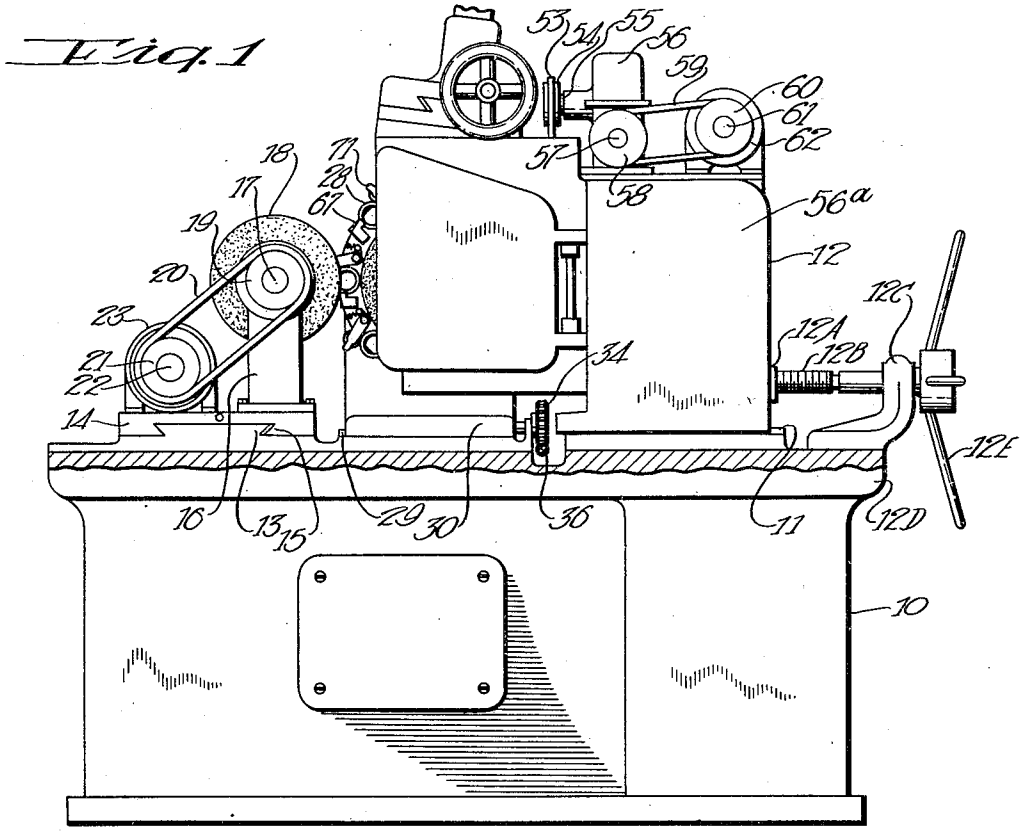
Sept. 12, 1933. S. EINSTEIN 1,926,974

GRINDING MACHINE

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Fig. 1



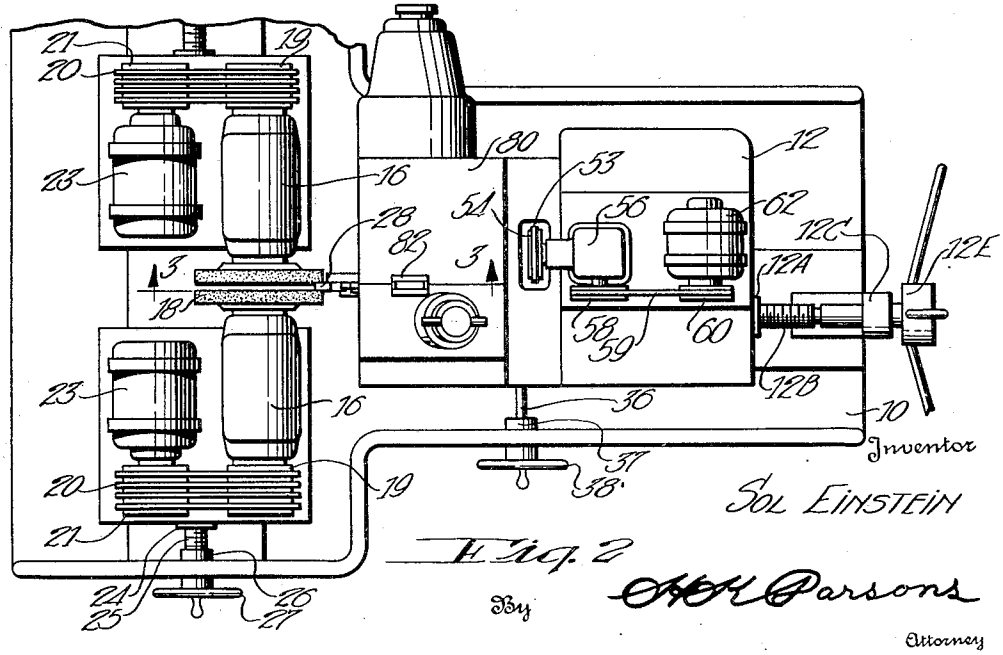


Fig. 2

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GRINDING MACHINE

