Aug. 6, 1935. R. E. W. HARRISON 2,010,361

GRINDING MACHINE

Filed April 15, 1930 4 Sheets-Sheet 1

Fig. 1

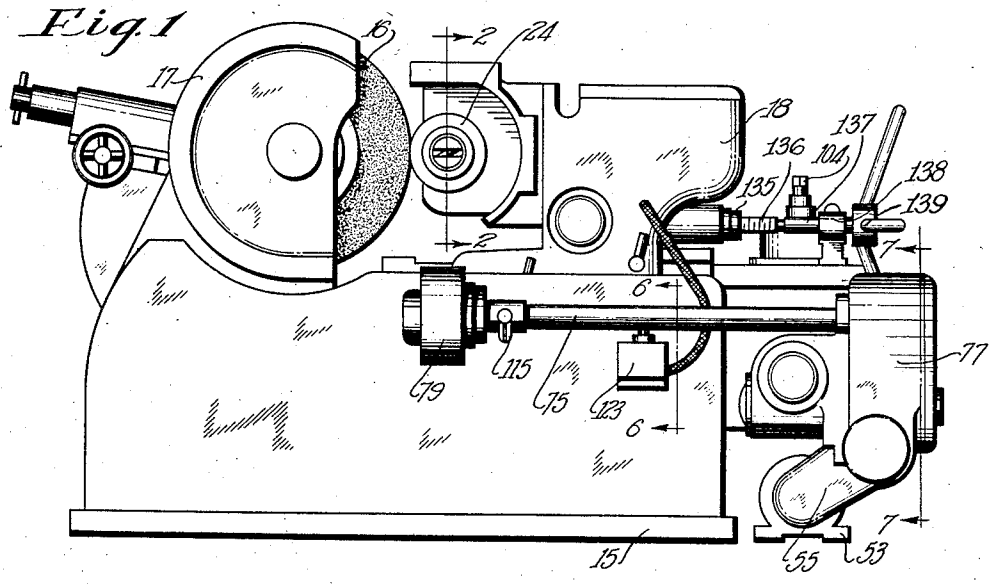


Fig. 2

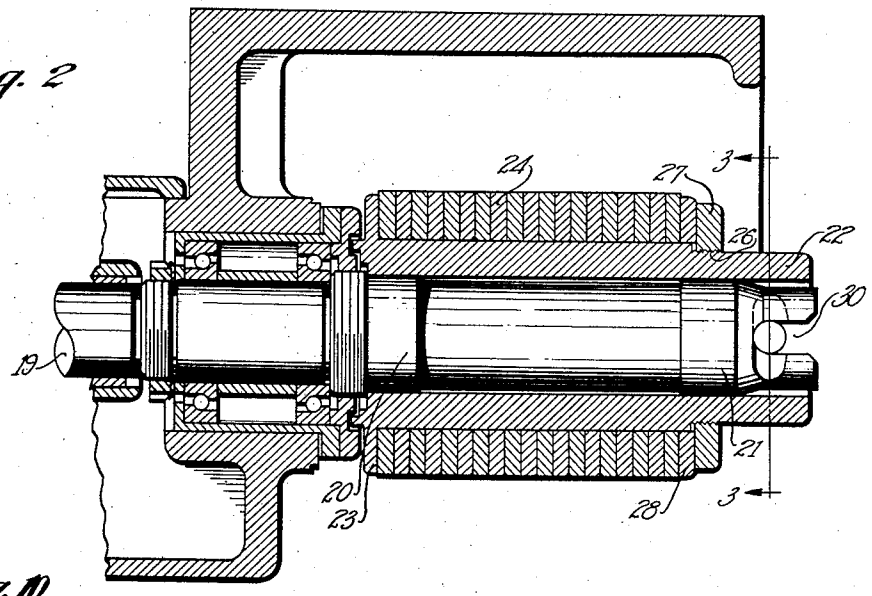
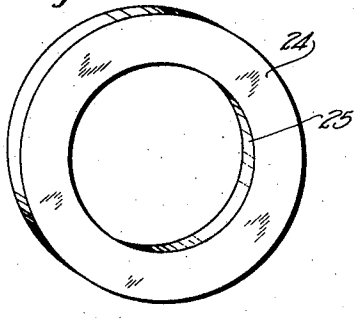


