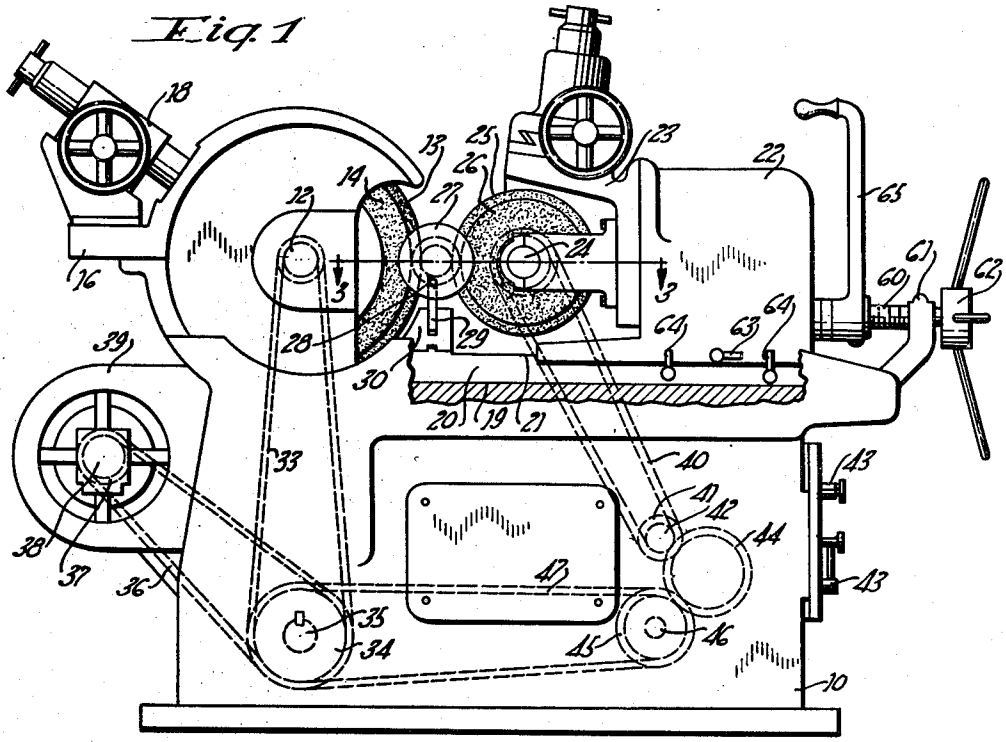
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GRINDING MACHINE