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Fig. 3

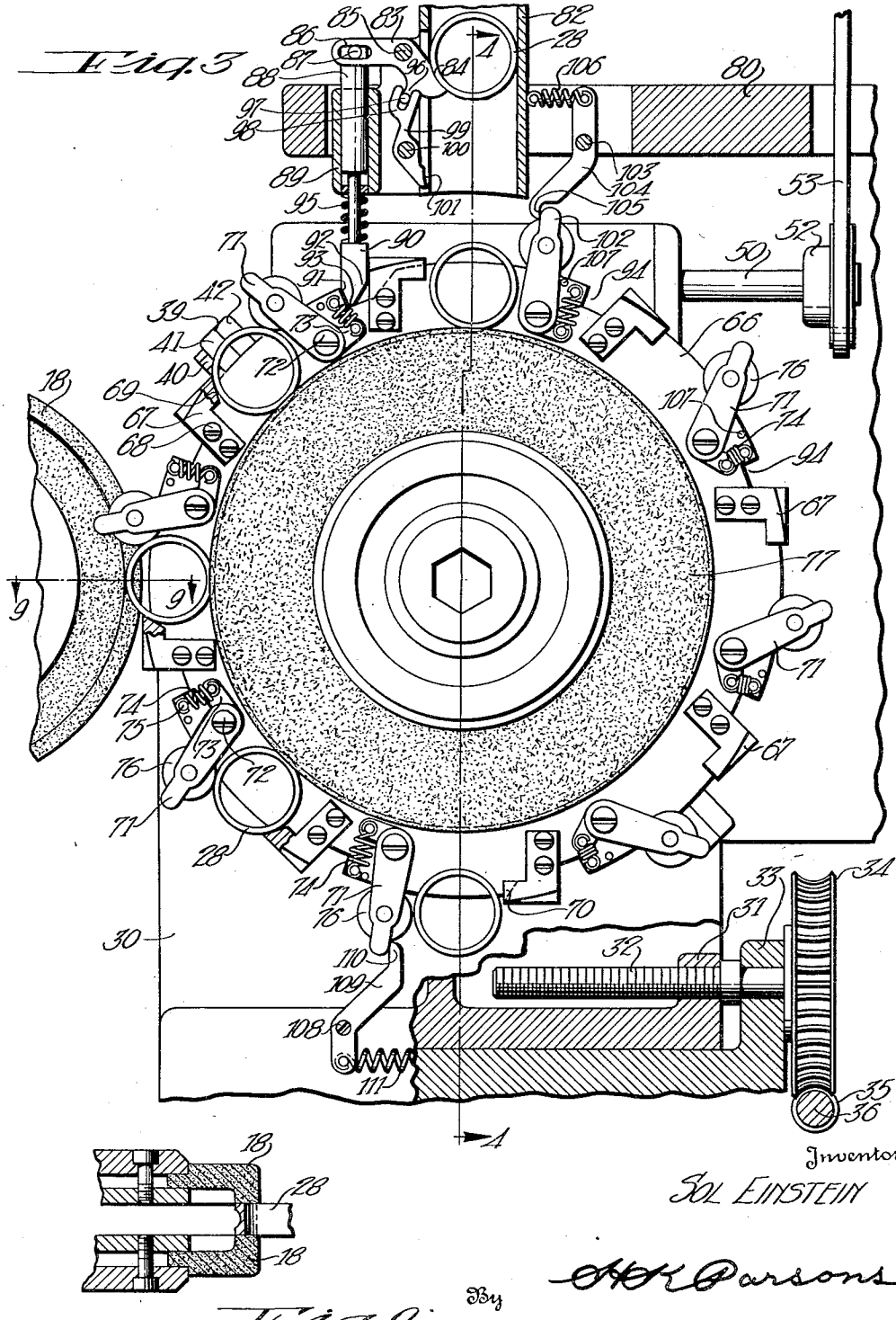


Fig. 9

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GRINDING MACHINE

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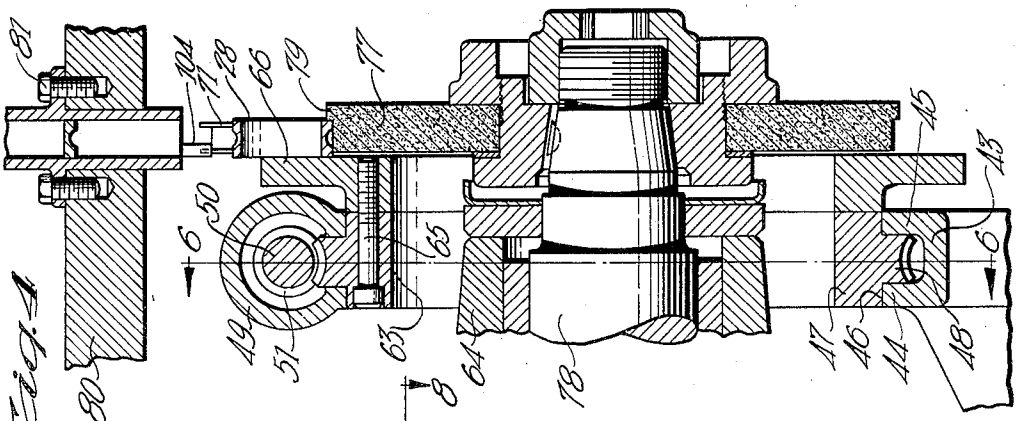