Fig. 4



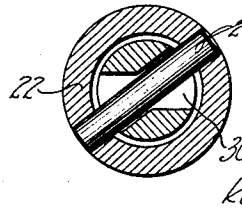


Fig. 3

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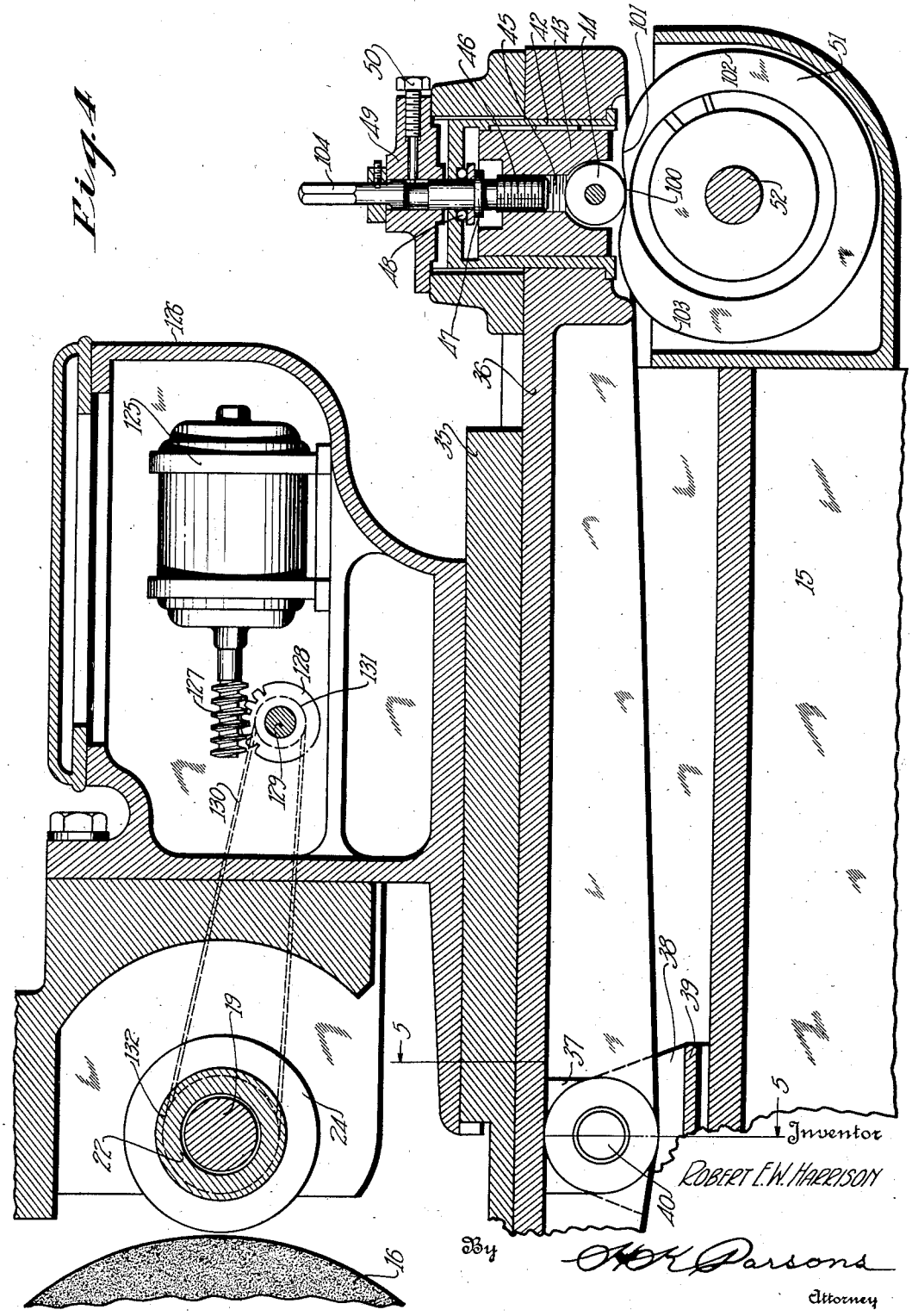
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GRINDING MACHINE

