Dec. 27, 1932. C. T. RAULE 1,892,364

EXTERNAL GRINDER

Original Filed Sept. 21, 1926 2 Sheets-Sheet 1

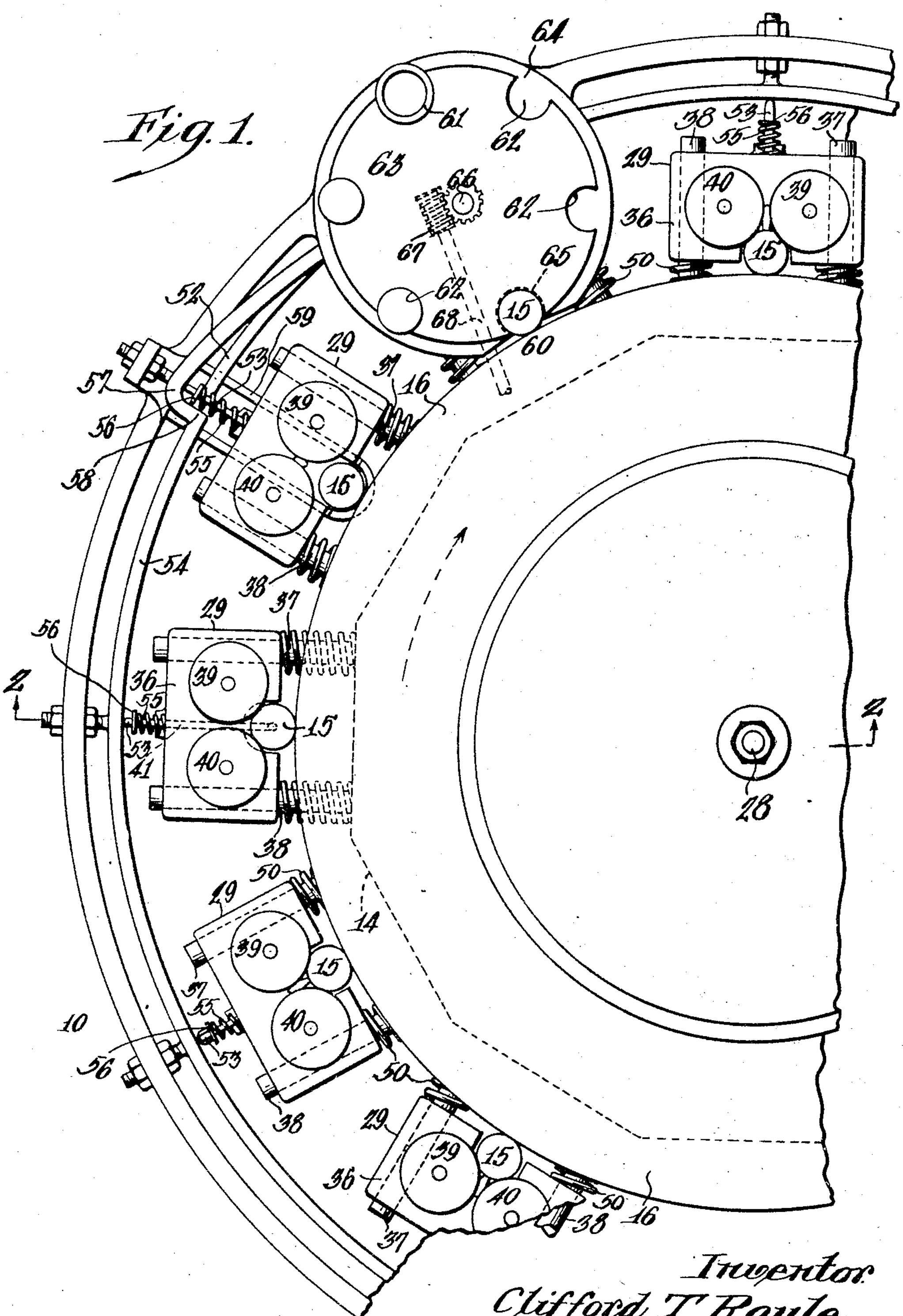


Fig. 1.