Fig. 1

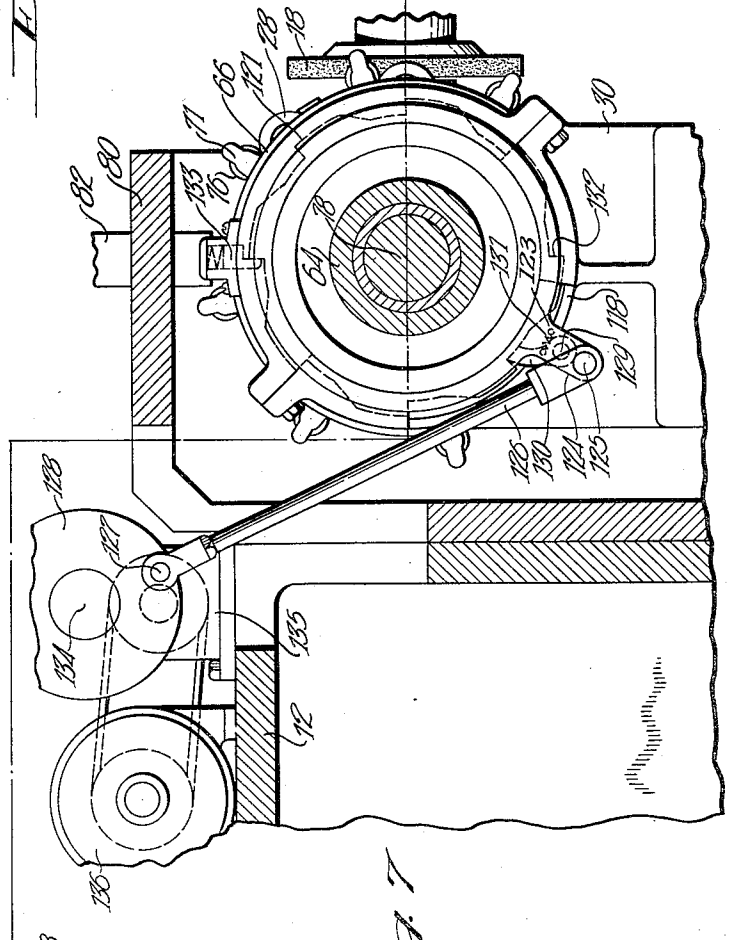


Fig. 7

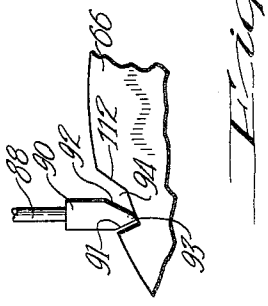


Fig. 5

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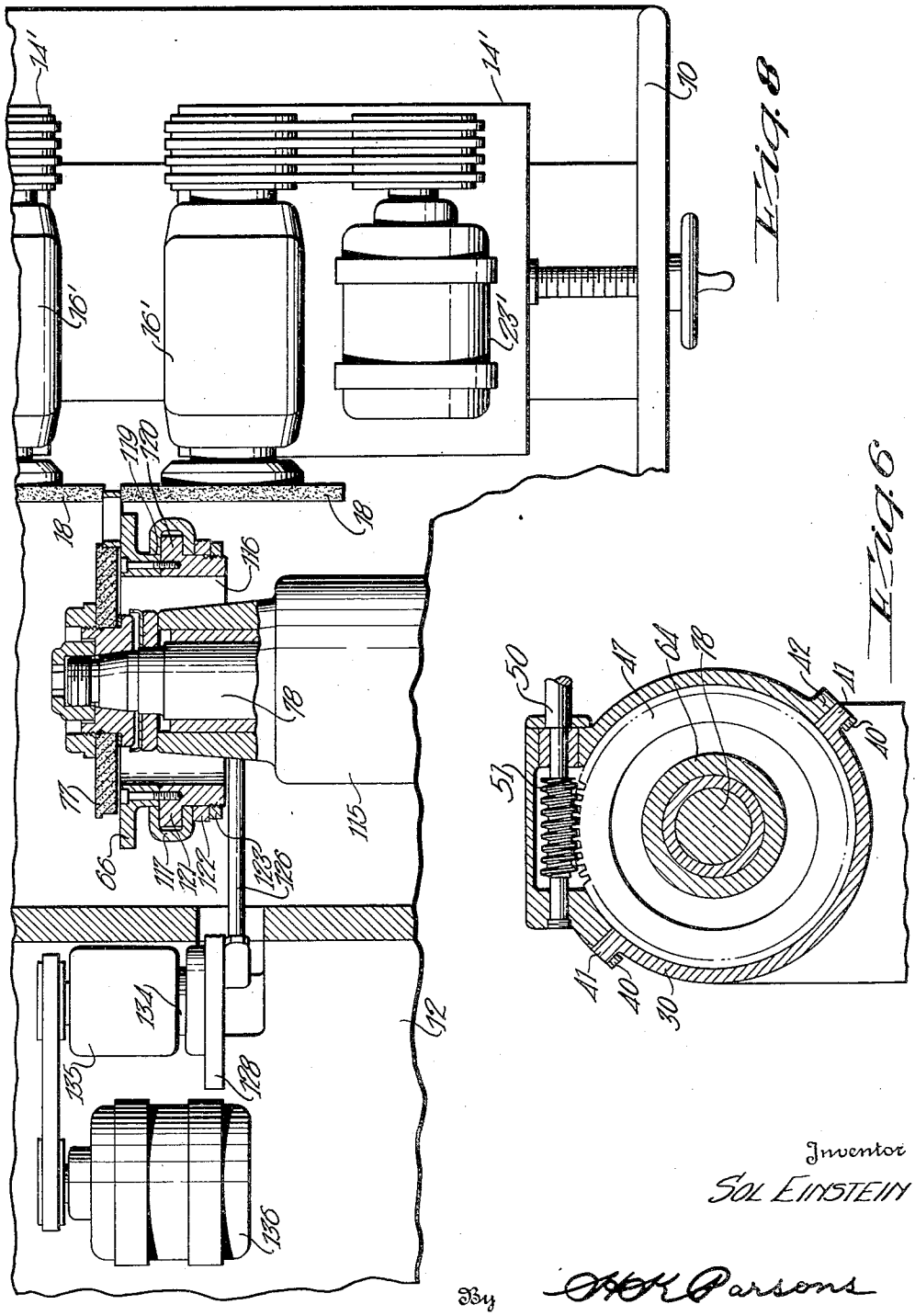