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Fig. 1



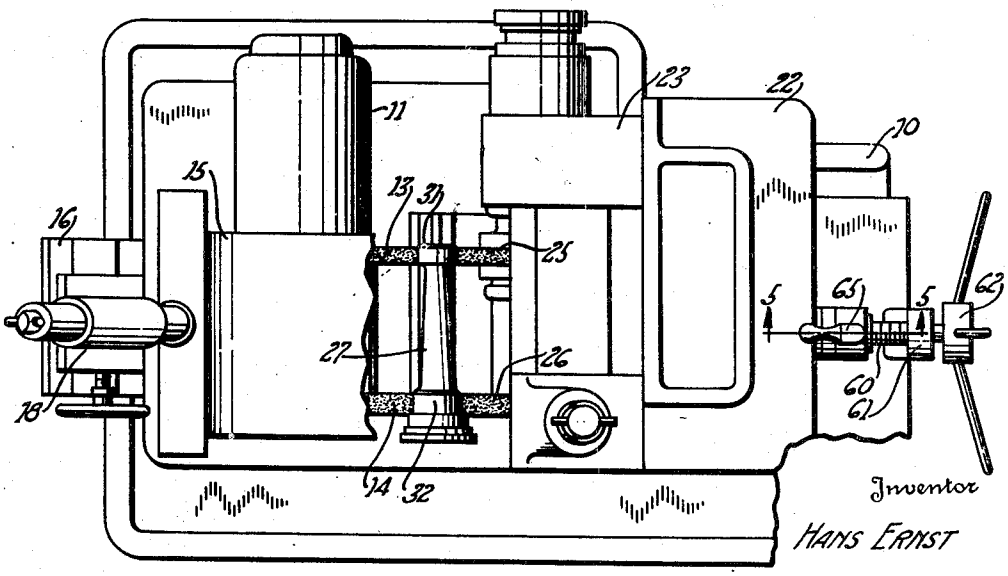


Fig. 2

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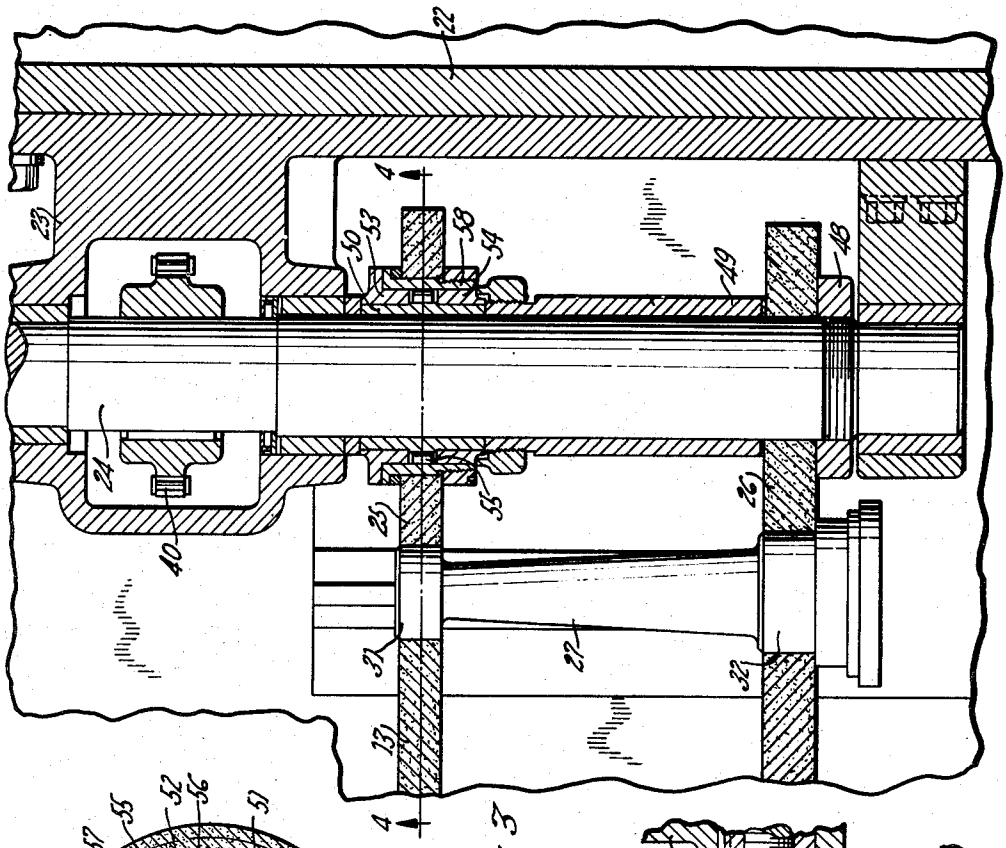


Fig. 3

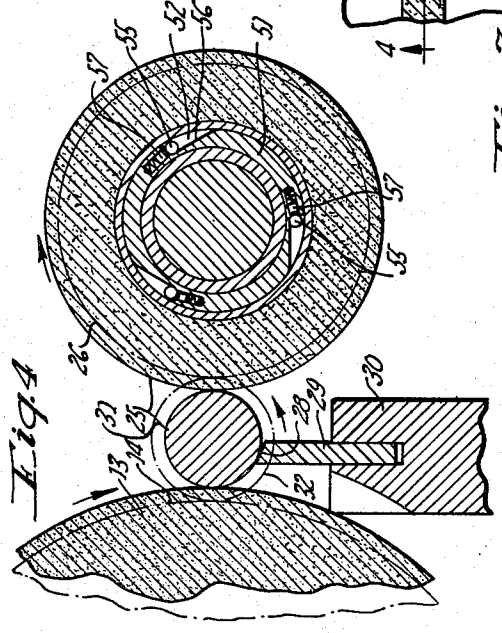


Fig. 4

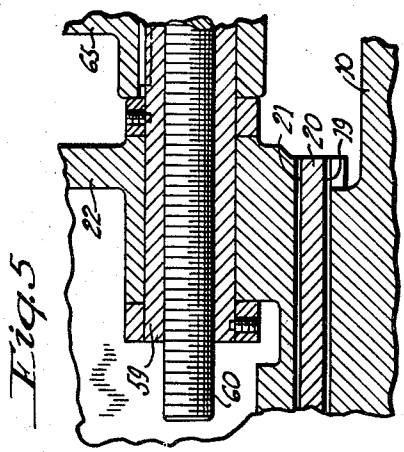


Fig. 5

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UNITED STATES PATENT OFFICE

2,020,541

GRINDING MACHINE

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Application September 8, 1933, Serial No. 688,645

6 Claims. (Cl. 51—103)

This invention relates to improvements in grinding machines and particularly to improvements in centerless type of grinding machines.

