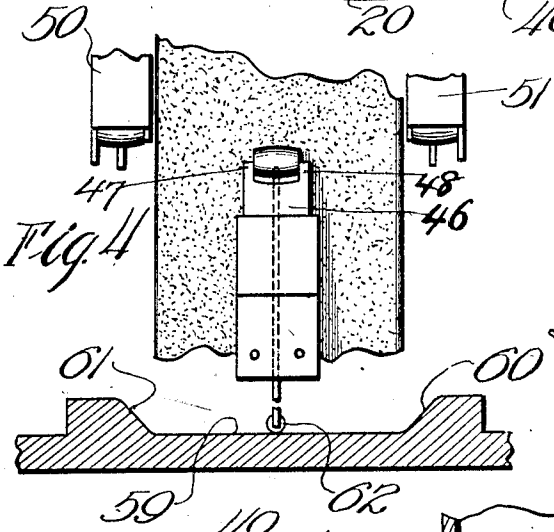


Fig. 4

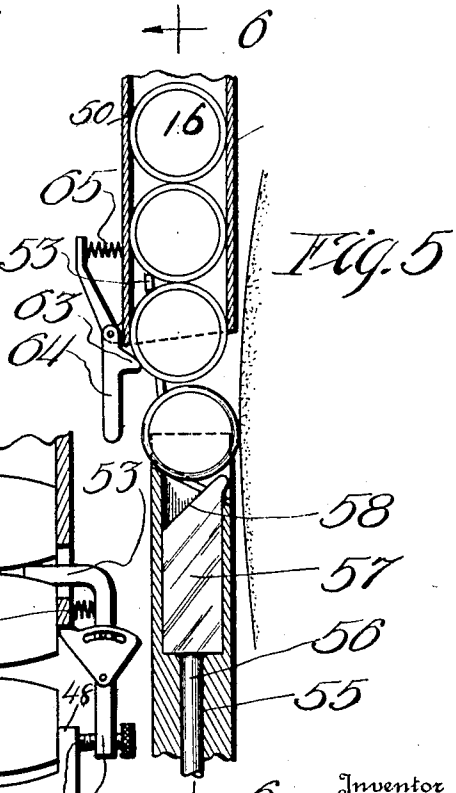


Fig. 5

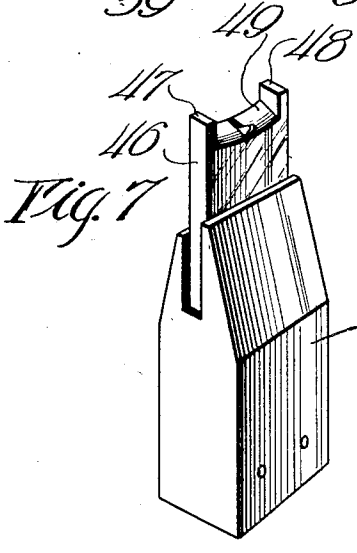


Fig. 7

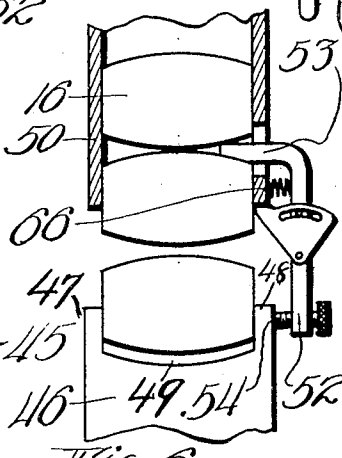


Fig. 6

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Patented Dec. 27, 1927. 1,654,236

UNITED STATES PATENT OFFICE.

GEORGE W. BINNS, OF CINCINNATI, OHIO, ASSIGNOR TO CINCINNATI GRINDERS INCORPORATED, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

ROLL-GRINDING MACHINE.

Application filed June 9, 1927. Serial No. 197,740.

This invention relates to improvements in roll grinding machines and has particular reference to a machine for production of arcuate or barrel shaped rolls.

