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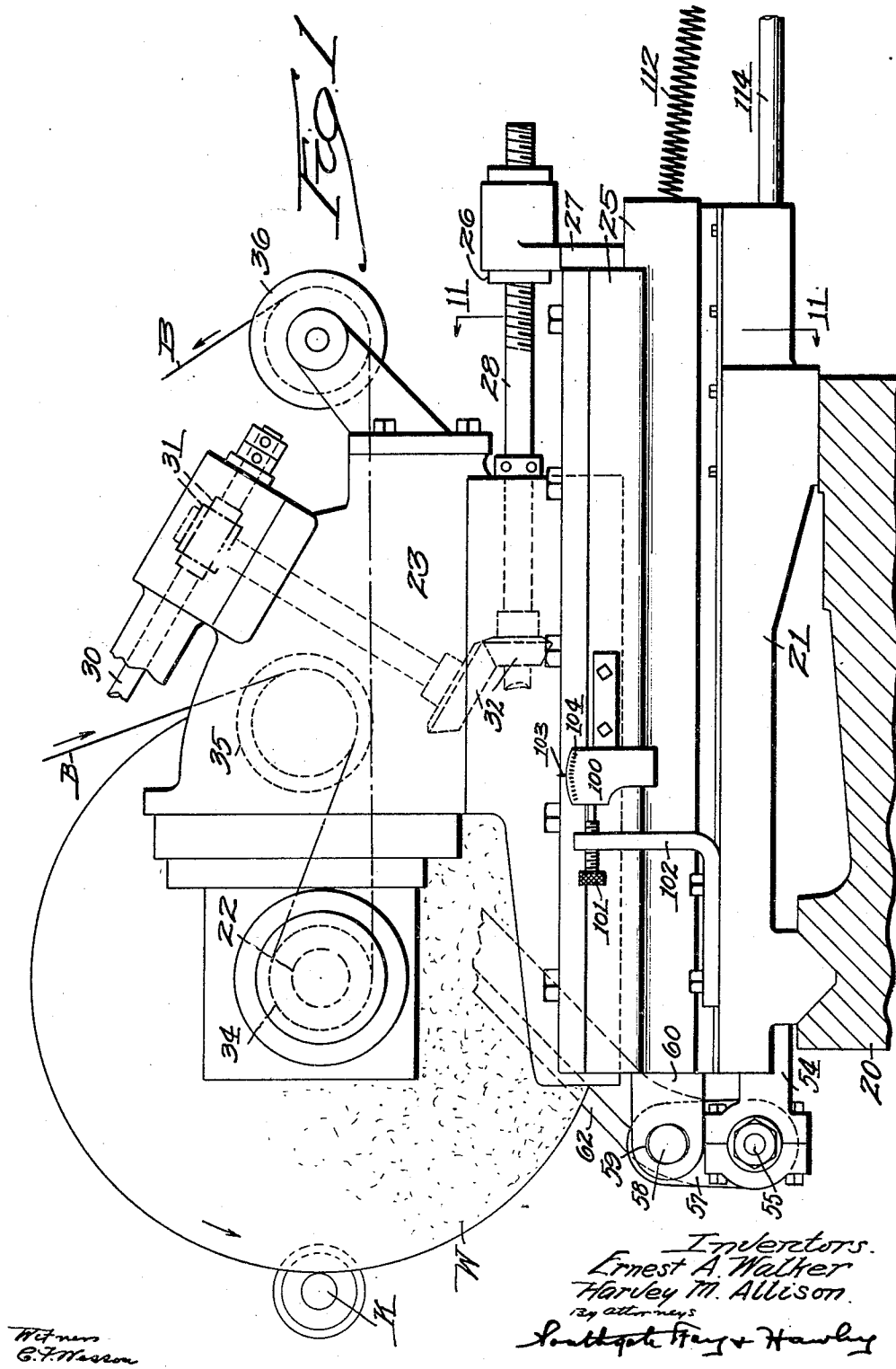
E. A. WALKER ET AL