Inventor
Clifford T. Raule
by
Wm Steell Jackson
Attorney

Witness:
Walter Chism

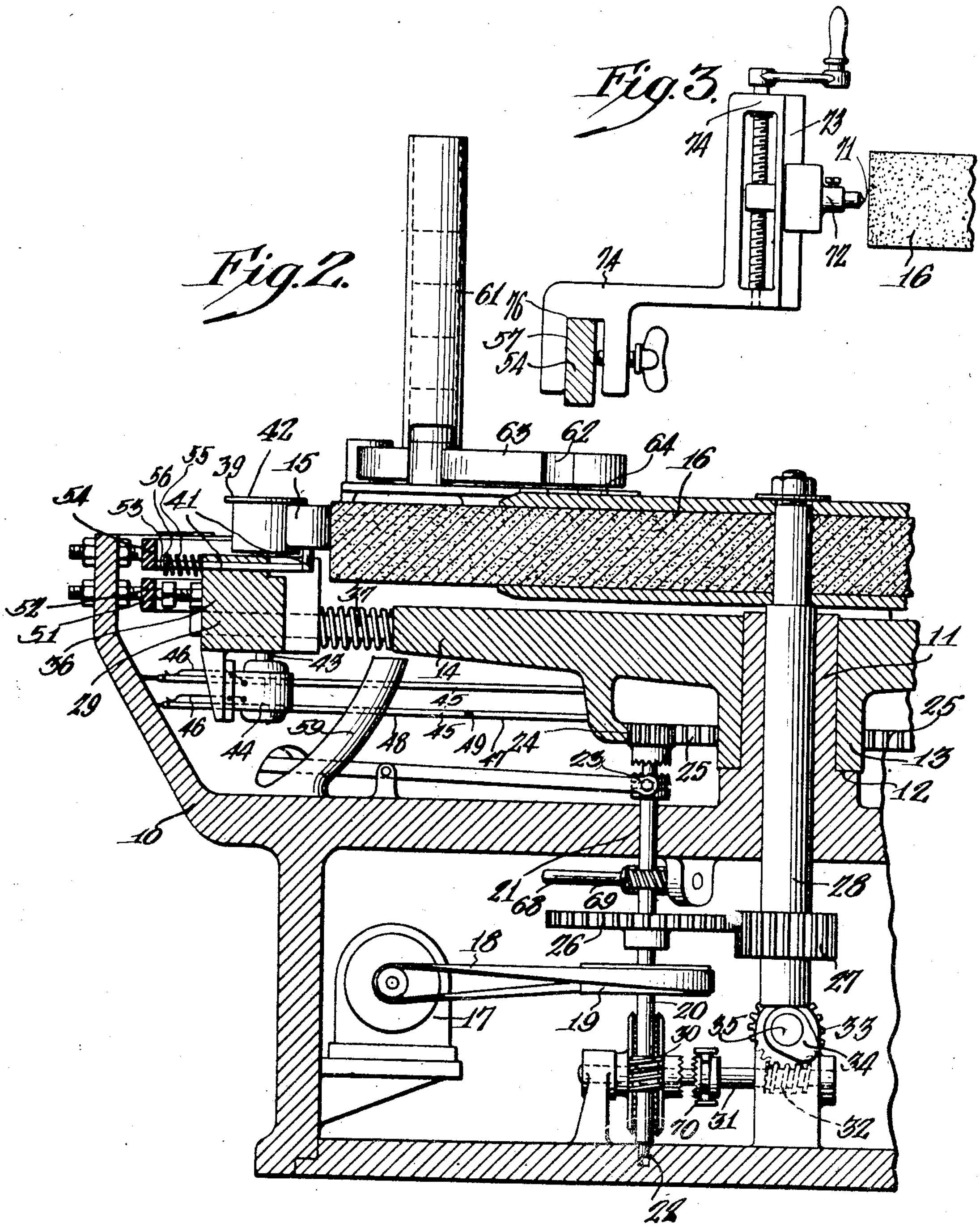
Dec. 27, 1932. C. T. RAULE 1,892,364

EXTERNAL GRINDER

Original Filed Sept. 21, 1926 2 Sheets-Sheet 2

Fig. 3.

Fig. 2.



Inventor
Clifford T. Raule.

by Wm. Steel Jackson
Attorney.