Fig. 8

Fig. 6

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Patented Sept. 12, 1933 1,926,974

UNITED STATES PATENT OFFICE

1,926,974

GRINDING MACHINE

Sol Einstein, Cincinnati, Ohio, assignor, by mesne assignments, to The Heald Machine Company, Worcester, Mass., a corporation of Massachusetts

Application November 23, 1931
Serial No. 576,662

19 Claims. (Cl. 51—117)

This invention relates to improvements in machine tools and especially to improvements in a grinding machine.

An object of the invention is the provision of an improved grinding machine for grinding flat surfaces.

Another object of the invention is the provision of a grinding machine for grinding sides or flat surfaces of work pieces in definite relation to other preformed surfaces of the work.

A further object of the invention is the provision of an improved grinding machine for accomplishing the above objects and including improved means for supporting and rotating a work piece while having the aforementioned side faces thereof ground.

A still further object of the invention is the provision of a grinding machine for automatically expeditiously grinding the sides of ring-like work pieces such as bearing races so that said sides are absolutely parallel to one another and bear a definite relation to the surface of revolution.

Other objects and advantages of the present invention should be readily apparent by reference to the accompanying drawings taken in connection with the following specification, and it is to be understood that any modifications may be made in the exact structural details there 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 grinding machine embodying the invention.

Figure 2 is a fragmentary top plan view of the machine shown in Figure 1.

Figure 3 is a sectional view substantially along the line 3—3 of Figure 2.

Figure 4 is a sectional view substantially along the line 4—4 of Figure 3.

Figure 5 is an enlarged detail view of the cam operating the magazine release forming a detail of the invention.

Figure 6 is a sectional view substantially along the line 6—6 of Figure 4.

Figure 7 is a view similar to Figure 3 showing a slight modification.

Figure 8 is a sectional view along the line 8—8 of Figure 7.

Figure 9 is a sectional view along the line 9—9 of Figure 3.

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

Anti-friction bearings comprising inner and outer races which contact with the anti-friction members such as balls or rollers must have their side faces at right angles to the outer surface of revolution in order that when mounted in position for use no undue strain will be thrown on either the anti-friction members or the races while in use. If the said sides and peripheral surfaces are not at a true right angle the races have a tendency to cock when forced into the position thereby shifting the anti-friction elements relative to the race portion and effect a rapid wearing on the said members or races. By this invention the said bearing races are machined to exact details so that when mounted in position for use the anti-friction bearing members ride on the race ways provided therefor.

A machine for finishing the said races or other ring-like work pieces may comprise a bed or support 10 having formed on its upper surface ways 11 which extend longitudinally of the machine for supporting and guiding the work rotating and supporting unit 12. The bed 10 is further formed with a transverse guide 13 on which is mounted a slide 14 supporting the grinding wheels. The guide 13 is of a dove-tail cross section and is received in a correspondingly shaped guideway 15 formed in the slide 14. As shown in Figure 2 there are two slides 14 employed, each of which is identical with the other and a detail description of one of the slides will suffice for both. Each slide 14 has rising therefrom a pedestal bearing 16 in which is rotatably journaled a spindle 17. The spindle 17 has secured to its one end a grinding wheel 18 and to its other end a sheave or pulley 19. As illustrated, the sheave 19 is of the multiple belt type for receiving the transmission belts 20 which are in turn mounted about a second sheave 21 secured to the motor shaft 22. The motor shaft 22 is connected with a prime mover or electric motor 23 also mounted upon the upper surface of the slide 14. Each slide 14 has secured to it a nut 24 receiving the threads of an adjusting screw 25 rotatably journaled in a bearing 26 associated with the bed 10. A hand wheel 27 is secured to the screw 25 beyond the bearing 26 whereby the said screw may be rotated for effecting the adjustment of the slides 14 toward and from one another.

It will be noted from Figure 2 that the grinding wheels 18 are spaced from one another a distance corresponding to the exact width or thickness of the work to be ground here shown as anti-friction bearing races 28. The slides are independently adjusted through the agency of hand wheel and screw 25 and 27 for varying the width

of grinding throat between the wheels 18 as well as for taking up for the inevitable wear on the wheels.

