Sept. 4, 1928.

J. MILLER, JR

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WORK FEEDING DEVICE FOR GRINDING MACHINES

Filed Jan. 29, 1927

4 Sheets-Sheet 1

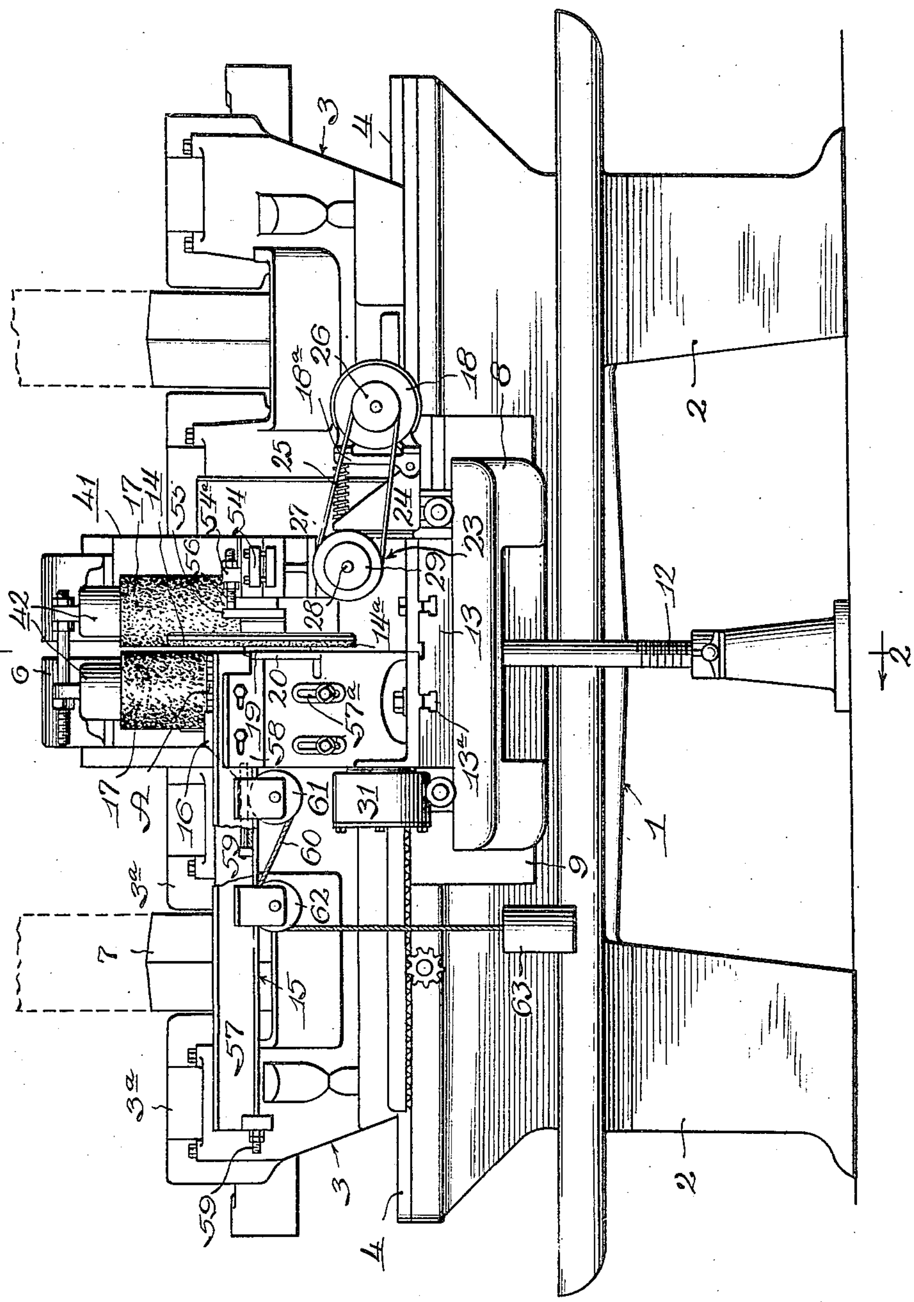

Fig. 1

Witness:
Chas. R. Koursh.

Inventor,
John Miller, Jr.,
Offield, Mebel, Scott & Poole,
Attys.