1,835,733

BACKING OFF MECHANISM FOR GRINDING MACHINES

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4 Sheets-Sheet 1



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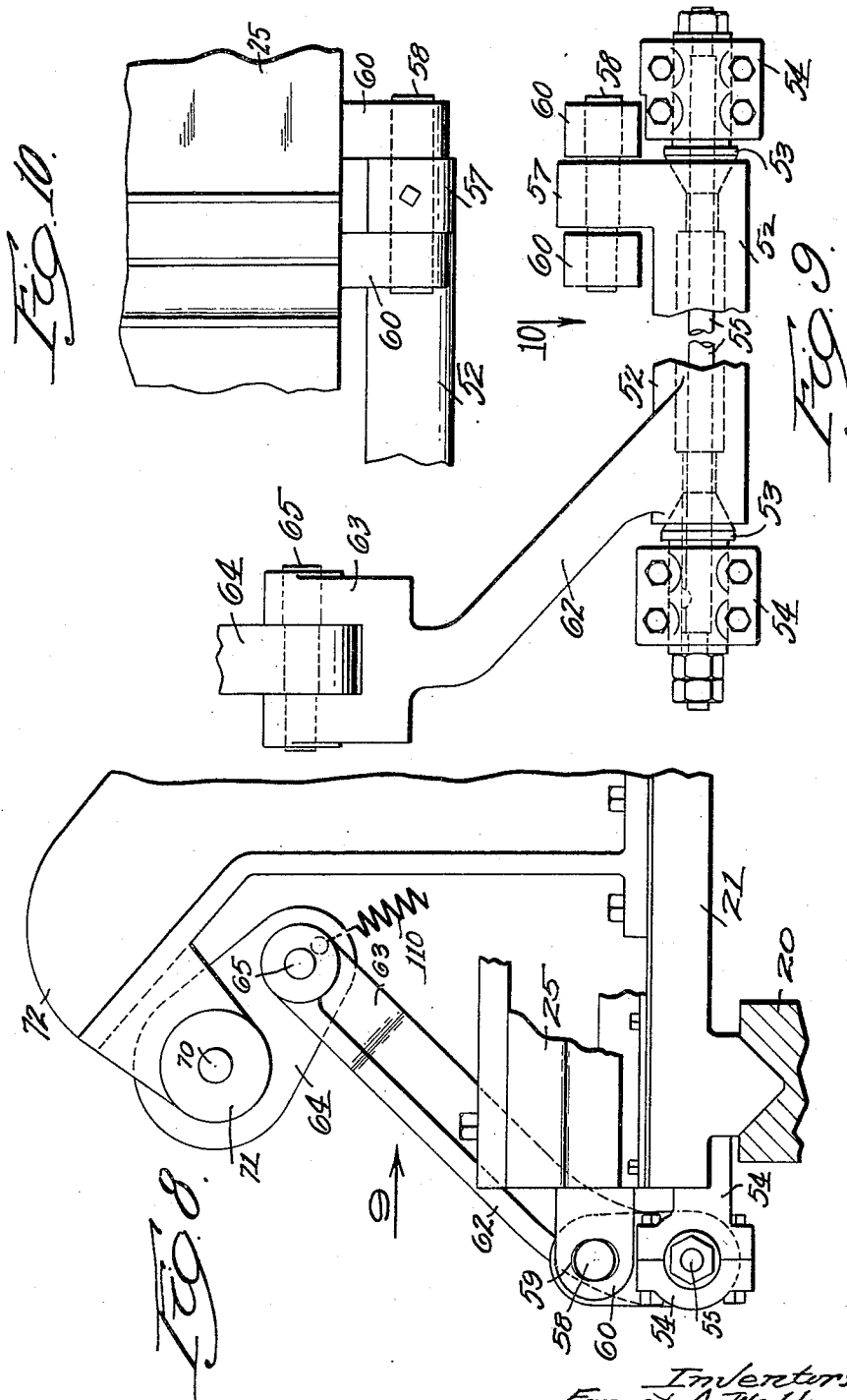
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4 Sheets-Sheet 3