An object of the invention is the provision of improved means for controlling the rotation of multiple diameter work pieces while being operated upon and within the grinding throat.

Another object of the invention is the provision of a centerless grinding machine for grinding two or more diameters of a work piece simultaneously, together with means for frictionally controlling the rotation of the work piece and operable from any one of the diameters thereof.

A still further object of the invention is the provision of an improved centerless grinding machine for simultaneously finishing two or more diameters on a work piece in which the slip or relative surface movement between said diameters of the work and their opposed regulating wheels is reduced to a minimum.

A further object of the invention is the provision of an improved centerless type of grinding machine for simultaneously finishing two or more diameters on a work piece including improved means for insuring the rotation of the work at a definite work speed regardless of which of the several diameters is operating to control the speed of the work.

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.

In the drawings:

Figure 1 is a front elevation of a centerless grinding machine embodying the improvements of this invention.

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

Figure 3 is a fragmentary sectional view taken on line 3—3 of Figure 1.

Figure 4 is a fragmentary sectional view taken on line 4—4 of Figure 3.

Figure 5 is a fragmentary sectional view taken substantially on line 5—5 of Figure 2.

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

In order to properly produce and finish work pieces by grinding it is essential that a definite speed be maintained between the surface of the grinding wheel and the surface of the work. This speed ratio is dependent upon the material and size of the work and the type of grinding wheel. These prerequisite conditions apply with equal force to grinding machines, whether of the centerless or center type.

In a centerless grinder the speed of the work is effected or controlled by frictional engagement thereof with a regulating wheel and the peripheral speed of said regulating wheel is determined by the size of the work piece, since in practice the work piece is given the same peripheral speed as that of the controlling or regulating wheel. It frequently is desirable to simultaneously grind two or more portions of a work piece, which portions are backed up by different sizes of regulating wheels. If these wheels are driven at the same R. P. M. the peripheral speeds thereof will vary and each wheel will attempt to rotate the work through its particular portion thereon, thereby attempting to rotate the work at a plurality of conflicting R. P. M. It is, therefore, necessary to provide means whereby, regardless of which of the several regulating wheels is effecting the actual control of the work, it will be rotated at the most satisfactory speed which is generally determined by the largest portion of the work. By this invention the rotation of the work is properly effected by means which will be described later.

A centerless grinder with which this invention is employed comprises a bed 10, having rising thereabove at one end a pedestal bearing 11. Rotatably journaled in the bearing is a spindle 12 to which is secured in the present instance a pair of grinding wheels 13 and 14. These wheels are suitably enclosed in a hood or guard 15 to confine the coolant usual with grinding machines. Projecting from the guard or hood 15 is a shelf 16 supporting a trueing mechanism 18 adapted to be traversed relative to the wheels for effecting the trueing thereof.

The bed 10 on its upper surface has extending from the pedestal bearing 11 a guide 19 or a slide 20. The slide 20 in turn provides on its upper surface a guide 21 for an upper slide or housing 22. The housing 22 has secured to it a head 23 in which is journaled a spindle 24. Secured to the spindle 24 is a pair of friction control or regulating wheels 25 and 26 which are disposed in position to the grinding wheels 13 and 14.

The opposed grinding and friction control or regulating wheels form between them a grinding

throat in which the work 27 is disposed. The said work is peripherally supported within the grinding throat by peripherally engaging the inclined top or operative surface 28 of a work rest blade 29 carried by a block 30, in turn secured to the inner end of the lower slide 20. The work rest blade 29 has in reality a pair of stepped supporting surfaces, one for the small diameter 31 of the work and the other for the large diameter 32 thereof. Each of these steps, however, is provided with an inclined supporting surface, such as 28, which are disposed in parallelism.

The grinding wheels 13 and 14 are adapted to be rotated at a high grinding rate of speed, for which purpose the spindle 12 thereof has trained about it, or a pulley thereon, a flexible transmission belt or the like 33. This belt 33 is in turn trained about a pulley or sheave 34 keyed or otherwise secured to a jack shaft 35 journaled within the bed 10. A second pulley or the like, similar to the pulley 34, and likewise keyed on the shaft 35, has trained thereabout a flexible transmission member 36, in turn extending around a pulley or the like on the rotor or shaft 38 of a prime mover 39. The prime mover 39 is secured in any desirable manner to one end of the bed 10. The prime mover is connected with the spindle 12 through the transmission members 36 and 33 in such a way as to rotate the grinding wheels at a high grinding rate of speed in a clockwise direction whereby the operative surfaces of the wheels travel downwardly as respects the blade 29 and work supported thereby.