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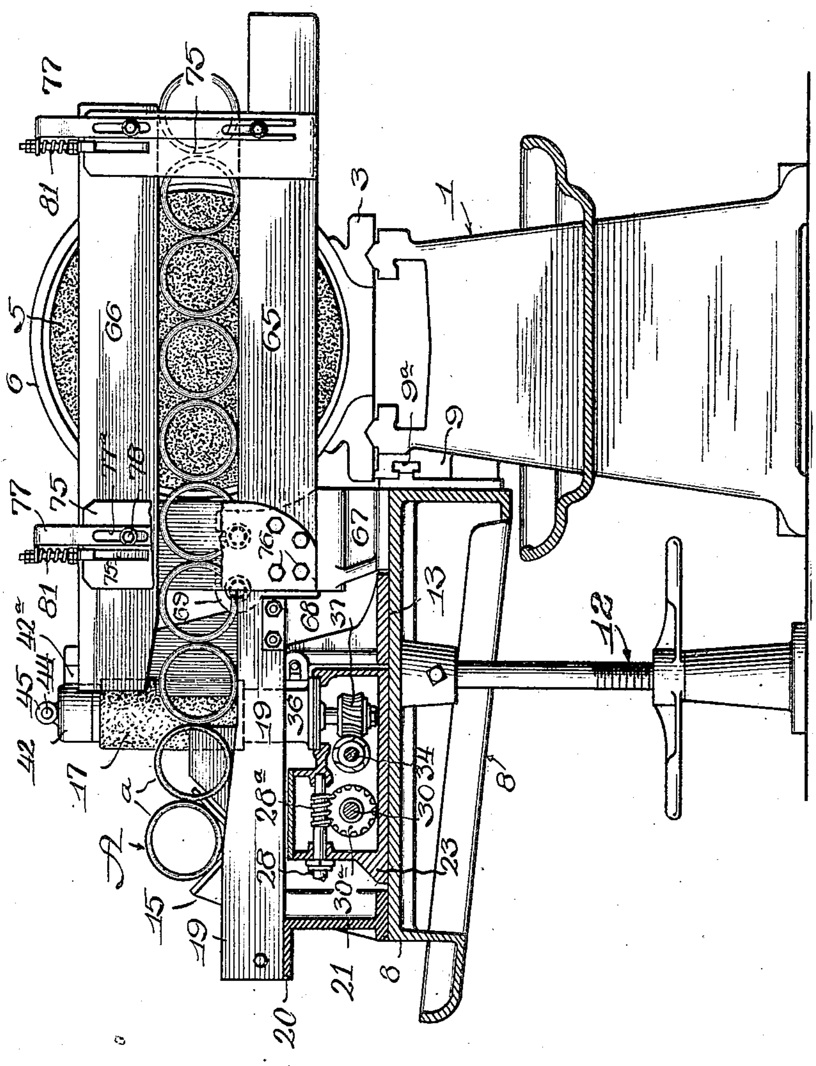
4 Sheets-Sheet 2

Fig. 2



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Chas. L. Koursh

Inventor,
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Offield, Poole, Scott & Poole
Attys.

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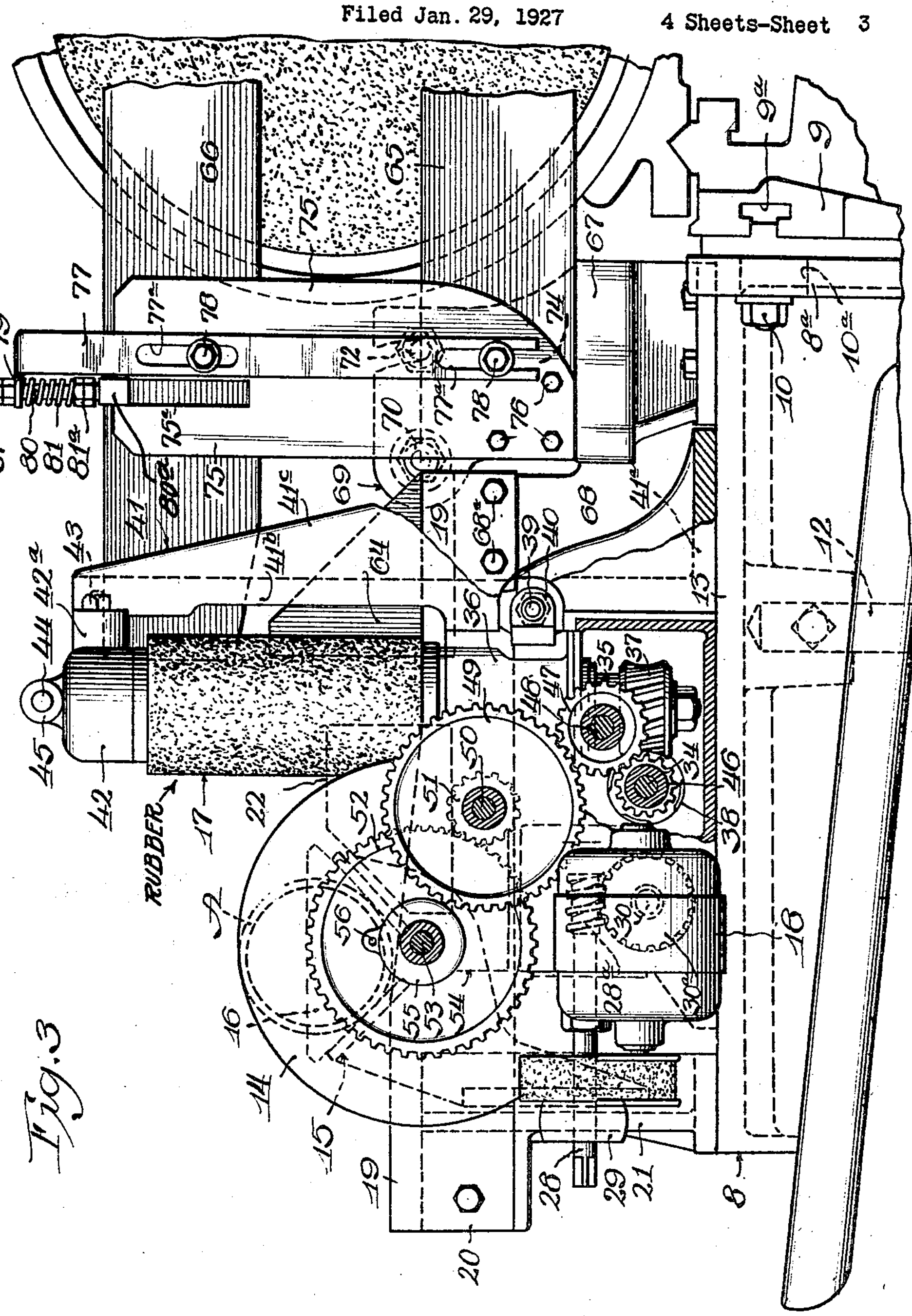