Witness:
Walter Chism

Patented Dec. 27, 1932

1,892,364

UNITED STATES PATENT OFFICE

CLIFFORD T. RAULE, OF BROOKLINE, PENNSYLVANIA

EXTERNAL GRINDER

Original application filed September 21, 1926, Serial No. 136,771. Divided and this application filed March 1, 1929. Serial No. 343,802.

My invention relates to external grinders intended for grinding a large quantity of like articles, and is a division of my application for multiple external grinder, Serial No. 136,771, filed September 21, 1926.

A purpose of my invention is to obtain quantity production of precision externally ground duplicate parts without the necessity for center-chucking the parts.

A further purpose is to move work pieces around and against a grinding wheel by means of a succession of pairs of spaced rollers, making the pieces follow a definite orbit around and against the wheel with predetermined and gradually diminishing distances between the opposing surfaces of the wheel and rollers. I rotate the work piece held to place against the grinding wheel by any pair of the rollers by rotating one or both of the rollers of the pair on its own axis. Where only one roller is driven the other roller of the pair rotates as an idler. I provide non-resilient connections that are operative along the grinding portion of the common orbit to force the pairs of rollers along a definite path progressively approaching the wheel surface in order to grind to definite size, and I inwardly adjust the orbit to accommodate gradual reduction in size of the wheel during use.

A further purpose is to load and unload the roller chucks of a multiple external grinder automatically.

A further purpose is to removably mount diamonding mechanism upon the feed cam of an external grinder.

Further purposes will appear in the specification and in the claims.

I prefer to illustrate my invention by one form only of the many in which it may be embodied, selecting a form that is practical, and efficient in operation and which well illustrates the principles involved.

Figure 1 is a fragmentary top plan view of structure embodying my invention.

Figure 2 is a fragmentary section taken upon the line 2—2 of Figure 1.

Figure 3 is a fragmentary enlarged section, corresponding generally to that upon the line 3—3 of Figure 1 and shows a diamonding attachment.

Like numerals refer to like parts in all figures.

Describing in illustration and not in limitation, and referring to the drawings:—

I show a stationary frame 10 upon which is formed a central bearing 11 shouldered at 12 to receive the hub 13 of a rotatable table 14 which carries work pieces 15 around a grinding wheel 16 as later described.

At any convenient point in or upon the frame I mount a motor 17 connected by belt 18 with pulley 19 upon the shaft 20 shown as supported in stationary bearings 21 and 22. The shaft has a hand-clutch connection at 23 with a gear 24 that engages an internal gear 25 rigid with the table to rotate the table.

A gear 26 upon the shaft 20 engages a gear 27 upon a shaft 28 journaled within the bearing 11 to rotate the shaft and with it to rotate the grinding wheel 16 mounted upon the top of the shaft.

The grinding wheel cooperates with the work-holding devices which are supported upon the table at uniformly spaced intervals, the wheel operating at the same time upon all of the pieces of work following one another around the wheel between positions of charging and discharging.

In order to protect against grinding too much at the same part of the wheel width, the wheel is traversed (reciprocated) axially while it is continuously rotated.

This traversing is secured by spiral gearing 30 connecting the shaft 20 with the shaft 31, a worm 32, worm gear 33 and cam 34 upon the shaft 35 of the worm gear, whereby the shaft 28 and the grinding wheel carried by it are vertically reciprocated by engagement between the bottom of the shaft and the cam 34.

The gear 27 is given sufficient length of tooth to continue in engagement with the gear 26 at all times notwithstanding the traversing movement.

The work-holders 29 spaced around the turn-table are mounted upon radially slidable carriers 36. Each carrier is adapted to movement radially of the turn-table along

parallel and horizontally spaced slideway rods 37 and 38 supported to extend horizontally outwardly from the turn-table.

The work 15 is pressed inwardly against the periphery of the grinding wheel by the rollers 39 and 40 being laterally supported on the outside by the rollers and on the inside by the wheel and supported underneath by a removable rod 41.

The rollers 39 and 40 are preferably flanged upon the upper end at 42. One of the rollers drives the work piece and is shown as direct-connected to the shaft 43 of a motor 44 which is desirably adapted to operate at different speeds. The other roller is an idler turning by reason of its engagement with the circular work piece.

Stationary electric busses 45 feed the motor, trolleys 46 from the motor sliding along the busses, any desired change in motor speed being effected by making one of the busses in relatively insulated sections that are under different voltages, as for example, sections 47 and 48 relatively insulated at 49.