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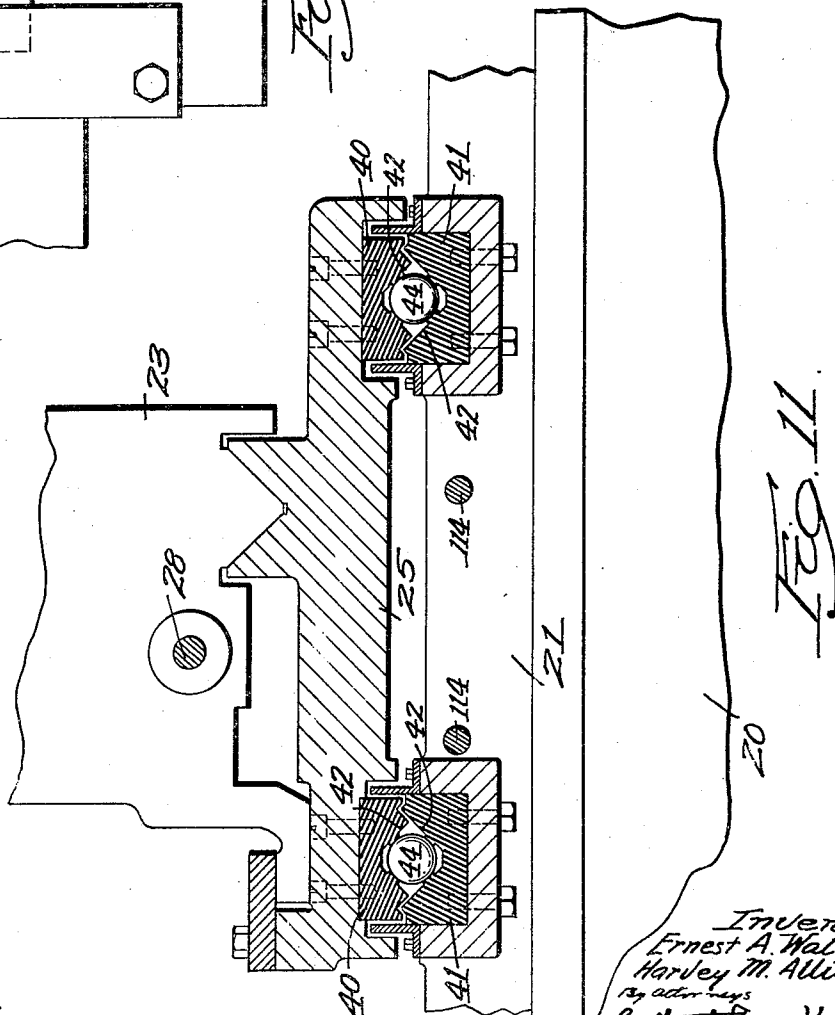
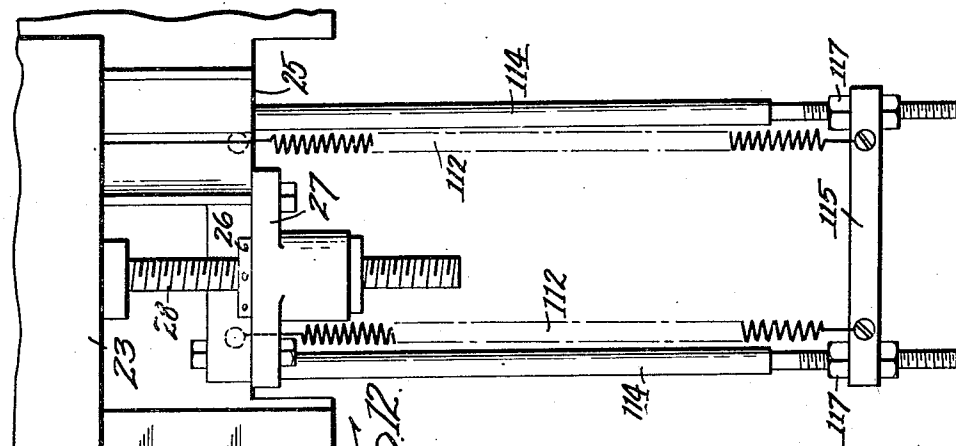
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BACKING OFF MECHANISM FOR GRINDING MACHINES

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4 Sheets-Sheet 4



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BACKING OFF MECHANISM FOR GRINDING MACHINES

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This invention relates particularly to grinding machines adapted for the production of ground taps and other similar work.