Inventor,
John Miller, Jr.
Offield, Mehlhope, Scott & Poole
Attys

Witness:
Chas. R. Koursh

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J. MILLER, JR

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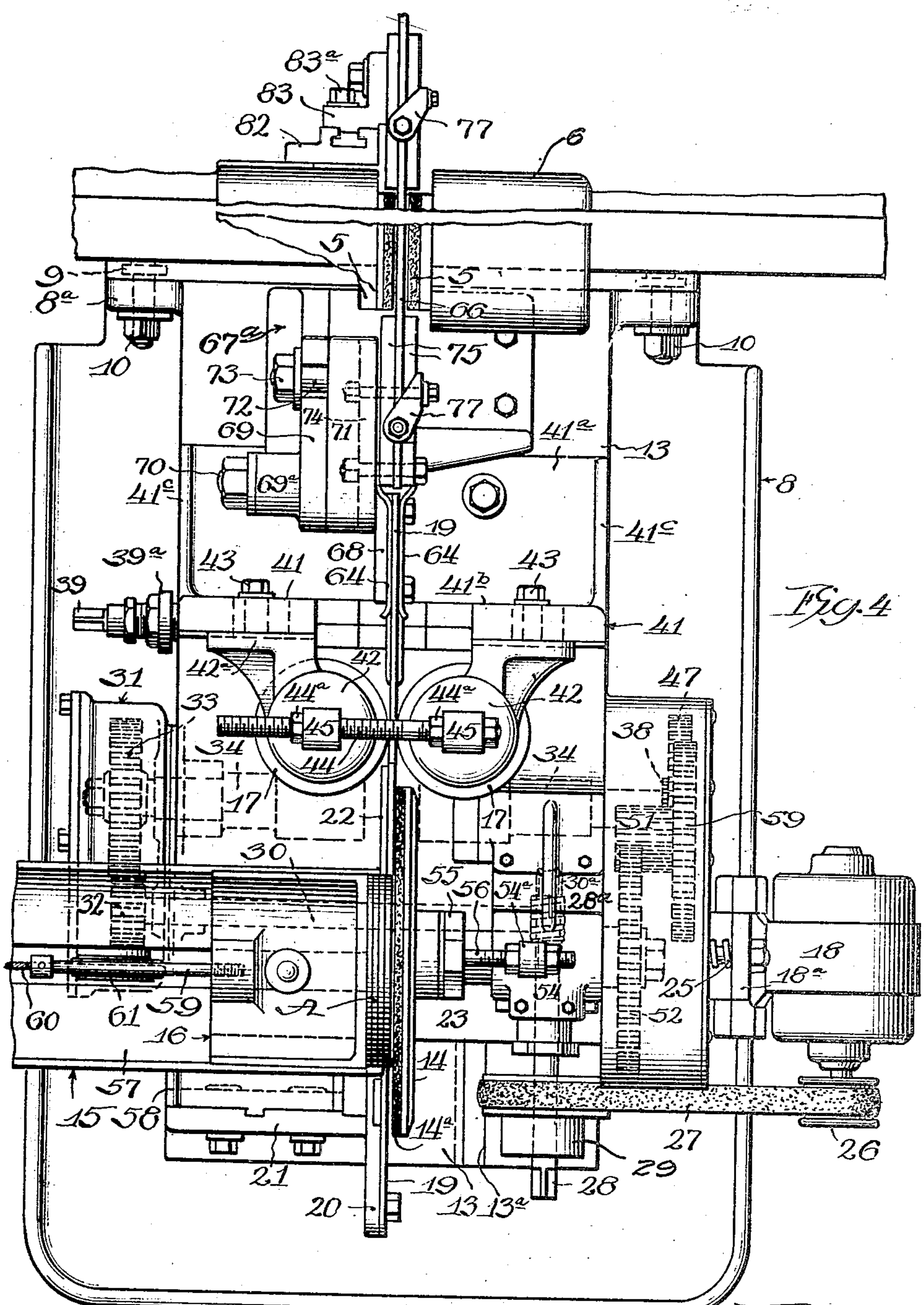
Filed Jan. 29, 1927 4 Sheets-Sheet 4