Desirably the rotation of the work on its own axis is speeded up during final polishing, preparatory to final discharge of the finished piece.

A spiral spring 50 is placed upon each of the projecting rods 37 and 38. These springs surround the rods between the outer periphery of the turn-table and the inner face of the carrier 36 which supports the rollers 39 and 40 and resiliently press the carrier outwardly.

Each work-holder carries a longitudinal adjustable arm 51 midway between the slideway rods 37 and 38 and extending radially outwardly to engage the inner surface of a feed cam 52. Preferably the arm 51 screws into the body of the carrier.

Vertically above the arm 51 I show a radial slidable stem 53 which is bent upwardly at its inner end to present the removable support 41 to the bottom of the work piece. The stem 53 extends radially outward to engage a suitable circumferential cam 54 which may or may not form part of the feed cam, and is spring-pressed outwardly by a spring 55 compressed between the outer face of the carrier 36 and the inner face of the flange 56 upon the stem. Outward movement of the stem is limited by the engagement of its outer end with the inner face of the cam 54.

During grinding each work piece is supported against downward movement by the bent portion 41 of the stem and is prevented from moving upwardly under the traversing action of the wheel by the protecting rims 42 upon the upper ends of the rollers.

The removable supporting member 41 is positioned by the cam 54 in cooperation with the spring 55. When the unloading position is reached at 57, Figure 1, the support 41 moves away radially outward under the action of the spring by reason of a suitable outward offset 58, preferably an abrupt offset, in the cam 54. The feed cam 52 is also here somewhat relieved radially outwardly so that when the unloading position is reached the support 41 snaps away and the work piece drops to an inclined chute 59 whence it discharges into a suitable receptacle, not shown.

By the time loading position is reached at 60, Figure 1, the support 41 has been moved back by the cam into position to support the work piece of the new cycle.

At this time the work-holder is still positioned radially out from the grinding wheel a sufficient distance to permit the new work piece to drop to place (past the rims 42 of the rollers) upon the support 41.

The work pieces are fed by gravity from a supply tube 61 into successive holes 62 that are uniformly spaced around a rotor disc 63 and that are adapted to successively register with the bore of the supply tube.

The bottom work piece in the supply tube drops into a hole of the disc as soon as the rotation of the disc brings the hole into registry with the bore of the supply tube. A stationary supporting plate 64 beneath the rotating disc is provided with a perforation 65 at the loading position and keeps the work piece from dropping through the disc 63 until the piece has been swept around by the disc to the loading position, at which point the hole 62 registers with the perforation 65 of the plate and the work piece drops to the support 41 in a position between the rollers 37 and 38 on the outside and the periphery of the grinding wheel on the inside.

The rotation of the disc 63 is synchronized with the rotary movement of the turn-table so as to bring the holes 62 successively into position to deliver to the successive work-holders as these holders reach loading position.

The rotor member 63 is mounted upon a shaft 66 which may conveniently be driven through spiral gears 67, shaft 68 and spiral gears 69, one of which is mounted upon the shaft 20.

The grinding wheel has to be periodically trued up by traversing a diamond across its face. The wheel is preferably large as compared to the work pieces, which makes the truing operations usually far apart, as perhaps once or twice a day.

The wheel revolves at its normal cutting speed while being trued up, but the turn-table should not revolve during the truing of the wheel as the work-holders would then strike the diamonding mechanism, and a suitable hand-operated clutch 23 between the gear 24 driving the turn-table and the shaft 21 is provided to permit independent operation of the wheel and turn-table. This clutch permits rotation of the wheel without rotation of the turn-table, and a similar clutch 70 is shown diagrammatically on the shaft 31 to

permit rotation of the wheel without traverse of the wheel.

Figure 3 shows a diamond 71 mounted in a holder 72 that is adapted to a hand-screw vertical traverse along a slideway 73. The slideway forms part of a bracket 74 that is removably clamped at 75 to a stationary portion 76 of the machine. Preferably the bracket of the diamond is mounted upon the feed cam at or very near the position at which the cam is most near to the wheel, so that the point of attachment to the machine is preferably upon the feed cam at the position of finish grinding.