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Fig. 4



Aug. 6, 1935. R. E. W. HARRISON 2,010,361

GRINDING MACHINE

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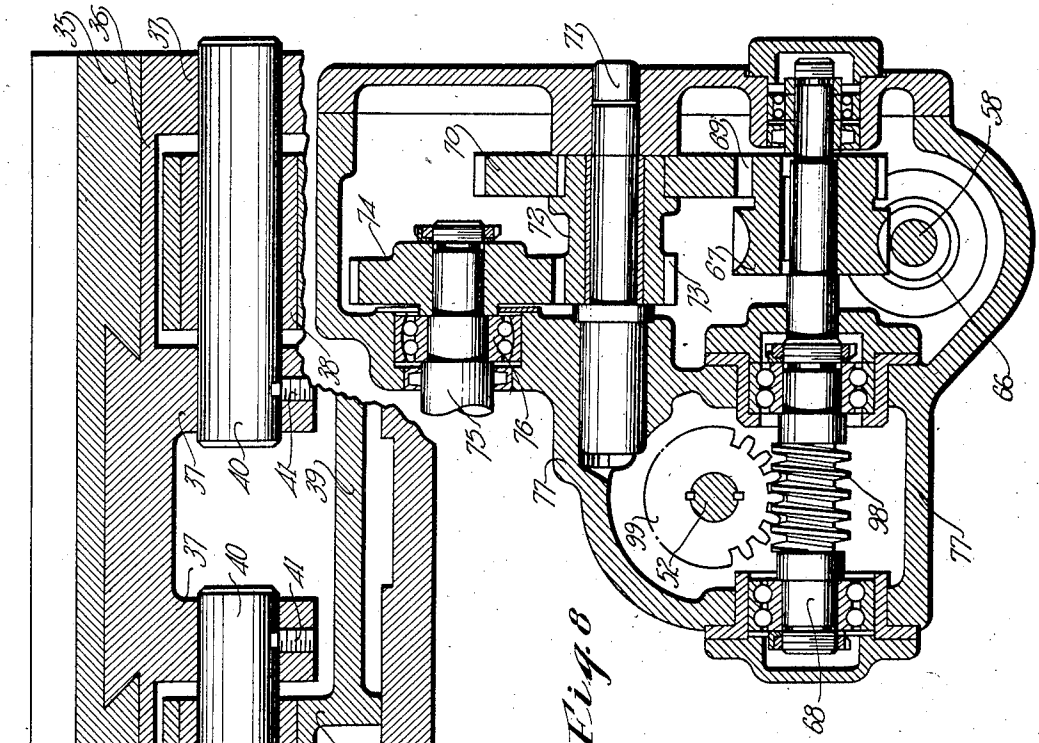