The work 28 is actuated in a vertical plane and passed through the narrowest point of the grinding throat and as the work passes therethrough the grinding wheels 18 respectively operate on the opposite sides of the work. For effecting this passage of the work through the grinding throat the bed 10 is provided with a guideway 29 for guiding the bracket 30 in its adjustment toward and from the grinding wheels. The bracket 30 has secured thereto or formed integral therewith a nut 31 receiving the threads of an adjusting screw 32 rotatably journaled against axial movement in a bearing 33 associated with the bed 10. The screw 32 has secured thereto beyond the bearing 33 a worm wheel 34 which meshes with a worm 35 on the inner end of a shaft 36. The shaft 36 extends transversely of the bed 10 and is journaled at its outer end in a bearing 37 carried by the bed 10. A hand wheel 38 is secured to the shaft 36 beyond the bearing 37 whereby it is rotated for effecting the adjustment of the bracket 30. The bracket 30 is formed in two halves which are bolted together at 39, Fig. 3, by means of bolts 40 which extend through adjacent ears 41 and 42 formed on the said portions of the bracket 30. The bracket is channel-like in cross section as shown particularly at 43 in Figure 4. The flanges 44 and 45 of the channel 43 engage the bearing surface 46 of a comparatively large worm gear 47 which is journaled in the bracket 30 having the worm wheel portion 48 thereof extending into the channel. The upper end of the bracket 30 is formed into a cylindrical housing 49 in the opposite ends of which is journaled a worm shaft 50 having integral therewith or secured thereto the worm 51 which meshes with the worm gear 48. The worm shaft 50 has secured to its outer end a pulley 52, Fig. 3, about which is mounted the transmission belt 53 which extends upwardly about a second pulley 54, Figs. 1 and 2, on the end of a shaft 55 projecting from speed reducer 56. The speed reducer 56 is mounted on the upper surface of a slide member 56*a* and has projecting from it a second shaft 57 carrying a pulley 58 belted by transmission belt 59 to a pulley 60. The pulley 60 is in turn secured to motor shaft 61 adapted to be rotated at the desired speed by a prime mover or motor 62 also mounted upon the upper surface of the slide member 56*a*.

The comparatively large worm gear 47 has an enlarged opening 63 formed therein which encircles a spindle housing 64 which is carried by the slide member 56*a*, whereby the bracket 30 and member 56*a* may be actuated independently relative to the bed 10 without interference with one another. The worm wheel 47 has secured thereto as by means of bolts 65 a plate member 66 which is rotated with the worm wheel 47 for carrying work pieces through the grinding throat. The plate 66 provides a plurality of work supporting stations so that as soon as one work piece has passed through the grinding throat a second work piece is in position for being immediately inserted in the said throat. To this end the plate has secured to it a plurality of work rests or supports 67 each of which is L shaped in formation, and these rests are secured to the plate 66 through one leg thereof by fastening screws 68. The other leg has formed thereon a work supporting surface 69 which inclines toward the center of the ring or plate 66. The work rests 67 are of a width in excess of the width of the work 28 being ground so that a lug 70, Fig. 3, is formed on the work supporting leg of the blocks, which lug tends to hold the work against tilting relative to the plate 66. In order to urge the work into contact with the supporting surface 69 the plate has pivoted thereto an arm 71 for each of the work supports or blocks 67. The arm is pivoted at 72 and has extending therefrom at substantially a right angle thereto the lug or ear 73. One end of a spring 74 is secured to the end of the lug or ear 73 and its other end is anchored at 75 to the plate 66. A pressure roller 76 is rotatably mounted on the arm 71, and the spring 74 tends to oscillate the arm 71 in a counter-clockwise direction as seen in Figure 3 for urging said pressure rollers 76 into engagement with the outer surface of the work piece 28 thereby forcing the said work against the supporting seat or surface 69.

The work pieces 28 are also held in contact with the operative surface of a comparatively slow rotating regulating or friction drive wheel 77 which effects and controls the rotation of the work as it passes through the grinding throat. This regulating wheel 77 is secured in any desirable manner to the end of a spindle 78 journaled in the spindle bearing 64 which, as noted above, is carried by the slide member 56*a*. The regulating wheel 77 is provided with a circumferential flange 79 spaced from the adjacent face of the work carrying plate a distance substantially equal to the width of the work pieces 28 and said flange cooperates with the lugs 70 of the work rest blocks 67 in effectively preventing lateral tilting of the work. As above noted, the regulating wheel 77 is rotated at a speed for frictionally rotating the work at the desired speed as it passes through the grinding throat so that all points on the opposite surfaces of the work are presented to the adjacent grinding wheels. For shifting the regulating wheel and its supporting slide member or housing 56*a* relative to the bed and maintain proper frictional contact between the work and regulating wheel the said slide has mounted therein a nut 12A in threaded engagement with an adjusting screw 12B. This screw 12B is rotatably journaled in a bearing 12C connected to an extended portion 12D of the bed 10. A pilot or hand wheel 12E is secured to the end of the screw beyond the bearing whereby said screw is actuated for effecting the shifting of the slide member 56*a*.

From the foregoing it will be noted that the work pieces are rotated on their previously formed exterior surface and are rotated in a plane determined by said previously formed surface and the side faces of the work pieces are ground while the work is rotating in this plane. This construction insures a true right angle between the periphery and side faces of the work pieces.

The work pieces are adapted to be automatically disposed on the work supporting blocks 67 and automatically ejected therefrom. To this end the slide member 56*a* has extending from it a portion 80 to which is bolted, as at 81 in Figure 4, a magazine 82 containing a supply of unfinished work pieces. The work pieces except the lowermost one are held against discharge from the magazine 82 by a bell crank 83 which has formed at one end a seat 84 for engaging the second lowermost work piece of the stack. The bell crank 83 is pivoted at 85 to a lug or the like, car-

ried by the magazine 82 and has formed in its other end an elongated perforation 86 receiving therein a pin 87 extending from a plunger 88. The plunger 88 is guided by a boss 89 extending from the magazine 82. The plunger 88 is further provided on its lower end with a head 90 having cam faces 91 and 92. It will be noted that the cam face 92 is of a steep angle while the face 91 is substantially vertical as respects the sides of the head, and a flat portion 93 forming a nose on the head 90 is provided between the cam faces 91 and 92. This nose 93 is adapted when the carrying plate 66 is rotated to ride on the outer periphery of said plate, which is provided on its said periphery with a series of depressions or notches 94 into which the head 90 drops when any of said notches is aligned with the plunger 88. To insure proper contact between the head 90 and plate 66 the plunger is surrounded by a coiled spring 95 abutting on one end the head 90 and on the other end the bearing lug 89 and asserting a yielding influence downwardly toward the plate 66.