It is the general object of our invention to provide improved mechanism in such a grinding machine, by which the teeth of a tap or other similar article may be conveniently and accurately backed off or relieved to provide a desired clearance.

In the preferred form, our improved backing off mechanism is actuated by an eccentric to positively advance the grinding wheel toward the work and to alternately and positively withdraw the wheel therefrom.

Our invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of our invention is shown in the drawings in which

Fig. 1 is a side elevation, partly in section, showing our improvements applied to a grinding machine;

Fig. 2 is a plan view of the backing off or relieving attachment, with certain parts shown in section;

Fig. 3 is a detail left hand side elevation of certain parts, looking in the direction of the arrow 3 in Fig. 2;

Fig. 4 is a detail sectional side elevation, taken along the line 4—4 in Fig. 2;

Fig. 5 is a plan view of an eccentric shaft;

Fig. 6 is a plan view of an eccentric sleeve;

Fig. 7 is a plan view of an adjusting element cooperating with said sleeve;

Fig. 8 is a right hand side elevation showing the connections from the eccentric to the grinding wheel slide;

Fig. 9 is a front elevation of certain parts shown in Fig. 8;

Fig. 10 is a detail plan view, looking in the direction of the arrow 10 in Fig. 9;

Fig. 11 is a sectional rear elevation, taken along the line 11—11 in Fig. 1; and

Fig. 12 is a plan view of certain parts to be described.

Referring to the drawings, we have shown portions of a grinding machine particularly adapted to the production of ground taps and other similar threaded work. The grinding

machine shown in the drawings comprises a base or frame 20 (Fig. 1) on which a wheel table or carriage 21 is mounted for sliding movement axially of the grinding wheel W. The wheel W is mounted on a wheel shaft 22, rotatable in bearings in a wheel head 23, which in turn is mounted in transverse guideways on a cross slide 25.

A nut 26 (Fig. 1) is mounted on a bracket 27 projecting upward from the cross slide 25 and an adjusting screw 28 is threaded in the nut 26. The screw 28 is rotatable in bearings in the wheel head 23, but is held from relative axial movement therein.

A hand wheel (not shown) is mounted on a shaft 30 having bearings on the wheel head 23 and projecting forwardly above the wheel and work. The shaft 30 is connected by spiral gears 31 and bevel gears 32 to the adjusting screw 28. By these connections the wheel head 23 may be manually adjusted forward or rearward on the cross slide 25. The wheel W is rotated by a belt B which is guided to and from the wheel pulley 34 by guide pulleys 35 and 36.

The cross slide 25 and the carriage or table 21 are provided with guide bars 40 and 41 (Fig. 11) respectively, which guide bars are formed with V-shaped guideways 42, reversely disposed and adapted to receive balls 44 on which the cross slide is movable forward and rearward with very slight resistance.

The work K (Fig. 2) may be supported upon centers, the head center 46 being shown in Fig. 2. The center 46 is mounted in a spindle 47 and is continuously rotated by a worm (not shown) meshing with a worm gear 48 on the spindle 47. The spindle 47 is mounted in a work head 49, supported on a work table 50, which may be automatically reciprocated during the grinding operation by any suitable mechanism.

We will now describe the mechanism by which the relieving or backing off movement of the grinding wheel is produced.

A hollow shaft or casting 52 (Fig. 9) is mounted on cone bearing members 53, one at each end thereof, said members being secured in supporting brackets 54 (Fig. 8) project-

ing forwardly from the front end of the table or carriage 21. A shaft or rod 55 (Fig. 9) extends through the hollow shaft 52 and is provided with nuts at each end by which the conical bearing members 53 may be adjusted relative to the shaft 52 so that all back lash will be eliminated while the shaft is left free to turn.