Fig. 8

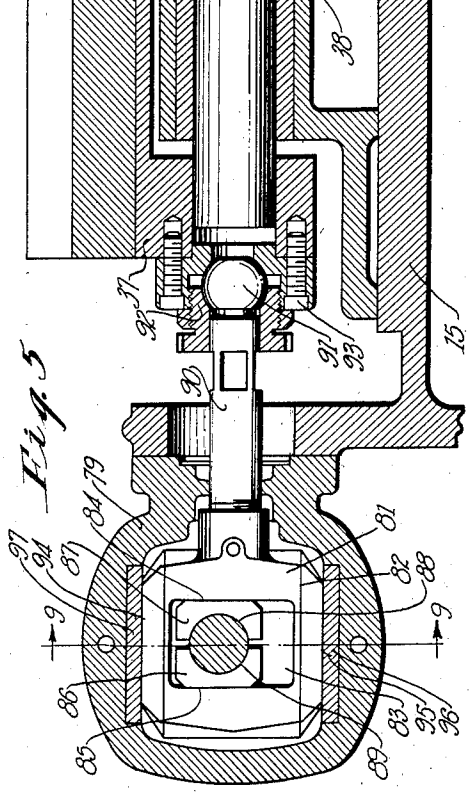


Fig. 5

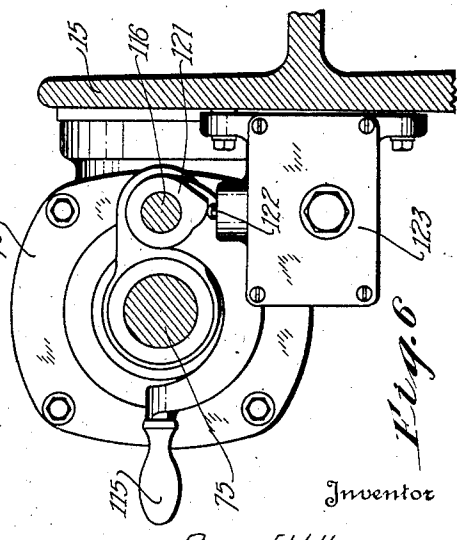


Fig. 6

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GRINDING MACHINE

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Fig. 7

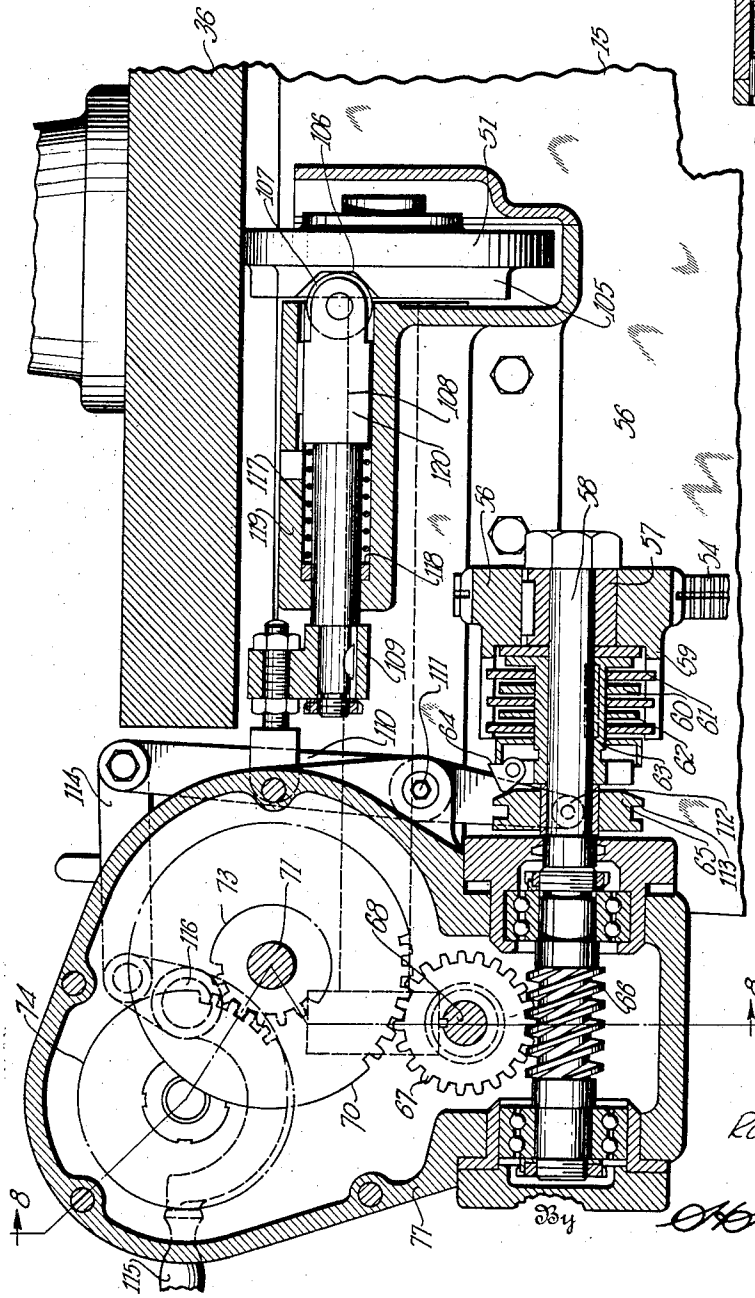
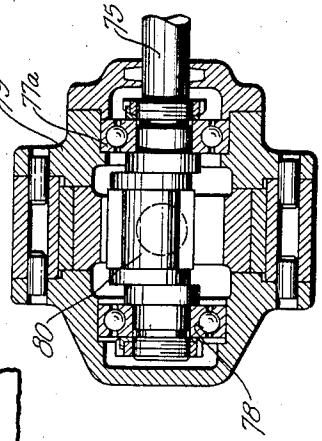


Fig. 9



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Patented Aug. 6, 1935 2,010,361

UNITED STATES PATENT OFFICE

2,010,361

GRINDING MACHINE

Robert E. W. Harrison, Cincinnati, Ohio, assignor to Cincinnati Grinders Incorporated, Cincinnati, Ohio, a corporation of Ohio

Application April 15, 1930, Serial No. 444,581

11 Claims. (Cl. 51—95)

This invention relates to improvements in grinding machines and has particular reference to automatic mechanism for cyclic performance of cylindrical grinding operations.

One of the principal objects of the invention is the provision of an improved mechanism for simultaneously forming and finishing a plurality of work pieces to the same form and size for individual interchangeable use in similar articles of manufacture.

Another object of the invention is the provision of an automatically controlled machine tool of the center or chucked-work type which shall automatically effect the rotation of the work, the feed thereof into a grinding wheel, a reciprocation of the work across the face of the wheel to break up grinding lines and a retraction of the work from the wheel followed by a complete stopping of the various parts at the completion of the cycle.

An additional object of the present invention is the provision of an improved work holding and driving mechanism which will greatly increase the efficiency of the machine while operating and the finish on work pieces such as clutch disks or other work pieces of circular contour but of relatively thin or narrow width.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification considered in conjunction with the accompanying drawings forming a part thereof 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.

Figure 1 is a side elevation of a machine embodying this invention.

Figure 2 is a sectional view taken on line 2—2 of Figure 1.

Figure 3 is a sectional view taken on line 3—3 of Figure 2.

Figure 4 is a fragmentary sectional view taken longitudinally through the right hand portion of the machine as seen in Figure 1.

Figure 5 is a sectional view taken on line 5—5 of Figure 4.

Figure 6 is a sectional view, partly in elevation as seen from line 6—6 of Figure 1.

Figure 7 is a sectional view taken on line 7—7 of Figure 1.

Figure 8 is a sectional view taken on line 8—8 of Figure 7.