One of the objects of the present invention is the provision of a production machine of the centerless type for rapid automatic grinding of what are commonly termed barrel shaped rolls for roller bearings or the like, having a larger central than terminal diameter.

A further object of the present invention is the provision of a roll grinding machine which shall be generative in its action, thus tending to maintain to a maximum degree the efficient operation of the grinding wheel and eliminate the necessity of frequent truing present in ordinary form grinding.

Another object of the present invention is the provision of a machine for production of work of the general nature above mentioned, which through utilization of a double supply mechanism will perform substantially continuous grinding for the attainment of machine production.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification taken in conjunction with the accompanying drawings, and it will be understood that I may make any modifications in the specific structural details of the embodiment chosen for purposes of illustration within the scope of the appended claims, without departing from or exceeding the spirit of the invention.

Figure 1 is a front view of a machine embodying my improvements.

Figure 2 is a horizontal sectional view thereof.

Figure 3 is a fragmentary view of the main slide and certain of the parts associated therewith.

Figure 4 is a vertical section as on the line 4—4 of Figure 1.

Figure 5 is a vertical section through the magazine and associate parts as on the line 5—5 of Figure 3.

Figure 6 is a section on line 6—6 of Figure 5, and

Figure 7 is a perspective view of the work rest blade and support.

In the drawings the numeral 10 designates the base or bed of a machine of the general centerless grinder type, having mounted thereon the slide 11 supporting the grinding wheel 12 disposed within the guard 13. In and out movement of this wheel may be effected through the medium of hand wheel 14.

The grinding wheel is formed with an arcuate face 15 as clearly illustrated in Figure 2 for example, this face having a transverse curve complementary or controgeneric to that to be produced on the finished work pieces 16.

It will be understood that in grinding of barrel shaped work pieces 16 as shown, that it is impossible to pass these pieces directly through a centerless grinder as is done in the grinding of ordinary cylindrical rollers. The purpose therefore of the present invention is to provide a method of grinding such rolls and an apparatus for carrying out the method which will facilitate the most rapid and at the same time accurate production thereof. In the attainment of this result the bed 10 is provided with a guideway for the slide 17, disposed in opposition to the grinding wheel slide 11 and adjustable as by screw 18 and hand wheel 19. This slide is formed with a trunnion or pivot as at 20 for the oscillatable supporting plate 21 and is further formed with the cam slot 22 within which rides the actuating eccentric or cam disk 23.

The plate 21 is further provided with ways 24 slidably supporting the regulating wheel unit 25.

This unit as is shown in detail in Figure 2, includes a suitable self-contained actuating motor 26, coupled through a train of gearing or the like 27, with the transverse shaft 28. This shaft has a drive sprocket 29 coupled by chain 30 with a sprocket 31 on the regulating wheel shaft 32. This shaft supports the regulating wheel 33 in opposition to the grinding wheel 12. Like the grinding wheel the regulating wheel has its face formed with a transverse groove or curve as at 34.

In addition, shaft 28 is provided with a bevel gear 35 in turn meshing with gear 36 on shaft 37. This shaft bears pinion 38 driving gear 39 of the oscillation controlling shaft 40.

Shaft 40 is suitably journalled in the unit 25 and bears on its lower end the eccentric 23. Consequently, as the motor 26 is operated to rotate the regulating wheel it will simultaneously impart a slow rotary move-

ment to shaft 40 and eccentric 23. Since eccentric 23 just fits between the side walls 41 and 42 of the slot 22, its rotation will cause a lateral swinging movement of the plate 21 and regulating wheel unit about trunnion 20 as a center. The radius through which the unit swings it will be understood may be varied by back and forth shifting of the regulating wheel unit 25 on supporting plate 21 through actuation of adjusting screw 43. Consequently, a number of different radii of roll may be satisfactorily produced on the same machine by different settings thereof. To permit of this adjustment it will be noted that intermediate plate 21 is formed with an elongated slot 44 through which shaft 40 depends. Additionally, the cam slot 22 is of sufficient length that desired back and forth adjustment of unit 25 may be made and additionally that the eccentric 23 may freely rotate in contact with the ends of slot 22. Consequently, the rotation of member 23 will impart a continuous swinging or oscillatory movement to the regulating wheel without effecting either the rotative drive therefor or without tending to impart any in and out movement to said wheel.