An arm 57 projects upward from the shaft 52 and is provided with a cross rod 58 extending through slots or openings 59 in spaced arms or brackets 60 projecting forward from the cross slide 25.

A second arm 62 projects obliquely upward and rearward from the shaft 52 and is provided with a forked bearing portion 63 to receive a link or eccentric connector 64, pivotally mounted therein on a cross pin or stud 65. The shaft 52 and the arms 57 and 62 may conveniently be formed as a single casting.

The eccentric connector 64 (Fig. 2) is provided with a bushing 66 to receive an eccentric sleeve 68 (Fig. 6), which in turn is mounted on the eccentric portion 69 of a shaft 70. The shaft 70 is rotatable in bearings 71 secured to a stand or bracket 72 (Fig. 8), which in turn is bolted to the wheel table 21 and is thus maintained in fixed transverse position.

The eccentric sleeve 68 is provided with a notched flange 74 and a serrated end portion 75. A collar 77 (Figs. 2 and 7) is keyed to the eccentric portion 69 of the shaft 70 and is provided with a serrated face 78. The serrated face 78 of the collar 77 may be forced against the serrated face 75 of the eccentric sleeve 68 by an adjusting nut 78^a (Fig. 2).

By changing the relative angular relation of the eccentric sleeve 68 to the eccentric portion 69 of the shaft 70, the eccentricity of the outer bearing surface of the sleeve 68 may be varied within substantial limits. The parts may be so adjusted that the surface 68 will be concentric with the axis of the shaft 70 or they may be so adjusted that any desired eccentricity within reasonable limits will be produced.

When it is desired to adjust the eccentricity, the nut 78^a is screwed outward, the collar 77 is withdrawn, and the eccentric sleeve 68 may then be turned by applying a spanner wrench to the notched disc 74.

The end of a square shaft 80 (Figs. 2 and 4) is received in a slot 81 (Fig. 5) formed in the head 82 of the shaft 70. A cylindrical extension 83 of the shaft 80 is received in an opening 84 in the head 82 and may be secured therein by a cross pin 85.

The square shaft 80 extends through a wide faced gear 87 (Fig. 2) having hub portions 88 supported in bearings in a bracket 90 extending rearward from the work driving head 49. The work spindle 47 is connected to continuously rotate the square shaft

80 through a pair of spur gears 91 and 92 (Fig. 2), an intermediate shaft 93, a gear 94 mounted thereon, an intermediate gear 95 (Fig. 3) mounted on an angularly adjustable bracket 96, an intermediate pinion 96^a also mounted on the bracket 96, and a change gear 97 engaging the wide faced gear 87. The bracket 96 is held in position by bolts 98 extending through slots 99 which permit limited angular adjustment of the bracket.

Through the connections above described, the eccentric shaft 70 and sleeve 68 mounted thereon are continuously rotated from the work spindle 47, while the sliding connection of the square shaft 80 with the gear 87 permits relative axial movement of the work head and eccentric shaft.

The eccentric sleeve 68 acts through the eccentric connector or link 64 to oscillate the shaft 52 and the arm 57 formed thereon. Such movement of the arm 57 is directly communicated to the cross slide 25 and causes a reciprocating movement thereof which is positive in both directions.

This movement, while positive, is of very slight extent and is commonly limited to a few thousandths of an inch in each direction. In fact, the movement is so slight that it is difficult to visually estimate the extent of movement and for this reason we have provided an indicator 100 (Fig. 1) mounted on the cross slide 25 and engaging a contact screw 101 threaded in a bracket 102 secured to the table or carriage 21. Magnifying leverage (not shown) causes the very slight transverse movements of the cross slide to be magnified and visibly indicated by a pointer 103 on a suitable scale 104.

In order to prevent any lost motion or chatter of the parts, we have provided a spring 110 (Fig. 8) connected to the arm 62 and tending to take up any back lash in the connections between the arm 62 and the eccentric sleeve 68.