Witness:
Chas. R. Koursh

Inventor,
John Miller, Jr.
Offield, Poole, Brown, Scott & Poole
Attys.

Patented Sept. 4, 1928. 1,682,925

UNITED STATES PATENT OFFICE.

JOHN MILLER, JR., OF BELOIT, WISCONSIN, ASSIGNOR TO CHARLES H. BESLY AND COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

WORK-FEEDING DEVICE FOR GRINDING MACHINES.

Application filed January 29, 1927. Serial No. 164,388.

This invention relates to improvements in work feeding devices for grinding machines, and more particularly to a machine for grinding relatively small work, such as piston rings, and embodying mechanism for automatically feeding the work through the grinding zone of the machine.

The feeding device may be considered either as an attachment or as an integral part of what might be termed an automatic feed grinding machine. In either instance, the grinding machine, per se, is of standard double spindle type, that is, with two grinding discs mounted on separate spindles in horizontal alignment with each other, the discs being mounted face to face with a narrow space separating their grinding faces. In operating such a grinder, the piston rings, for example, are fed edgewise between the discs, which are spaced to the thickness to which the rings are to be ground and thus the opposite sides or faces of the work are ground at the same time.

The function of the feeding device is to deliver the work from a magazine onto a track extending between the grinding discs, the work being fed continuously forward by coacting feeding devices located in the path of the advancing work. In this manner the grinding operation becomes entirely automatic except for supplying the magazine with work to be ground and removing the finished work from the machine.

In the accompanying drawings is illustrated a grinding machine equipped with the feeding device embodying the invention, wherein

Figure 1 is a general view in front elevation of the machine embodying the features of the invention.

Figure 2 is a view in vertical section through the machine as taken on line 2—2 of Figure 1.

Figure 3 is an enlarged view in side elevation of the work feeding mechanism; and

Figure 4 is an enlarged top plan view of the work feeding mechanism and portions of the grinding machine adjacent the grinding zone.

Referring first to the grinding machine proper, the same, as already explained, may be of any standard construction comprising generally a machine frame consisting of a horizontal bed frame 1 supported upon legs 2. On the bed frame 1 are carriages 3, 3 mounted to slide on tracks 4, 4 extending lengthwise of the frame. The carriages comprise bearings 3^a, 3^a in which are journaled the spindles (not shown) for the grinding discs 5, 5, which are located centrally of the machine and mounted at the inner and adjacent ends of their respective spindles. The adjacent faces of the grinding discs are spaced relatively close together, the distance between them being variable by shifting the carriages 3, 3 in either direction. The grinding discs 5, 5 are preferably enclosed within a cylindric housing or casing 6. The spindles are belt-driven in the machine illustrated, each spindle carrying a belt pulley 7 located intermediate its ends and between the pairs of spindle bearings 3^a, 3^a.

The feeding device has an independent base or bed casting 8 extending outwardly from the front of the frame 1 of the machine immediately in front of the grinding discs, and is mounted for horizontal adjustment to a vertical face plate 9 formed integral with the machine frame 1 (Figure 3), said face plate having a horizontal T-groove 9^a in which slide the heads of anchor bolts 10 extending through vertical slots 10^a formed in flanges or wings 8^a at either side of the bed casting. The bed casting is thus capable of vertical and horizontal adjustment, an elevating screw 12 being preferably provided to support the bed casting and to be used in making vertical adjustments.

The bed casting 8 has a base plate 13 with inverted T-grooves 13^a extending lengthwise thereof or at right angles to the grinding spindles. Bolted to the bed casting 8 by the usual arrangement of anchor bolts engaging the T-grooves in the base plate thereof, are the several frame castings of the feeding device, and which are movable with respect to the bed casting so that the necessary adjustment can be made depending on the size of the work to be ground.