Figure 9 is a sectional view taken on line 9—9 of Figure 5.

Figure 10 is a perspective view of one of the individual work pieces illustrating a type of work piece that may be machined on a device of this invention.

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

A device of this invention may comprise a bed 15 having mounted thereon a grinding wheel 16 rotatable in a clockwise direction at a high or grinding rate of speed. The grinding wheel 16 is supported by the usual spindle journaled in a bracket or housing 17 secured to the bed 15.

Supported by the bed in opposition to the grinding wheel 16 is a housing or unit 18 having journaled therein a spindle or shaft 19 rotatable in a clockwise direction at a relative slow rate of speed by any desirable means, to be later described. The forward end of the shaft 19 is provided with bearings 20 and 21 on which is mounted a sleeve 22. A flange 23 is formed on the sleeve near one end thereof and forms an abutment for a plurality of work pieces 24, here shown as clutch facings or the like being circular in shape and having a bore 25 centrally thereof. The diameter of the sleeve 22 is such as to be just received in the bore 25 in the work piece so that no lost motion or play exists between the surface of the sleeve and the inner surface of the bore. To secure the work pieces to the sleeve it is provided with a threaded portion 26 for clamp nut or the like 27. A spacer collar 28 is interposed between the nut 27 and face of the work piece 24. The sleeve 22 is adapted to be locked to the shaft 19 so as to rotate therewith and to this end has extending through it a pin 29 received in bayonet slot 30 formed in the extreme end of the spindle or shaft 19.

To lock the sleeve 22 on the shaft or spindle 19 the said sleeve is placed thereon with the bore therein engaging the bearings 20 and 21 whereupon it is given a partial revolution in a counter clockwise direction to insert the pin 29 within the walls of the bayonet slot 30.

The work supporting unit 18 is secured to a slide 35 movable longitudinally of the bed toward and from the grinding wheel to vary the separation of the axes of the shaft 19 and grinding wheel 16 to adapt or change the capacity or size of the machine for grinding a different size of work piece. The slide 35 is therefore supported by an oscillatable slide 36 and any suitable or desirable means may be employed for

effecting the adjustment of the said slides 35 and 36. For example, and as shown in the drawings, this means may comprise a sleeve nut 135 secured in the unit or head 18 and having its internal threads in threaded engagement with the threads 136 on the adjusting screw 137. This screw 137 is rotatively journaled in a bearing bracket 138 secured to the oscillatable slide 36 at or near its outer end. The adjusting screw 137 projects from and beyond the bearing 138 to receive a pilot or hand wheel 139 whereby the said screw is rotated.

As was mentioned above, the slide 35 is supported by an oscillatable slide 36 which has depending near one end thereof the lugs 37 spaced on opposite sides of similar lugs 38 extending upwardly from a bed plate 39. Trunnions 40 extend through aligned bores formed in the lugs 37 and 38 and the said trunnions are secured in the lugs 37 by set screws 41. The other end of the slide 36 has secured therein a guide sleeve 42 through which a cam follower 43 is adjusted. The cam follower 43 rotatably supports a roller 44 and the follower has a threaded perforation 45 therein receiving the threaded end of adjusting screw 46. The screw 46 is limited in its axial movement relative to the guide sleeve 43 by a collar 47 formed thereon abutting an anti-friction thrust bearing 48 supported by the upper end of the sleeve 42. The body of the screw is journaled in a cover plate 49 secured to the slide 36 and the said screw is prevented from inadvertent disassociation from the cover plate 49 by a screw 50.

Rotatably supported by the bed 15 for rotation in a plane parallel to the roller 44 is a cam 51 keyed or secured to a shaft 52 rotatably connected through suitable transmission gearing with a prime mover 53. Prime mover 53 transmits power through sprocket chain 54 enclosed within housing 55, see Figure 1, and extends about a driving pinion 56 keyed or otherwise secured to a sleeve 57 loosely journaled on shaft 58. The pinion 56 has integral therewith a flange 59 forming one member of multiple disc friction clutch 60 having alternate discs 61 connected therewith. The intermediate discs 62 are keyed or otherwise secured to a hub 63 forming the other member of the friction clutch. The clamp dogs 64 are carried by the flange on the member 63 and are adapted to be actuated about their pivot by sliding member or clutch spool 65.

The driven shaft 58 has formed integral therewith or secured thereto a worm 66 meshing with worm wheel 67 on one end of shaft 68. A spur gear 69 is secured to the shaft 68 or it may be formed integral with the worm wheel 67 for rotation therewith and meshes with spur gear 70 on transverse shaft 71. Connected with the gear 70 by a connecting sleeve 72 is a pinion 73 in turn meshing with driving gear 74 on the end of longitudinal shaft 75 extending longitudinally of the bed across the forward face of the machine. The said shaft 75 is journaled at one end in suitable anti-friction bearings 76 supported by the housing 77 mounted on the rear of the bed 15 and enclosing the transmission gearing just described. The inner end of the longitudinal drive shaft 75 is journaled in anti-friction bearings 77a and 78 supported by the bracket 79 secured to the forward face of the bed 15 in alignment with the trunnions 40.