The feed cam needs to be periodically adjusted to accommodate gradual reduction in size of the wheel due to wearing away and diamonding, and during each truing operation I preferably support the bracket of the diamond upon that part of the feed cam which determines the finish size of the work piece, therefore upon that part of the feed cam which makes nearest approach to the wheel. When this is done adjustment around the feed cam preparatory to diamonding need not be extremely close in that lack of exactness of adjustment will not affect the size of finish grinding, unless the inexactness of adjustment be at the part of the cam at which it makes nearest approach to the wheel.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In an external grinder a central grinding wheel, spaced pairs of rollers spaced from the wheel in the plane thereof to adapt each pair to present a work piece to the wheel, means for bodily moving the pairs of rollers around the wheel and for positively feeding the rollers inwardly of the wheel along a definite path of grinding, and other means for driving one of each of the pairs of rollers to rotate the respective work pieces.

2. In an external grinder, a grinding wheel, a turn-table coaxial therewith, carriers mounted on the turn-table, circumferentially spaced around the turn-table and movable toward and away from the wheel, resilient means pressing each carrier away from the wheel, a stationary arcuate feed cam along the outside of the turn-table, a projection from each carrier making sliding engagement with the feed cam and a pair of spaced rollers upon each carrier adapted to rotate in the plane of rotation of the wheel and throughout a portion of each rotation of the turn-table to maintain and rotate a work piece against the wheel.

3. In an external grinder, a central grinding wheel, a turn-table coaxial therewith, carriers spaced around the turn-table and movable thereon inwardly toward the wheel and outwardly away from the wheel, a pair of relatively spaced rollers rotatably mounted upon each carrier and adapted to maintain a work piece in engagement with the wheel, a radial projecting lip around the upper end of each roller preventing longitudinal movement of the work piece upwardly and a removable upwardly directed support adapted to support a work piece upon its underside near the axis thereof.

4. In an external grinder, a grinding wheel adapted to traverse a turn-table coaxial therewith, carriers circumferentially spaced around the turn-table and movable thereon toward and away from the grinding surface of the wheel, a feed cam around the turn-table, a projection from each carrier engaging the feed cam, a pair of relatively spaced rollers rotatably mounted upon each carrier and adapted to hold a work piece against the wheel, means for driving one of the rollers of each pair to rotate the work piece, a slidable removable lower support for the bottom of each of the work pieces, a second cam adapted to be engaged by the removable supports, a spring pressing each support outwardly into engagement with the cam, an offset portion on the cam at unloading position, and a releasing portion on the first cam effective at the unloading position to permit the carrier to move outwardly to release the work piece.

5. In an external grinder, a central grinding wheel, spaced pairs of rollers each pair being spaced from and in the plane of the wheel to present a work piece to the wheel, means for bodily moving the pairs of rollers around the wheel and during the grinding range portion of each bodily movement positively guiding the rollers inwardly of the wheel, a motor drive for one of the rollers of each pair, and means for changing the speed of the drive preparatory to finish grinding.

6. A central cutting wheel and means for feeding a workpiece positively simultaneously inwardly and peripherally of the wheel along a predetermined definite path of grinding, so that the distance between the axes of the workpieces and wheel while the workpiece is along its range of grinding is determined by the angular position of the workpiece about the wheel irrespective of variation of the workpiece diameter when fed to the machine.

7. A central cutting wheel and means for feeding a succession of workpieces successively and positively along the same predetermined definite path of grinding, said path progressing inwardly and peripherally of the

wheel at a distance from the wheel axis determined by the angular position about the wheel axis.

8. In an external grinder, a central grinding wheel, spaced pairs of rollers spaced from the wheel in the plane thereof to adapt each pair to present a work piece to the wheel, means for bodily moving the pairs of rollers around the wheel and for positively feeding the rollers inwardly of the wheel along a definite path of grinding.

9. A central horizontal cutting wheel, spaced pairs of rollers radially spaced from and in the plane of the wheel, each to present a workpiece to the wheel along a range of grinding, means for vertically supporting a work piece between the rollers and wheel preparatory to grinding engagement between the work piece and wheel, means for bodily moving the pairs of rollers peripherally and radially inwardly of the wheel along the range of grinding and other means for driving one of each of the pairs of rollers to rotate the respective work pieces.

CLIFFORD T. RAULE.