Before taking up the details of construction of the feeding device, a general description of the essential parts thereof will be given, together with brief explanation of their relative positions and functions. At the central portion of the device is a vertical feed disc 14 rotating on a horizontal axis and located in front of and substantially in the plane of the space between the grinding discs 5, 5. This feed disc is essentially a rotative friction member having its front or left face covered

with a layer 14ª of abrasive material, leather, rubber or other suitable material. Extending horizontally and to the left from the face of the feed disc 14, is a V-shaped trough or magazine 15 of considerable length, in which is placed the work to be ground, there being also provided a gravity actuated pusher block 16 sliding lengthwise of the magazine, so that the work, such as piston rings, standing on edge crosswise of the same are continually forced against the face of the feed disc. Immediately behind the feed disc 14 but still in front of the grinding discs, is a pair of vertical feed rollers 17, 17 with an opening or slot between, in alignment with the space between the grinding discs as well as the plane of the feed disc 14. The feed rolls are driven to rotate in opposite directions and have resilient surfaces so that the work fed between them from the feed disc 14, is picked up and positively advanced between them and to the space between the grinding discs. Tracks and guides for the work extend from the feed disc to the feed rolls and thence beyond through the grinding zone as will presently be described, and finally, the feed disc and feed rolls are driven from a motor 18 through a series of shafts and gears so arranged as to give the friction disc a slight excess in peripheral speed over the feed rolls so as to insure a continuous feed from one to the other. However, means are provided for varying the speed of both the feed disc and feed rolls.

The work supporting track and guide members consist generally of a plate 19 supported on edge between the feed disc 14 and the magazine and extending from a point just in front of the feed disc between the feed rolls and a short distance beyond. The top edge of the track plate is inclined downwardly toward the feed rolls, as clearly shown in Figure 3, and is bolted to a track flange 20 forming an integral part of an upright standard 21 bolted down to the bed casting 8. On the side of the track plate opposite the feed disc 14 is a side guide plate 22 extending from the magazine to the feed rolls, the disc itself forming the other side guide for the work as it is fed to the feed rolls. On the opposite side of the feed rolls is a separate arrangement of guide tracks extending from the feed rolls 17, 17 and through the space between the grinding discs. This portion of the work guiding means is constructed so that it may be shifted or swung upwardly and out of the grinding zone, so that access may be had to the grinding faces for dressing them from time to time. These parts will be later described in detail.

The essential parts of the device having been located, the details of construction pertaining to the drive of the moving parts, the various adjustments necessary to accommodate different kinds of work, and the provision for changing the speed of rotation of the feeding members, will now be described, although it is not thought necessary to enlarge on minute details of construction inasmuch as standard practice in machine design has been followed in the construction of the machine.

Referring now to the driving mechanism for the feed disc and rolls, the main parts are enclosed in a hollow base or casing 23 bolted to the bed casting 8 by the usual arrangement of anchor bolts passing through base flanges and engaging the T-grooves 13ª in the base plate 13, the casing being thus capable of being adjusted bodily with respect to the grinding machine. The casing 23 also provides a base or support for the exposed moving parts at the same time containing a quantity of oil so that the gearing enclosed therein is immersed in an oil bath.

The base 18ª of the motor 18 (Figure 1) is hinged at its lower edge to a bracket 24 bolted to the end wall of the casing 23 with a compression spring 25 between the bracket and the upper edge of the motor base. The motor carries a drive pulley 26 carrying a belt 27 which in turn drives a shaft 28 extending parallel to the axis of the motor and journaled in the casing 23, although the forward end of the shaft extends through the casing and carries a belt pulley 29.

The shaft 28 which may be termed the primary drive shaft, carries a worm 28ª which drives a secondary shaft 30 through a worm wheel 30ª mounted thereon, said shaft 30 extending transversely of the casing 23 and journaled in bearings at either end thereof. The opposite or left end of the shaft 30 extends through the adjacent end wall of the casing into a change gear box 31 mounted on the left side of the casing 23. A spur pinion 32 is mounted on the end of the shaft 30 within the gear box which drives a gear 33 also located in the gear box and mounted on a third shaft 34 extending parallel with the secondary shaft and immediately behind it. This shaft also extends the full width of the casing 23 with its opposite end extending through the casing at the right thereof, as will be presently pointed out. The gears 32 and 33 are interchangeable with sets of gears of different gear ratio so that the relative speeds of the drive shafts 30 and 34 may be varied when required.

The drive shaft 34 extends below the feed rolls 17, 17 which comprise a pair of vertical spindles 35, 35 journaled at their lower ends in bearing sleeves 36, 36 on top of the casing 23 and capable of sliding adjustment toward and from each other in order to vary the spacing between the rolls. At the lower ends of the spindles 35, 35 are spiral gears 37, 37 which mesh with spiral gears 38, 38 mounted on the drive shaft 34. The pairs of spiral gears driving the feed rolls are of opposite lead, so that the rolls rotate in opposite direc-

tions and the movement of the work will be toward the grinding zone of the machine.