The said drive shaft 75 has formed on its inner end, intermediate the bearings 77a and 78, an eccentric crank 80 for actuating a cross head, indicated in general by the numeral 81 in Figure 5. The cross head 81 comprises a block 82 having formed therein an elongated angular opening 83 providing walls or guide ways 84 and 85. Within the opening 83 is a pair of sliding members 86 and 87 having on one side thereof plane faces for engaging the seats 84 and 85 and on the other side arcuate seats 88 and 89 engaging the crank 80 at points diametrically opposite one another. The block or head 82 has extending therefrom a link 90 provided on its inner end with a ball 91 received in socket 92 secured by cap screws or the like 93 to the outer lug 37 depending from the carriage 36. The cross head 82, in addition, is provided with guides 94 and 95 for sliding engagement with strips or guides 96 and 97 secured to bracket or housing 79.

Rotation of the drive shaft 75 through the crank 80 will exert first a push and then a pull on the blocks 86 and 87 causing them to shift vertically along the guides 84 and 85. At the same time cross head 81 is horizontally shifted across the guide strips 96 and 97 for correspondingly axially shifting the link 90 and slide 36. This shifting of the slide breaks up the grinding lines and produces the desired finish on the surfaces of the work pieces being ground by the grinding wheel 16.

During the transverse shifting of the slide 36 the worm 98 integral with or secured to shaft 68 is in mesh with a worm wheel 99 keyed or otherwise secured to a shaft 52. By this it will be seen that the cam is rotated at the same time that the slide is reciprocated so that the work pieces are being fed into the grinding wheel to reduce them to the proper size and form. For this purpose the cam is provided with a low spot 100 at which time the work pieces and sleeve 22 are spaced from the grinding wheel for replacing them with an unfinished unit. The cam 51 rotates in a counter clockwise direction and is provided adjacent the low point 100 with an abrupt rise 101 for rapidly bringing the work pieces into position for operation thereon by the grinding wheel. The abrupt rise portion 101 extends to substantially a point 102 from which point to a point at substantially 103 the eccentricity of the cam is relatively small for feeding the work piece into the wheel at the desired rate. A short concentric portion on the cam extends from the point 103 permitting the work and wheel to spark out whereupon the cam abruptly falls away for again rapidly retracting the work piece from the wheel. As the wheel wears and it becomes necessary to take up said wear it is only necessary to rotate the screw 46 with a removable crank adapted to be secured to the angularly formed portion 104 thereon.

The machine is adapted to completely finish one set of work pieces and stop at which time the finished work pieces are replaced by an unfinished set. In order that the maximum production may be obtained from the machine use is made of more than one sleeve chuck 22 so that when one set of work pieces is being ground another sleeve chuck is being loaded with unfinished work pieces to be placed on the spindle 19 when the other is removed

To automatically effect the stopping of the machine at the completion of one cycle the cam 51 is provided with a flange 105 having formed therein a notch 106 in which roller 107 is adapted to be received. Roller 107 is carried on the end of the shifter rod 108 coupled through coupling 109 with shifter fork 110. The fork 110 is pivoted at 111 and carries at its lower end

suitable rollers 112 received in circumferential groove 113 formed in the clutch spool 65 whereby it is shifted. Secured to the upper end of shifter fork 110 is a link 114 connected with starting lever 115 pivoted to a rod 116 extending parallel with driven shaft 75. A spring 117 surrounds the rod 108 and abuts on one end with the shoulder 118 integral with housing 119 and on the other end abuts collar 120 surrounding the said rod 108.

From this it will be seen that as the grinding operation is completed the notch 106 will register with roller 107 allowing the spring 117 to expand carrying with it the shifter fork 110 to shift the clutch spool to the left as seen in Figure 7 and disengage friction discs 61 and 62 cutting off the drive to shaft 58 and stopping the rotation of the worm 66 and driven shaft 75.

The rotation of the spindle 19 and work pieces carried thereby are simultaneously stopped at the time the clutch disks 61 and 62 are separated. This spindle is rotated by a motor 125 mounted interiorly of the housing 126 forming a part of work supporting unit 18. The motor 125 drives a worm 127 in mesh with a worm wheel 128 for rotating a countershaft 129 to which the said worm wheel is secured. A transmission belt 130 extends about a pulley 131 on the countershaft 129 and about a pulley 132 fast on the spindle 19. A switch 123 is secured to the forward face of the bed 15 for controlling the rotation of the motor 125 and includes a depressible plunger 122. This plunger 122 is normally held down by a cam member 121 carried by shaft or pivot rod 116; the plunger being spring loaded so that upon removal of the cam 121 it will be actuated to break the motor circuit.