The bell crank 83 has extending from it an ear 96 from which a pin 97 projects, the latter being received in the forked end 98 of an arm 99 pivoted at 100 to the magazine 82. The other end of the arm 99 is provided with a seat 101 therein, adapted to engage the lowermost work pieces of a stack of work pieces for holding said stack within the magazine.

As above stated, the arm 71 carrying the pressure roller 76 is spring actuated to close in on the space between the pressure roll and the supporting block 67 when there is no work piece on the block 67. Therefore, as the several work receiving stations of the plate 66 align with the lower portion of the magazine, the space would be blocked by the pressure roller 76. To remove the pressure roller from the space for the work piece, its supporting arm is provided with a tang 102 which extends beyond the pressure roller 76. The slide bracket portion 80 has pivoted at 103 a latch 104 having a finger 105 adapted to engage the tang 102 of arm 71 and actuate it in a clockwise direction against the yielding resistance of its spring 74 as it passes therebeneath. This movement of the arm or holding against movement thereof occurs just before the station is aligned with the magazine. A spring 106 having one end secured to the latch 104 and the other to the magazine 82 is provided for resisting the movement of the latch 104 until the arm has been moved to the limit of its position which is defined by a pin 107 projecting from the plate 66 adjacent each of the levers.

The operation of the mechanism is as follows:

The plate 66 is rotated in a counter-clockwise direction thereby causing the several work supporting stations, identified by the work supporting block and pressure roller mechanism to pass beneath the magazine. At this time the nose 93 of the plunger head 90 is riding on the periphery of the wheel between adjacent cam slots or notches 94 therein. Just before the work stations are lined with the magazine 82 the latch 104 engages the arm 71 and removes the pressure roller 76 from the said station. As soon as the pressure roller 76 is clear of the magazine passage the slot 94 aligns with the plunger head 90 permitting the spring 95 to expand and force the said head into the slot. This oscillates the bell crank 83 in a counter clockwise direction about the pivot 85 causing the seat 84 thereon to engage with the second lowermost work piece in the magazine. At the same time the bell crank 83 oscillates the arm 99 in a clockwise direction removing its seat 101 from the lowermost work piece and freeing it to drop by gravity from the magazine. The fall of the work piece is arrested by the regulating or friction drive wheel 77 forcing it to roll into contact with the work supporting block 67. Continued rotation of the plate 66 to carry the finished work piece from the grinding throat and the unfinished work thereto rocks the latch 104 relative to its pivot, since the arm 71 is held against further rotation by the above mentioned pin 107, thereby expanding the spring 106 until the latch and tang 102 are separated from one another, whereupon the spring 74 actuates the arm 71 to bring the pressure roller into contact with the work. The plate 66 continues to rotate carrying the work out of the grinding throat to a point beneath it which is substantially diametrically opposite to the magazine 82. At this point the bracket 30 has pivoted thereto, as at 108, a latch 109 which has a finger 110 and is similar to the latch 104. A spring 111 is secured at one end to the latch 109 and at the other end to the bracket 30 and is of a strength sufficient to oscillate the arm 71 against the resistance of its spring 74. As shown in Figure 3, as the plate 66 successively brings the stations to the lowermost point the latch 109 operates the arm 71 for releasing the work permitting it to drop from the work station by gravity.

After the unground work piece has been released from the magazine and positioned at the work supporting station of the plate 66 the cam face 112, see Figure 5, engages with the cam face 92 of the plunger head 90 for shifting the plunger vertically against the yielding resistance of its spring. This movement of the plunger actuates the bell crank 83 in a clockwise direction tending to draw the seat 84 thereon from the work. At the same time the arm 99 is oscillated in a counter-clockwise direction to insert its seat 101 in the path of movement of the work 28 and to engage and arrest the said work movement through the magazine 82 until the next work receiving station is aligned with the magazine and ready for the unfinished work piece whereupon the operation above described is repeated.

In the modification shown in Figures 7 and 8 use is made of the periphery of the grinding wheels instead of the lateral faces thereof for accomplishing the results above specified. Further in the modification instead of the work passing continuously through the grinding throat the work carrier is intermittently operated for intermittently positioning a work piece within the grinding throat and allowing it to dwell therein during the grinding operation and subsequently removing it therefrom to be discharged as above described. For this reason the slides 14' have each mounted thereon the motor 23' and the pedestal bearings 16' facing in a direction at right angles to their positions relative to the slides 14.

The regulating wheel or friction drive wheel housing 115 projects through an opening or aperture 116 in the work rotating bracket 117 mounted on the bed 10 and adjusted relative thereto in the same manner that bracket 30 is actuated. Instead of the bracket having formed in its upper end the circular housing inclosing the worm 51 it has formed in one side thereof an arcuate slot or aperture 118. The bracket 117, however, is channel-shaped similar to bracket 30 and forms a bearing 119 for the trunnion portions 120 of a ratchet plate 121 mounted in