Extending along the rear of the bearing sleeves 36, 36 of the feed roll spindles, is a horizontal adjusting screw 39 having right and left-hand threads which turn in threaded lugs 40, 40 integral with the bearing sleeves. The outer end of the adjusting screw 39 passes through an adjustable bearing collar 39ª (Figure 4) and carries a lock nut 39 for holding the screw against turning when the adjustment of the rolls has been made. Thus by turning the adjusting screw in either direction, it moves the rolls toward or away from each other to vary the space between them.

At the rear of the feed rolls 17, 17 there are two vertical supports 41, 41 bolted to the hollow base or casing 23 and consisting of L-shaped brackets having feet 41ª and vertical standards 41ᵇ reinforced by vertical webs 41ᶜ. These brackets act as supporting members for upper spindle bearings 42, 42 of the feed rolls, the same having lugs 42ª, 42ª extending rearwardly in sliding bearing contact with the upper edge portions of the support, which are slotted horizontally to receive bolts 43 which are anchored in lugs 42ª as clearly shown in Figures 3 and 4.

The upper spindle bearings 42, 42 are also connected by means of a tie rod 44 extending through bosses 45, 45, one at the top of each bearing and having nuts 44ª thereon. which may be adjusted to correspond with the adjustment of the lower spindle bearings by the adjusting screw 39.

As already stated, the feed rolls proper are of some resilient material, such as rubber, preferably in the form of cylinders mounted on the spindles 35, 35 between the upper and lower spindle bearings.

Continuing the description of the drive from the point where the feed rolls are driven from the shafts 34 by the gears 37, 38, this shaft as already stated, extending through the end wall of the casing 23 at the right of the feed rolls. Mounted on the end of the shaft 34 and exterior of the casing is a pinion 46 which drives a change speed reduction gearing as follows: Meshing with the pinion 46 is an idler pinion 47 journaled on an adjustable stub shaft 48 which in turn meshes with a change gear 49 removably mounted on a stud shaft 50. Rotating with the change gear 49 is a small pinion 51 meshing with a gear wheel 52 fixed to the outer end of a shaft 53 which carries the friction disc 14 at its inner end. This last mentioned shaft 53 is journaled in a bearing 54 mounted on the casing 23 just above the primary drive shaft 28. The friction disc 14 is mounted on the shaft 53 for limited endwise sliding movement through the medium of a collar 55 riding on the hub of the disc, and having a screw rod 56 passing through a lug 54ª mounted on top of the bearing 54 with nuts on either side so that the disc may be shifted axially to vary the distance of the face of the disc from the end of the magazine, depending on the thickness of the pieces being ground.

As already indicated, the magazine 15 consists of a V-shaped trough 57 extending at right angles to the face of the friction disc 14, and preferably made up of plates bolted to a bracket 58 which in turn is bolted to the vertical support 21 at the front of the bed casting, said support having elongated bolt holes 57ª to allow for the vertical adjustment of the magazine (Figure 1). At the bottom of the trough 57 is an endwise sliding rod 59 carrying at its forward end the pusher head 16. Attached to the rod 59 is a cable 60 which extends along the bottom of the trough to a pulley 61 mounted underneath the trough, thence around said pulley 61 and over a second pulley 62 likewise mounted below the trough. From the free end of the cable is suspended a weight 63 acting through the cable to force the pusher block toward the friction disc 14. The work A in the form of a large number of rings *a*, is held on edge and crosswise of the trough, and as each ring is discharged by the disc, the next one is pushed forward and so on, by the pusher block, the supply in the trough being replenished from time to time.

Referring now more in detail to the portions of the work guide extending from the feed rolls and between the grinding discs: As already explained, the track plate 19 extends from the feed disc between the feed rolls and a short distance beyond, the top edge of the track part clearing the bottom edges of the feed rolls. This track 19 is fixed and provided for guiding the work to a point about midway between the feed rolls and the grinding disc, being aided by a pair of upright guide plates 64, 64 on either side of the track and located just beyond the feed rolls (Figure 3).

Beyond the end of the fixed track 19 (Figure 2) is a guide bar or track 65 extending horizontally between the grinding discs 5, 5 and below the centers thereof, said track being a prolongation of the fixed track 19. Above the lower guide bar 65 is another guide bar 66 extending parallel therewith, the space between the edges of the two bars being substantially equal to the diameter of the rings *a*. This upper bar is held by springs so that it can exert a slight pressure on the work as it passes through the grinding zone. Moreover, these two bars together with their supports, are joined together to form a frame which is hinged to swing bodily upward and out of the space between the grinding discs.