In the ordinary form of centerless grinder a stationary work rest is provided and the work is either fed axially along this work rest as in the case of through feed grinding or remains in fixed position on the work rest as in infeed grinding, the wheels ordinarily being separated to permit of removal and insertion of work pieces.

The present invention, however, contemplates attainment of the several advantages of through feed grinding in connection with work which has hitherto been considered impossible to grind by such methods. In the accomplishment of this result there is secured to the oscillating plate 21 a work rest support 45 having set into its upper end a work rest blade 46. This blade has terminal work engaging portions 47 and 48 for substantial engagement with the ends of the work piece being operated upon and has its upper face provided with a combined arced and angled recess 49. The shape of this recess as will probably be best understood by reference to Figures 4 and 7 is such that longitudinally it corresponds substantially to the arc of curvature of the face of the work and transversely it is inclined in the direction of the regulating wheel, so that the weight of the work piece tends to urge the work and hold it in contact with the regulating wheel.

By so forming and mounting the work rest blade or support, a work piece may be placed on the surface 49 between the end engaging members 47 and 48 and the regulating wheel unit and work rest jointly oscillated across the face of the grinding wheel, the end members insuring movement of the work piece with the rest, the shape and position of the rest producing proper contact with the grooved face of the regulating wheel and the oscillation causing a generation of the proper curve on the work piece with an automatic maintenance of the desired curve on the face of the grinding wheel, thus reducing to a minimum the necessity of truing operations on the grinding wheel.

That production may be speeded up as much as possible, there is preferably mounted on the grinding wheel slide 11 the pair of magazines 50 and 51 projecting one each side of the operative edge of the grinding wheel and in position to overlie the recess in the work piece when it has swung to one side or the other beyond the grinding wheel. This relationship is most clearly shown in Figure 6 from which it will be noted that there is pivoted to the side of the magazine a retaining finger 52 having a portion 53 projectable into the path of movement of the work pieces as the adjustable abutment screw 54 on its lower end contacts with the side of the work blade 46. This finger locks the series of rolls in the magazine against downward movement except as respects the lowermost roll and at the same time prevents any upward movement of the lowermost roll.

The purpose of this should be best apparent by reference to Figures 4 and 5. It will here be noted that the work rest blade and support are drilled as at 55 to receive the ejector rod 56, having the flattened head 57 at its upper end preventing rotation thereof. This head has a reversely bevelled surface 58 disposed in opposition to the angled top of the work rest. Suitable mechanism such as a cam track 59 with risers 60 and 61 may be employed to impart a vertical movement to the ejector.

As the regulating wheel carriage and wheel swing to one side or the other, roller 62 on the lower end of the ejector will contact with one of the risers, moving the ejector upward, while at the same time finger 53 will be projected to prevent rising movement of the series of rolls in the magazine, while leaving the lowermost roll free. This lowermost roll normally supported at the base of the magazine as by latch 63 will be engaged by the bottom roll as it is pressed upward on movement of the ejector. The combined restraining action of this lower roll and the angle top 58 of the ejector will cause the lower or completed work piece to be laterally shifted as toward the left in Figure 5, off the work rest when it may drop into a suitable container. At the same time this movement of the work piece will engage lever portion 64 of latch 63, swinging it outward against spring 65 and releasing the lowermost work piece. As a result this work piece will tend to drop down beyond

the completed work just being ejected and below latch 63, so that when the ground work piece is ejected the new work piece will be in position on the work rest blade between members 47 and 48 for grinding on the reverse stroke. At the inception of the reverse swinging movement the rest and roll will be carried away from the position shown in Figures 5 and 6 and at the same time screw 54 will be disengaged, so that spring 66 may reversely rock the arm and release the rolls in the magazine, their downward movement being limited as indicated by latch 63.