The shifting of the plunger 108 under the influence of spring 117 causes as noted above, an actuation of the fork 110 to disengage the clutch disks 61 and 62 and at the same time through the link 114 a rocking of the pivot bar 116 to which the cam member 121 is secured. From this it will be noted that switch 123 is opened to stop the rotation of the motor 125 at the same time that the rotation of the cam 51 and driven shaft 75 are stopped. The parts of the machine are then in position to remove the chuck sleeve 22 and finished work pieces from the spindle 19 and replace same with another chuck sleeve containing a set of unfinished work pieces.

What is claimed is:

1. In a grinding machine the combination of a bed, a grinding wheel carried thereby, an oscillatable work support, a cam for oscillating the support in a direction toward and from the grinding wheel to effect a stock removal from the work pieces, a prime mover for rotating the work, a second prime mover for rotating the cam, a switch for controlling the work rotating prime mover, a separable clutch for connecting and disconnecting the second prime mover with the cam, and common means for connecting and disconnecting the switch and clutch whereby the rotation of the work and cam are simultaneously controlled.

2. In a grinding machine the combination of a bed, a grinding wheel carried thereby, a carriage pivotally supported by the bed, a work support carried by the carriage comprising a spindle, a work holder removably connected with the spindle, a cam for oscillating the carriage about its pivot in a direction toward and from the grinding wheel, a prime mover for effecting a rotation of the work support spindle, a driven shaft, a separable clutch for connecting the driven shaft with the cam for controlling the actuation thereof, means for reciprocating the carriage axially of the work spindle, means operatively connecting the reciprocating means with the driven shaft controlled by the separable clutch, a switch controlling rotation of the work rotating prime mover, and a common means for actuating switch and clutch whereby the various movements of the parts are simultaneously started and stopped.

3. In a device of the class described, the combination of a bed, a grinding wheel carried thereby, a work supporting and controlling unit including a carriage pivotally secured to the bed, means for oscillating the carriage about its pivot comprising a rotatable cam, a driven shaft, transmission mechanism between the cam and driven shaft whereby the cam is rotated, a separable clutch on the driven shaft controlling the rotation thereof, a prime mover carried by the carriage for rotating the work, and means disconnecting the separable clutch and stopping the rotation of the prime mover at the completion of the grinding operation.

4. In a device of the class described the combination of a bed, a grinding wheel rotatably carried thereby, means carried by the bed for supporting and rotating a work piece while in engagement with the grinding wheel, means for effecting a relatively short reciprocation of the work across the face of the grinding wheel comprising a support for the work piece, a cross head carried by the support, a rotatable shaft, a crank on the shaft operatively connected with the cross head, a driven shaft, transmission mechanism between the driven shaft and rotating shaft whereby the crank on the rotating shaft is actuated for effecting a lateral movement of the said cross head and carriage for reciprocating the work across the face of the grinding wheel, means for feeding the work pieces into the grinding wheel while the said reciprocation is being effected and means for stopping both the feeding of the work into the wheel and the reciprocation thereof across the wheel at the completion of the grinding operation.

5. In a device of the class described the combination of a bed, a grinding wheel rotatably carried thereby, means carried by the bed for supporting and rotating a work piece while in engagement with the grinding wheel, means for shifting the work across the face of the grinding wheel comprising a support for the work piece, a cross head carried by the support, a rotatable shaft, a crank on the shaft operatively connected with the cross head, a driven shaft, transmission mechanism between the driven shaft and rotating shaft whereby the crank on the rotating shaft is actuated for effecting a lateral movement of the said cross head and carriage for reciprocating the work across the face of the grinding wheel, means for feeding the work pieces into the grinding wheel while the said reciprocation is being effected, means for stopping both the feeding of the work into the wheel and the reciprocation thereof across the wheel at the completion of the grinding operation, and means for re-initiating the cyclic operation of the device.

6. In a grinding machine of the class described for simultaneously grinding the exterior face of a plurality of rings the combination of a bed, a grinding wheel rotatably supported by the bed, an opposed work supporting and rotating unit comprising a revolvable spindle having a projecting nose, a hollow work chuck supporting a plurality of rings adapted to be received on the nose of the spindle, cooperating means associated with

the spindle nose and work chuck for securing the chuck to the spindle nose, a carriage for the spindle, a pivotally mounted member carried by the bed and slidably supporting the carriage, means for adjusting the position of the carriage with respect to the pivotally mounted member for varying the position of the work spindle with respect to the grinding wheel, a rotatable cam carried by the bed, and a cam follower on the pivotally mounted member whereby the said member and parts carried thereby are oscillated toward and from the grinding wheel to effect a stock removal from the work.