the housing. The work carrying plate 66 is secured to the ratchet plate 121 as particularly described above for effecting the unitary rotation of the work carrying plate and ratchet plate. The bearing 120 is extended on one side beyond the walls of the housing 117 and has oscillatably mounted thereon a ring or collar 122 held against displacement by a nut 123 secured to the extreme end of the said bearing portion. An arm 124 projects radially from the collar or ring 122 and the arm 124 provides a pivot 125 for one end of a link 126 which is pivoted at its other end at 127 to a plate 128. The pivot 127 of the plate is eccentric to the axis of rotation thereof whereby rotation of the plate will effect through the link 126 an oscillation of the arm 124 and collar 125. Pivotally secured to the arm 124 as at 129 is a pawl 130 actuable by a spring 131 in a clockwise direction. This pawl 130 extends through the arcuate slot 118 to overlie the ratchet plate 121 and is adapted to engage the ratchet teeth 132 formed in the periphery of said plate. From this it will be seen that as the plate 128 is rotated the ratchet plate will be intermittently advanced in a clockwise direction as seen in Figure 7 for successively presenting work pieces carried by the plate to the grinding throat. In order to prevent the plate from being reversely actuated, there is provided a spring loaded detent 133 cooperating with the ratchet teeth 132 when in the upper position and this detent effectively prevents reverse actuation of the ratchet plate and the parts controlled thereby. The work carrying plate 66 is operated and so timed as to present a work receiving station to the magazine each time a new work piece is positioned in the grinding throat.

The eccentric plate 128 for oscillating the arm 124 is mounted on the end of a shaft 134 extending from one side of a speed reducing unit 135 driven by a motor 136. The motor 136 and speed reducing unit 135 are mounted on the upper surface of the slide 56*a*.

It is believed that the operation of the modified structure is self-evident in view of the specific description of the mechanism illustrated in Figures 1 to 6 inclusive.

What is claimed is:

1. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels rotatably mounted thereon and forming a grinding throat therebetween, a fricton control wheel rotatably mounted on the bed for controlling the rotation of a work piece, means adjacent the friction control wheel for supporting the work in contact with the wheel, means for actuating the work arcuately of the friction control wheel through the grinding throat, and means for yieldably urging the work into contact with the work support and friction control wheel.

2. In a grinding machine for simultaneously grinding the lateral faces of flat cylindrical work pieces comprising a work carrier plate, means on the plate for peripherally supporting the work for rotation about an axis determined by the said peripheral surface, means for rotating the plate and work through an arcuate path, a pair of opposed grinding wheels forming a grinding throat therebetween in the path of travel of the work, and a friction drive wheel engaging the periphery of the work for controlling the rotation of said work.

3. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels mounted on the bed and forming a grinding throat between them, a work carrier rotatably mounted on the bed, a plurality of work supports on the carrier, a friction drive wheel associated with the carrier for engaging the periphery of the work on the carrier to effect and control its rotation, and means for actuating the carrier to effect the passage of the work through the grinding throat.

4. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels mounted on the bed and forming a grinding throat between them, a work carrier rotatably mounted on the bed, a plurality of work supports on the carrier, means associated with the carrier for engaging the work on the carrier to effect and control its rotation, means for actuating the carrier to effect the passage of the work through the grinding throat, and means yieldably urging the work into engagement with its support and the rotation and control means.

5. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels mounted on the bed and forming a grinding throat between them, a work carrier rotatably mounted on the bed, a plurality of work supports on the carrier, means associated with the carrier for engaging the work on the carrier to effect and control its rotation, means for actuating the carrier to effect the passage of the work through the grinding throat, means yieldably urging the work into engagement with its support and the rotation and control means, a magazine in alignment with the several work stations of the carrier as the carrier passes therebeneath, and means operated by the carrier for effecting the release of successive work pieces from the magazine.

6. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels mounted on the bed and forming a grinding throat between them, a work carrier rotatably mounted on the bed, a plurality of work supports on the carrier, means associated with the carrier for engaging the work on the carrier to effect and control its rotation, means for actuating the carrier to effect the passage of the work thru the grinding throat, means yieldably urging the work into engagement with its support and the rotation and control means, a magazine in alignment with the several work stations on the carrier as the carrier passes therebeneath, means operated by the carrier for effecting the release of successive work pieces from the magazine, and means for effecting the release and discharge of work pieces from the carrier after they have passed through and beyond the grinding throat.

7. In a mechanism for supporting and rotating work pieces the combination of a bed, a bracket mounted thereon, a carrier plate rotatably supported by the bracket, a plurality of work receiving and supporting stations on the carrier, each station comprising a work rest blade, a pressure roll on the carrier adjacent the blade for engaging the work at a point peripherally spaced from the point of contact of the work with the work rest blade, and friction drive and control means for engagement with the work at a third peripheral point thereon for effecting and controlling its rotation.

8. In a mechanism for supporting and rotating work pieces the combination of a bed, a bracket mounted thereon, a carrier plate rotatably supported by the bracket, a plurality of work receiving and supporting stations on the carrier, each station comprising a work rest blade, a pressure

roll on the carrier, adjacent the blade for engaging the work at a point peripherally spaced from the point of contact of the work with the work rest blade, friction drive and control means for engagement with the work at a third peripheral point thereon for effecting and controlling its rotation, and means for adjusting the bracket relative to the bed and relative to the friction drive and control means for positioning the carrier relative to the said friction drive and control means.

9. In a mechanism for supporting and rotating a work piece the combination of a bed, a bracket mounted thereon, a carrier plate rotatably supported by the bracket, a plurality of work receiving and supporting stations on the carrier, each station comprising a work rest blade, a pressure roll on the carrier adjacent the blade for engaging the work at a point peripherally spaced from the point of contact of the work with the work rest blade, friction drive and control means for engagement with the work at a third peripheral point thereon for effecting and controlling its rotation, means for adjusting the bracket relative to the bed and relative to the friction drive and control means for positioning the carrier relative to the said friction drive and control means, means carried by the bed for rotatably supporting the friction control and drive means, and means for adjusting the supporting means relative to the bed for adjusting the friction control and drive means relative to the bracket and work carrier.