In the operation of a machine of this type the grinding wheel is rotated at a high rate of speed for example five thousand feet surface speed per minute for the grinding and in a direction toward the work rest blade as indicated by the arrow in Figure 1. At the same time the regulating wheel which is disposed in opposition to the grinding wheel is rotated with its operative surface moving upwardly at the point of engagement with the work as is also indicated by a suitable arrow. The oscillating regulating wheel carriage is so positioned that it carries the work back and forth across the face of the grinding wheel at the arc of curvature to be reproduced on the finished work. This oscillatory movement is imparted through interengagement of the eccentric 23 with the walls 41 and 42 of the control slot in slide 17. This movement will generate the desired curvature on the roll, maintaining the surface of the grinding wheel in proper condition for continuous grinding without liability of grooving or the like, or undue breaking down of the wheel at certain points as is liable to occur with a direct infeed grinding operation where the engagement of various work pieces with the grinding wheel is duplicated.

It will further be noted that in operation upon each lateral oscillation or swinging of the regulating wheel a completed work piece is automatically discharged and a new piece correspondingly automatically fed into the grinding throat, so that the machine is substantially continuous in its operation, insuring maximum output.

I claim:—

1. A roll grinding machine of the centerless type, including opposed grinding and regulating wheels and an intermediate work rest, the grinding wheel being formed with a transversely curved surface to be reproduced on the work, and means for imparting a joint swinging movement to the regulating wheel and work about the center of curvature on the face of the grinding wheel.

2. A roll grinding machine of the character described, including a grinding wheel, an opposed regulating wheel and an intermediate work rest, and means for swinging the regulating wheel and work across the face of the grinding wheel to generate the desired longitudinal curve on the work.

3. A grinding machine of the centerless type, including a grinding wheel, a regulating wheel and a swinging carriage for the regulating wheel, means for swinging the regulating wheel carriage, a work rest movable therewith for supporting work in the throat between grinding and regulating wheels and means for terminally engaging the work to insure synchronous movement of the work and work rest.

4. A centerless grinding machine, including a grinding wheel, an opposed regulating wheel and an intermediate work rest, magazines disposed at opposite sides of the grinding wheel, means for shifting the regulating wheel and work rest in an arcuate path concentric with the face of the grinding wheel, an automatic means for discharging a finished work piece and replacing it with a piece to be ground from the magazine at each stroke of the regulating wheel.

5. A centerless grinder of the character described, including a bed or support, a grinding wheel adjustably mounted thereon, said grinding wheel having a transversely curved peripheral operative face, a regulating wheel unit mounted for arcuate swinging movement on the bed and disposed in opposition to the periphery of the grinding wheel, and means for swinging the regulating wheel transversely of the operative face of the grinding wheel.

6. A centerless grinder of the character described, including a bed or support, a grinding wheel adjustably mounted thereon, said grinding wheel having a transversely curved peripheral operative face, a regulating wheel unit mounted for arcuate swinging movement on the bed and disposed in opposition to the periphery of the grinding wheel, means for swinging the regulating wheel transversely of the operative face of the grinding wheel, and means movable with the regulating wheel for supporting a work piece in the throat between the grinding and regulating wheels during said swinging movement.

7. A centerless grinder of the character described, including a bed or support, a grinding wheel adjustably mounted thereon, said grinding wheel having a transversely curved peripheral operative face, a regulating wheel unit mounted for arcuate swinging movement on the bed and disposed in opposition to the periphery of the grinding wheel, means for swinging the regulating wheel transversely of the operative face of the grinding wheel, means movable with the regulating wheel for supporting a work piece in the throat between the grinding and regulating wheels during said swinging

movement, and means for shifting the grinding wheel toward and from the regulating wheel.