As a preferable construction for the hinged frame, fixed supports are provided at each end and on opposite sides of the grinding discs. The support for the inner end of

the frame is a bracket 67 mounted on the bed casting 8 near its rear edge and just behind the feed roll supporting bracket 41.

The bracket 67 is a casting having the usual base which is bolted down to the bed casting, with a block 67^a elevated above the base, this block being located to the left of the frame as shown in Figure 4. Incidentally the bracket 67 also includes an auxiliary bracket 68 extending from the base upwardly and forwardly and bolted at 68^a, 68^a to the fixed track 19, thus forming the support for the adjacent extremity thereof.

Projecting upwardly from the top of the block 67^a is a vertical web 69 which provides the main support for the bars 65 and 66. This web has a boss 69^a near its rear edge in which is journaled a hinge pin 70 extending horizontally through the web and toward the plane of the bars 65 and 66. Between the web 69 and the bars 65 and 66 is a plate 71 in which the pin 70 is anchored, and thus revolves about the axis of said pin. The plate 71 also carries a stud 72 projecting laterally from its face adjacent the web 69, and a short distance from the hinge pin 70. This stud normally engages a notch or recess in the top edge of the web and carries a nut 73 at its end so that by tightening the nut the frame is held in fixed position.

The plate 71 has a tapered web 74 extending downwardly to the bottom edge of the lower bar 65 and to which the frame proper is bolted, said frame consisting of the two horizontal bars 65 and 66 together with a pair of vertical guide plates 75, 75 at each end of the bars. These vertical plates are located on opposite sides of the bars with bolts 76 passing through the lower ends of the innermost pair of plates and the inner end of the lower bar, thus securing the frame to the plate 71. In like manner, the outer pair of guide plates 75, 75 are bolted to the lower bar. The upper bar 66, however, is loosely held between the guide plates, and since the connection at each end is the same, both will be included in the following description.

A vertically adjustable supporting bracket 77 is mounted on the outer face of one of the vertical guide plates by bolts 78 engaging elongated slots 77^a in said bracket. The upper end of the bracket projects above the top bar 66 and has its end bent over at right angles above the bar in the form of an arm 79. Passing through the arm 79 is a threaded rod 80 secured at its lower end to the upper edge of the bar 66 by means of a block 80^a engaging guide slots 75^a in the vertical guide plates 75. A coil spring 81 surrounds the rod 80 and acts to yieldingly oppose the upward movement of the bar, said rod and spring having adjusting nuts 81^a and 81^a, respectively.

The outer end of the frame is detachably secured to the hood 6 enclosing the grinding discs, by a bracket 82 and an intermediate angle member 83 fixed to one of the guide plates 75, near its bottom and having a bolt 83^a with a square head engaging a T-slot in the bracket 82 (Figure 4).

By this arrangement, the bars can be adjusted to different diameters of work to be ground, with the upper guide bar exerting pressure upon the work as it is passing through the grinding zone, as shown in Figure 2. As already stated, the entire work guide, consisting of the bars 65 and 66, with its associated parts, can be swung bodily into an elevated position and clear of the space between the grinding discs.

It is manifest from the preceding disclosure that the work A in the form of rings *a*, is delivered successively from the magazine onto the track 19, and thence advanced edgewise by the friction disc between the feed rolls.

From the feed rolls the work continues onward to the grinding zone, the positive action of the feed rolls on the rings behind forcing those ahead with a uniform advance movement. On passing the grinding zone, the rings are discharged from the guide tracks into a suitable receiving receptacle with both faces ground to the exact thickness and finish. Manifestly the entire feeding of the work through the machine is automatic, requiring only the replenishing of the magazine from time to time and the disposal of the finished work.

Having disclosed a preferred embodiment of the invention, I claim:

1. In a work feeding device for grinding machines the combination of a pair of rotative grinding discs, means for guiding the work to be ground between said discs, a pair of feed rolls mounted in advance of said discs and in line with said work guiding means, a work magazine, a rotative friction disc mounted at the discharge end of said magazine, and operative to advance the work successively from said magazine to said feed rolls.

2. In a work feeding device for grinding machines the combination of a pair of rotative grinding discs, means for guiding the work to be ground between said discs, a pair of rotative feed rolls mounted in advance of said discs and in line with said work guiding means, a work magazine, a rotative friction disc mounted at the discharge end of said magazine, and means for discharging successive pieces of work from said magazine into contact with said friction disc whereby the same is advanced to said feed rolls.

3. In a work feeding device for grinding machines, the combination of a pair of spaced grinding discs, a pair of vertical feed rolls mounted adjacent the peripheries of said discs, and opposite the space therebetween, a work magazine, a friction disc at the discharge end of said magazine, means acting on

the work in said magazine to force successive pieces of the same against said friction disc and means for driving said disc and feed rolls whereby the work is continuously advanced from said magazine to said feed rolls and thence between said grinding discs.