7. In a grinding machine of the class described for simultaneously grinding the exterior face of a plurality of rings the combination of a bed, a grinding wheel rotatably supported by the bed, an opposed work supporting and rotating unit comprising a revolvable spindle having a projecting nose, a hollow work chuck supporting a plurality of rings adapted to be received on the nose of the spindle, cooperating means associated with the spindle nose and work chuck for securing the chuck to the spindle nose, a carriage for the spindle, a pivotally mounted member carried by the bed and slidably supporting the carriage, means for adjusting the position of the carriage with respect to the pivotally mounted member for varying the position of the work spindle with respect to the grinding wheel, a rotatable cam carried by the bed, a cam follower on the pivotally mounted member whereby the said member and parts carried thereby are oscillated toward and from the grinding wheel to effect a stock removal from the work, and means for varying the operative position of the cam follower with respect to the member to vary the throw of the pivotally mounted member and consequently the feed of the work toward the wheel.

8. In a grinding machine of the class described for simultaneously grinding the exterior face of a plurality of rings the combination of a bed, a grinding wheel rotatably supported by the bed, an opposed work supporting and rotating unit comprising a revolvable spindle, a removable work chuck supporting a plurality of rings on the spindle, a carriage for the spindle, a pivotally mounted member carried by the bed and slidably supporting the carriage, means for adjusting the position of the carriage with respect to the pivotally mounted member for varying the position of the work spindle with respect to the grinding wheel, a rotatable cam carried by the bed, a cam follower on the pivotally mounted member whereby the said member and parts carried thereby are oscillated toward and from the grinding wheel to effect a stock removal from the work, and means carried by the bed connectible with the pivotally mounted member for effecting a limited shifting thereof relative to the bed to correspondingly reciprocate the work with respect to the wheel.

9. In a grinding machine of the class described for simultaneously grinding the exterior face of a plurality of rings the combination of a bed, a grinding wheel rotatably supported by the bed, an opposed work supporting and rotating unit comprising a revolvable spindle having a projecting nose, a hollow work chuck supporting a plurality of rings adapted to be received on the nose of the spindle, cooperating means associated with the spindle nose and work chuck for securing the chuck to the spindle nose, a carriage for the spindle, a pivotally mounted member carried by the bed and slidably supporting the carriage, means for adjusting the position of the carriage with respect to the pivotally mounted member for varying the position of the work spindle with respect to the grinding wheel, a rotatable cam carried by the bed, a cam follower on the pivotally mounted member whereby the said member and parts carried thereby are oscillated toward and from the grinding wheel to effect a stock removal from the work, and means operable in synchronism with the cam for stopping the movement of the cam at the conclusion of each complete revolution.

10. In a grinding machine of the class described for simultaneously grinding the exterior face of a plurality of rings the combination of a bed, a grinding wheel rotatably supported by the bed, an opposed work supporting and rotating unit comprising a revolvable spindle, a removable work chuck supporting a plurality of rings on the spindle, a carriage for the spindle, a pivotally mounted member carried by the bed and slidably supporting the carriage, means for adjusting the position of the carriage with respect to the pivotally mounted member for varying the position of the work spindle with respect to the grinding wheel, a rotatable cam carried by the bed, a cam follower on the pivotally mounted member whereby the said member and parts carried thereby are oscillated toward and from the grinding wheel to effect a stock removal from the work, means operable in synchronism with the cam for stopping the movement of the cam at the conclusion of each complete revolution, an independent power source for rotating the work and its spindle, a switch therefor, and means for simultaneously closing said switch and initiating the rotation of the cam.

11. In a grinding machine of the class described for simultaneously grinding the exterior face of a plurality of rings the combination of a bed, a grinding wheel rotatably supported by the bed, an opposed work supporting and rotating unit comprising a revolvable spindle, a removable work chuck supporting a plurality of rings on the spindle, a carriage for the spindle, a pivotally mounted member carried by the bed and slidably supporting the carriage, means for adjusting the position of the carriage with respect to the pivotally mounted member for varying the position of the work spindle with respect to the grinding wheel, a rotatable cam carried by the bed, a cam follower on the pivotally mounted member whereby the said member and parts carried thereby are oscillated toward and from the grinding wheel to effect a stock removal from the work, means operable in synchronism with the cam for stopping the movement of the cam at the conclusion of each complete revolution, an independent power source for rotating the work and its spindle, a switch therefor, means for simultaneously closing said switch and initiating the rotation of the cam, and yieldable means for opening the switch operable at the end of each complete revolution of the cam.

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