10. In a mechanism for supporting and rotating a work piece the combination of a bed, a bracket mounted thereon, a carrier plate rotatably supported by the bracket, a plurality of work receiving and supporting stations on the carrier, each station comprising a work rest blade, a pressure roll on the carrier adjacent the blade for engaging the work at a point peripherally spaced from the point of contact of the work with the work rest blade, friction drive and control means for engagement with the work at a third peripheral point thereon for effecting and controlling its rotation, means for adjusting the bracket relative to the bed and relative to the friction drive and control means for positioning the carrier relative to the said friction drive and control means, means carried by the bed for rotatably supporting the friction control and drive means, means for adjusting the supporting means relative to the bed for adjusting the friction control and drive means relative to the bracket and work carrier, and an independent power source for the work carrier and friction drive means.

11. In a grinding machine for grinding the sides of ring-like work pieces parallel to one another and in a predetermined definite relation to a preformed peripheral face thereon, the combination of a pair of opposed grinding wheels forming a grinding throat therebetween of a predetermined width or size, a work carrier supporting the work on its preformed peripheral surface, means for frictionally engaging the said preformed surface to control the rotation of the work, means associated with the carrier and friction control means for preventing tilting of the work, and means for actuating the carrier to pass successive work pieces through the grinding throat.

12. In a grinding machine for grinding the sides of ring-like work pieces parallel to one another and in a predetermined definite relation to a preformed peripheral face thereon, the combination of a pair of opposed grinding wheels forming a grinding throat therebetween of a predetermined width or size; a work carrier supporting the work on its preformed peripheral surface, means for frictionally engaging the said preformed surface to control the rotation of the work, means associated with the carrier and friction control means for preventing tilting of the work, means for actuating the carrier to pass successive work pieces through the grinding throat, said carrier having a plurality of work supporting stations thereon, and means for automatically supplying a work piece to each station and for automatically discharging a work piece from each station.

13. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels mounted thereon having their proximate points spaced from one another to form a grinding throat of desired width therebetween, a work carrier member supporting a plurality of work pieces and successively presenting same to the grinding throat, means for intermittently actuating the carrier to intermittently place a work piece in the throat and remove same therefrom, and means for automatically positioning work pieces intermittently on the carrier as the carrier is intermittently actuated.

14. In a grinding machine of the class described, the combination of a bed, a pair of opposed grinding wheels mounted thereon having their proximate points spaced from one another to form a grinding throat of desired width therebetween, a work carrier member supporting a plurality of work pieces and successively presenting same to the grinding throat, means for intermittently actuating the carrier to intermittently place a work piece in the throat and remove same therefrom, means for automatically positioning work pieces intermittently on the carrier as the carrier is intermittently actuated, and means for adjusting the grinding wheels relative to one another to vary the width of the grinding throat.

15. In a mechanism for supporting and rotating work pieces, a rotatably mounted carrier plate, a plurality of work receiving and supporting stations on said carrier plate, each station comprising a work rest and a pressure roll adjacent the rest for engaging the periphery of a work piece in said station at spaced points, and a friction drive and control wheel rotatable independently of the carrier plate, said wheel engaging the work piece at a point spaced from the points of engagement of the pressure roll and rest.

16. In a mechanism for supporting and rotating work pieces, a rotatably mounted carrier plate, a plurality of work receiving and supporting stations on said carrier plate, each station comprising a work rest and a pressure roll adjacent the rest for engaging the periphery of a work piece in said station at spaced points, a friction drive and control wheel rotatable independently of the carrier plate, said wheel engaging the work piece at a point spaced from the points of engagement of the pressure roll and rest, means for procuring the release and discharge of work pieces from the carrier, and means actuated by said carrier for positioning work pieces in work supporting position on said carrier.

17. In a mechanism for supporting and rotat-

ing work pieces, a rotatably mounted carrier plate, a plurality of work receiving and supporting stations on said carrier plate, each station comprising a work rest and a pressure roll adjacent the rest for engaging the periphery of a work piece in said station at spaced points, a friction drive and control wheel rotatable independently of the carrier plate, said wheel engaging the work piece at a point spaced from the points of engagement of the pressure roll and rest, means operable upon rotation of said carrier for procuring the release and discharge of work pieces from the work supporting stations on said carrier, and other means operated in response to movement of said carrier for positioning work pieces in the work supporting stations on said carrier.

18. In a grinding machine, a grinding wheel, a rotatably mounted carrier plate, a plurality of work receiving and supporting stations on said carrier plate, each station comprising a work rest and a pressure roll adjacent the rest for engaging the periphery of a work piece in said station at spaced points, a friction drive and control wheel rotatable independently of said carrier plate, said wheel engaging the periphery of the work at a third point spaced from said other points, and means for actuating said carrier plate to carry the work pieces in said work supporting stations past said grinding wheel.

19. In a grinding machine, a grinding wheel, a rotatably mounted carrier plate, a plurality of work receiving and supporting stations on said carrier plate, each station comprising a work rest and a pressure roll adjacent the rest for engaging the periphery of a work piece in said station at spaced points, a friction drive and control wheel rotatable independently of said carrier plate, said wheel engaging the periphery of the work at a third point spaced from said other points, and means for intermittently actuating said carrier plate to carry the work pieces in said work supporting stations into and out of operative engagement with said grinding wheel.

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