4. In a work feeding device for grinding machines, the combination of a pair of spaced grinding discs, a pair of feed rolls mounted opposite the space between said discs, a track extending between said feed rolls and between said discs, a work magazine on one side of said track on the opposite side of said feed rolls from said grinding discs, a friction disc on the other side of said track opposite the discharge end of said magazine, means for successively discharging pieces of work on to said track and in contact with said friction disc and means for driving said friction disc and feed rolls in a direction to continuously feed the work to said feed rolls and thence between said grinding discs.

5. In a work feeding device for grinding machines, the combination of a pair of grinding discs, a work guide extending between said grinding discs, means for positioning successive pieces of the work for movement along said work guide, a pair of vertical feed rolls in the path of the work, a rotative feed disc adapted to advance the work toward said feed rolls, means for driving said feed rolls and feed disc, and means for changing the relative speeds of said feed rolls and disc.

6. In a feeding device for grinding machines the combination of a rotative grinding disc, a work guide extending transversely of the face of said grinding disc, a pair of feed rolls at one end of said work guide and comprising rotative cylinders of resilient material adapted to advance pieces of work along said work guide and in contact with the face of said grinding disc, and means for feeding the work to said feed rolls comprising a rotative feed disc, a drive shaft operatively connected with said feed rolls, and gearing driven by said shaft and operatively connected with said feed disc.

7. In a feeding device for grinding machines the combination of a pair of spaced grinding discs, a work guide extending between said grinding discs, and means for continuously feeding the work to said work guide comprising a pair of feed rolls adjacent said grinding discs, a rotative friction disc for advancing the work between said feed rolls, a primary drive shaft, a motor operatively connected with said primary drive shaft, a secondary drive shaft in driving connection with said feed rolls, change gearing interposed between said primary and secondary shaft and gearing driven by said secondary shaft and in driving connection with said friction disc.

8. In a feeding device for grinding machines the combination of a machine frame, grinding discs journalled on said machine frame and rotative about a horizontal axis, a work guide mounted on said machine frame and extending between said grinding discs, a track extending toward said work guide, vertical feed rolls at one end of said track adjacent said work guide, a rotative feed disc adjacent said track, a drive shaft journalled below said feed rolls and disc, a motor having driving connection with said shaft, gearing driven by said shaft and operatively connected with said feed rolls and disc, including speed reducing change gearing intermediate said shaft and said feed disc.

9. In a work feeding device for grinding machines the combination of a pair of grinding discs having opposed faces with a relatively narrow space between, a work guide extending from one side of said machine through the space between said discs, a pair of feed rolls mounted at one end of said work guide, a work magazine, means for continuously feeding the work from said magazine to said feed rolls and means for driving said feed rolls and work feeding means at predetermined relative speeds.

10. In a work feeding device for grinding machines, the combination of a pair of grinding discs, means for guiding the work between said discs, a pair of feed rolls adjacent said work guiding means, a work magazine, a member coacting with said magazine for advancing the work continuously from said magazine to said feed rolls, and driving mechanism for said feed rolls and feeding member comprising means for controlling the relative work feeding speed of said feed rolls and feed member.

11. In a work feeding device for grinding machines, the combination of a pair of grinding discs, means for guiding the work between said discs, feed rolls mounted adjacent said grinding discs and acting to positively advance the work therebetween, a work feeding member for feeding the work continuously to said rolls, driving means for said feed rolls and feeding member, and means for regulating the relative work feeding action of said feed rolls and feeding member.

12. In a work feeding device for grinding machines, the combination of a pair of spaced grinding discs, a pair of feed rolls mounted opposite the space between said discs, work feeding means extending from said feed rolls between said discs, a work magazine, a friction disc coacting with said magazine for continuously feeding the work to said feed rolls, means for driving said friction disc and feed rolls, and means for regulating the speed of said disc driving means.

13. In a feeding device for grinding machines the combination of a pair of spaced grinding discs, a work guide extending horizontally between said grinding discs, a pair of vertical feed rolls mounted adjacent said

grinding discs, means for driving said feed rolls, a work magazine, a work feeding member coacting with said magazine for continuously advancing the work to said feed rolls, means for driving said work feeding member, and means for regulating the relative work advancing movements of said feed rolls and work feeding member.

14. In a feeding device for grinding machines the combination of a pair of spaced grinding discs rotative about a horizontal axis, a work guide extending transversely between the faces of said grinding discs, vertical feed rolls adjacent said work guide, a feed disc adjacent said feed rolls, and driving mechanism for said feed rolls and feed disc comprising a motor, a primary and secondary drive shaft, change speed gearing interposed between said primary and secondary drive shafts, said secondary shaft having driving connection with said feed rolls and change speed gearing intermediate said secondary shaft and said feed disc.

Signed at Beloit, Wis., this 24th day of Jan., 1927.

JOHN MILLER, Jr.