We have also provided springs 112 (Fig. 12) to take up any back lash in the connections between the cross slide 25 and the oscillating arm 57. For this purpose we provide rods 114 extending rearward from the table 21 and provided with a cross bar 115 to which the rear ends of the springs 112 may be attached. The opposite ends of the springs are secured to the cross slide 25. The tension of the springs may be adjusted by moving the cross bar 115 forward or rearward by nuts 117 on the threaded rear ends of the rods 114.

Having thus described our invention and the method of operation thereof, it will be seen that we have provided means for positively reciprocating the cross slide 25 and that we have provided means for conveniently and positively adjusting the extent of the reciprocating movement, said latter means

comprising toe eccentric sleeve 68 mounted on the eccentric portion 69 of the shaft 70.

The eccentric is continuously driven in exact timed relation with the rotation of the work K and commonly gives the grinding wheel several backing off movements for each revolution of the work K.

It is found by actual test that our improved backing off mechanism will produce extremely accurate results, so that the backing off may begin closely adjacent the cutting face of the teeth, whereas with certain devices previously used the variable operation of the relieving attachment made it impossible to start the backing off close to the cutting edge. Our device is operable at high speed and runs very smoothly and without any jar or vibration.

An important advantage in the use of an eccentric drive in our improved relieving mechanism arises from the fact that the mechanism operates equally well with the eccentric rotating in either direction. Accordingly, the work spindle may be reversed for grinding in the opposite direction and the teeth will be relieved as before. The invention is also applicable to the grinding of both right and left hand threads without any eccentric or gearing.

We claim:—

1. In a grinding machine, means to support and rotate a piece of work, a grinding wheel, said work and wheel being mounted for relative axial movement, means to rotate said wheel, and means effective to alternately positively advance and positively withdraw the wheel toward and from the work in timed relation to the rotation of the work, said means including a rock shaft, an arm on said shaft, a continuously rotating eccentric circular disc, a link pivoted on said eccentric disc and pivotally connected to said arm, a sliding support for the grinding wheel and a second arm on said rock shaft connected to said support.

2. In a grinding machine, means to support and rotate a piece of work, a grinding wheel, said work and wheel being mounted for relative axial movement, means to rotate said wheel, means to alternately advance and withdraw the wheel toward and from the work as the wheel and work are rotated, and multiplying means to indicate on an enlarged scale the extent of such forward and rearward movements.

3. In a grinding machine, means to support and rotate a piece of work, a rotatable grinding wheel, a wheel supporting head mounted to slide toward and from the work, an eccentric rotated in timed relation to the rotation of the work, and connections between said eccentric and said wheel head by which said wheel head is positively reciprocated radially of the work by said eccentric.

4. In a grinding machine, means to sup-

port and rotate a piece of work, a rotatable grinding wheel, a wheel supporting head mounted to slide toward and from the work, and driving connections including an eccentrically mounted circular disc by which said wheel head is positively advanced and positively retracted substantially radially toward and from the work a predetermined number of times for each revolution of the work, said eccentric driving connection being operable in either direction.

5. In a grinding machine, means to support and rotate a piece of work, a rotatable grinding wheel, a wheel table mounted for adjustment axially of the work, a wheel head mounted on said table for movement transversely of the work, a rock shaft on said table connected to reciprocate said wheel head, an eccentric, operating connections between said eccentric and said rock shaft, and means to rotate said eccentric in timed relation to the rotation of the work.

6. The combination in a grinding machine as set forth in claim 7, in which said latter means is operatively connected to the work rotating means in every axial position of the work relative to said grinding wheel.

7. In a grinding machine, means to support and rotate a piece of work, a grinding wheel, said work and wheel being mounted for relative axial movement, means to rotate said wheel, and means to alternately advance and withdraw the wheel toward and from the work in timed relation to the rotation of the work, said latter means including a rotating actuating member operative to produce the same movements of the wheel head and at the same relative speeds when rotated in either direction.

In testimony whereof we have hereunto affixed our signatures.

ERNEST A. WALKER.
HARVEY M. ALLISON.

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