8. A centerless grinder of the character described, including a bed or support, a grinding wheel adjustably mounted thereon, said grinding wheel having a transversely curved peripheral operative face, a regulating wheel unit mounted for arcuate swinging movement on the bed and disposed in opposition to the periphery of the grinding wheel, means for swinging the regulating wheel transversely of the operative face of the grinding wheel, means movable with the regulating wheel for supporting a work piece in the throat between the grinding and regulating wheels during said swinging movement, means for shifting the grinding wheel toward and from the regulating wheel, and means for varying the radius of swinging movement of the regulating wheel.

9. A roll grinding machine of the character described, including a rotary grinding wheel and an opposed regulating wheel shiftable in an arcuate path transversely of the face of the grinding wheel, and means for varying the radius of the path of shifting movement of the regulating wheel.

10. A roll grinding machine of the character described, including a rotary grinding wheel and an opposed regulating wheel shiftable in an arcuate path transversely of the face of the grinding wheel, means for varying the radius of the path of shifting movement of the regulating wheel, and additional means for adjustably varying the separation of said wheels.

11. A roll grinding machine of the character described, including a rotary grinding wheel and an opposed regulating wheel shiftable in an arcuate path transversely of the face of the grinding wheel, means for varying the radius of the path of shifting movement of the regulating wheel, work supporting means shiftable with the regulating wheel and adapted to project into the throat between the grinding and regulating wheels, and means for automatically ejecting a work piece at the limit of movement of the regulating wheel in one direction.

12. A roll grinding machine of the character described, including a rotary grinding wheel and an opposed regulating wheel shiftable in an arcuate path transversely of the face of the grinding wheel, means for varying the radius of the path of shifting movement of the regulating wheel, work supporting means shiftable with the regulating wheel and adapted to project into the throat between the grinding and regulating wheels, means for automatically ejecting a work piece at the limit of movement of the regulating wheel in one direction, and means for automatically supplying a new work piece to the rest prior to the return stroke of the regulating wheel.

13. A centerless grinding machine, including a bed or support, a grinding wheel carried thereby, a slide mounted on the bed adjacent the grinding wheel and providing a translatory pivot, a regulating wheel unit supported above the slide and oscillatable about the pivot and reciprocable relative to the pivot, and means for automatically imparting one of said movements to the regulating wheel unit.

14. A centerless grinder for the production of non-cylindrical bodies, including a grinding wheel and an opposed regulating wheel, a work support associated with the regulating wheel, and means for generatively shifting the regulating wheel and work rest transversely of the face of the grinding wheel to control the generative production of work pieces by the grinding wheel.

15. In a machine of the character described, the combination with a bed or support, of a regulating wheel unit mounted thereon, bearing a regulating wheel, a prime mover carried by the unit, a regulating wheel thereon, connections between the prime mover and regulating wheel for rotating the latter, means for imparting an arcuate swinging movement to the regulating wheel and additional connections between the prime mover and said means for actuating the latter.

16. A centerless grinder of the character described, including a bed or support, a grinding wheel carried thereby and having transversely curved peripheral operative face, a regulating wheel unit carried by the bed in opposition to the grinding wheel and including a regulating wheel and a work support, means for oscillating the regulating wheel across the face of the grinding wheel in a path concentric with the transverse curvature of the grinding wheel face and beyond the lateral limits thereof, and means for automatically ejecting a completed work piece and substituting a work piece to be ground as the regulating wheel swings beyond the lateral face of the grinding wheel.

17. In a machine of the character described, the combination with a bed or support, of a grinding wheel carried thereby, having transversely curved operative face, a regulating wheel unit, means intermediate the regulating wheel unit and bed supporting the unit for arcuate oscillation transversely of the operative face of the grinding wheel, means for adjusting the center of oscillation with respect to the grinding wheel and additional means for adjusting the regulating wheel unit with respects said center of oscillation.

In testimony whereof I affix my signature.

GEORGE W. BINNS.