The friction control or regulating wheels 25 and 26 are adapted to be rotated at a relatively slow work controlling rate of speed for which purpose the spindle 24 thereof or a pulley thereon has trained thereabout a flexible transmission member or belt 40, in turn extending about a pulley or the like 41 on a shaft 42. The shaft 42 is the final shaft of a change speed box supported by one end of the bed 10. As usual, this speed box comprises a plurality of shiftable transmission gears or the like under the control of suitable manually actuable levers, such as 43. Included within the speed box is a gear 44 meshing with a gear 45 on a shaft 46 intermediate the jack shaft 35 and change gear speed box. The shaft 46 may in addition have secured to it a pulley or the like about which is trained a flexible transmission member 47, in turn extending about a suitable pulley on the jack shaft 35. The drive just described, and including the gear box, is adapted to rotate the regulating wheels 25 and 26 at variable relatively slow work controlling speeds in a clockwise direction. By rotating the regulating wheels in a clockwise direction their operative surfaces travel upwardly as respects the work rest blade and work, thereby rotating the work in a counterclockwise direction against the clockwise direction of the grinding wheels and effecting a stock removal from the work.

As was noted above, the work 27 must rotate at a definite R. P. M. with respect to the grinding wheels 13 and 14. When the rough or unfinished work piece is placed in the grinding throat the two different diameter portions thereof will contact respectively with their regulating wheels. Depending upon which of these portions has the more stock, the speed of the work will be effected. From this, it will follow that if the smaller portion 31 of the work has the greater stock thereon through its contact with its regulating wheel 25 and the grinding wheel 13 the work will be rotated at a much faster rate than if the larger portion 32 were driving from its wheel 26. It will, therefore, be seen that the work speed will constantly vary, which would result in improperly finished work, if not a wreck to the machine.

To overcome this difficulty, only one of the regulating wheels is secured to the regulating wheel spindle 24, which as shown in Figure 3, is the wheel 26, being securely clamped to the spindle between a nut 48 threaded to the spindle on one side of the wheel 26 and a sleeve 49 on the other side thereof. The second wheel 25 is adapted to be connected with the spindle through an overrunning clutch whereby the spindle may be rotated relative to it in a clockwise direction at any desired speed, but it will not rotate in a clockwise direction at a speed faster than the rotation of the spindle. This overrunning clutch may take the form of any desired construction, but as shown in the drawings comprises a sleeve 50 having formed centrally thereof a collar 51 provided with notches 52. Mounted on the sleeve 50 and flanking opposite sides of the collar 52 are ring members 53 and 54, thereby forming pockets of the notches 52. Mounted in each of the said pockets is a roller 55 lying on the inclined base 56 of said pockets. Disposed at the end of each of the pockets is a spring pressed plunger 57 at all times engaging the rollers 55 and tending to shift same along the inclined surface 56 of the pockets.

The flanking rings 53 and 54 have their outer surfaces concentric and support for rotation thereon a collet 58 to which is secured the friction control or regulating wheel 25. The collet 58 completely closes the pockets in which the rollers 55 are disposed and forms with the surface 56 an acute angle into which the rollers 55 are wedged for locking the wheel 25 to the spindle.

By reference to Figure 4, it will be noted that with the spindle 24 rotating in a clockwise direction at a speed slower than the speed of rotation of the wheel 25 the rollers 55 will wedge themselves into the acute angle of their pocket, thereby locking the wheel 25 thereto. It will also be noted that should the work tend to drive the wheel 25 in a clockwise direction the same action of wedging the rollers takes place, thereby attempting to rotate the spindle and the transmission through the change speed box and jack shaft and prime mover at the said rate of speed at which it is traveling. This, however, is impossible, and the wheel will immediately lock up with the spindle and have its rotation effected only at the rate of speed of the regulating wheel which was previously determined through the shifting of the speed control handles 43.

From the foregoing it should now be evident that a work piece having multiple diameter portions will at all times be rotated only at the desired speed and be at all times under the control of the regulating wheels 25 and 26. It should be noted that, while there are but two regulating wheels shown in the drawings, any number of them may be supplied depending on the number of different diameter portions of the work, and each of the additional wheels having an overrunning clutch connection with the spindle.

In order to set up the machine for different diameters of work pieces the upper and lower slides and parts carried thereby are adapted to be shifted relative to their guide ways. For this purpose the upper slide or housing 22 has mounted therein a sleeve type nut 59 in threaded engagement with an adjusting screw 60 rotatably journaled in a bracket 61 carried by one end of the bed. The screw 60 projects beyond the

bracket 61 to receive a pilot or hand wheel 62 whereby said screw is adjusted. In order to simultaneously shift the slides 20 and 22 there is provided a clamp 63 for securing said slides to one another, while for independently adjusting the slide 20 there is provided clamps 64 for securing the lower slide to the bed.

In practice and during grinding operations the slides are retracted a given amount from the grinding wheel to permit the placing of a work piece on the work rest blade, whereupon the entire assembly is shifted toward the grinding wheel and a stock removal effected from the work. For this purpose the nut 59, see Figures 1, 2 and 5, has secured to it a handle 65 oscillatable from the position shown in Figure 1 through an arc of 90° thereby effecting a corresponding rotation of the nut relative to the screw. This rotation of the nut relative to the screw effects the movement of the parts either toward or from the grinding wheel depending upon the direction of oscillation of the nut and the hand of the screw.

It is believed that the full operation of a centerless grinding machine embodying the improvements of this invention should be readily evident from the foregoing description.

What is claimed is:

1. In a centerless grinder of the class described for simultaneously grinding work pieces having a plurality of different diameter portions thereon the combination of a bed, a grinding wheel rotatably mounted on the bed for each portion of the work, an opposed regulating wheel for each grinding wheel, said grinding and regulating wheels forming a grinding throat, a work rest blade beneath the grinding throat for peripherally supporting a work piece, a spindle for the regulating wheels, means for securing one of said wheels to the spindle for rotation therewith, and means securing the remaining regulating wheel to the spindle for movement therewith and relative thereto, said means including an overrunning clutch whereby the said regulating wheel may be rotated independently of the spindle until the speed of the spindle is reached.

2. In a regulating wheel unit for use with a centerless grinder for controlling the rotation of a multiple diameter work-piece the combination of a spindle, means for rotating the spindle, a regulating wheel secured to the spindle for rotation therewith, a second regulating wheel on the spindle, and an overrunning clutch between said second regulating wheel and spindle whereby the speed of the said second regulating wheel will not exceed the speed of the spindle.

3. A regulating wheel unit for use with a centerless grinder for controlling the speed of a multiple diameter work piece the combination of a spindle, means for driving the spindle at the desired rate of rotation, a plurality of regulating wheels, one for each diameter of work piece, means for securing one of said regulating wheels to the spindle for rotation therewith, and means for securing the remaining regulating wheels to the spindle for rotation at independent rates not in excess of the rate of rotation of the spindle, including an overunning clutch between said additional regulating wheels and the spindle.

4. A centerless grinder including work supporting means for peripherally engaging and supporting a work piece, grinding means disposed at one side of the work support for engagement with the work piece to effect a removal of stock therefrom, and regulating means disposed at the opposite side of the work piece for controlling its rate of rotation, said regulating means including a spindle rotatable at a determined number of revolutions per minute, a plurality of regulating members carried by the spindle, positive means securing one of said regulating members to the spindle for rotation therewith, and an over-run clutch between the spindle and the other regulating member arranged to be effective to prevent rotation of said member at a rate in excess of the rate of drive of the spindle, substantially as and for the purpose described.

5. A centerless grinder including opposed grinding and regulating members providing a work receiving throat and means for supporting a work piece in operative position within the throat, said regulating means including a first regulating wheel positively rotatable at a definite revolution per minute, a second freely rotating regulating wheel adapted to be frictionally driven by the work, and means for preventing rotation of the second regulating wheel in one direction at a revolution per minute in excess of that prescribed for the first mentioned regulating wheel.

6. In a machine of the character described, the combination with work supporting means and grinding means disposed adjacent thereto for operation on a work piece carried by the support, of means for controlling the rate of rotation of the work piece including a pair of members frictionally engaging the work piece, means for positively rotating one of said members whereby to determine the normal rate of rotation of the work piece, and means for automatically limiting the rate of rotation of the other of said regulating members as effected by the work piece whereby excessive speed of rotation of the work piece is prevented on failure of the positively driven regulating member accurately to determine same.

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