Oct. 29, 1940. C. I. LOTT 2,219,425

GRINDING MACHINERY

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Fig. 1

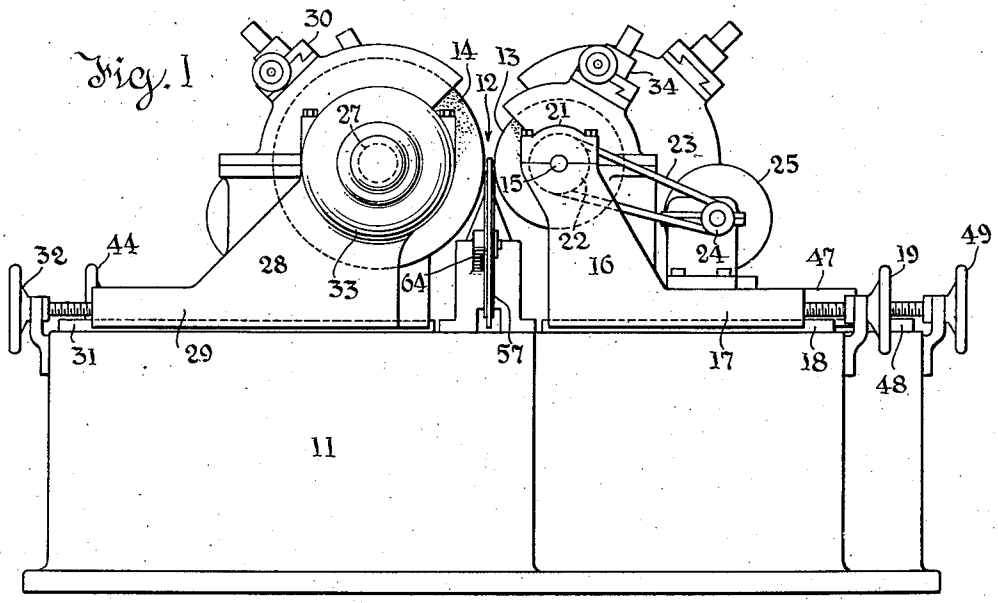
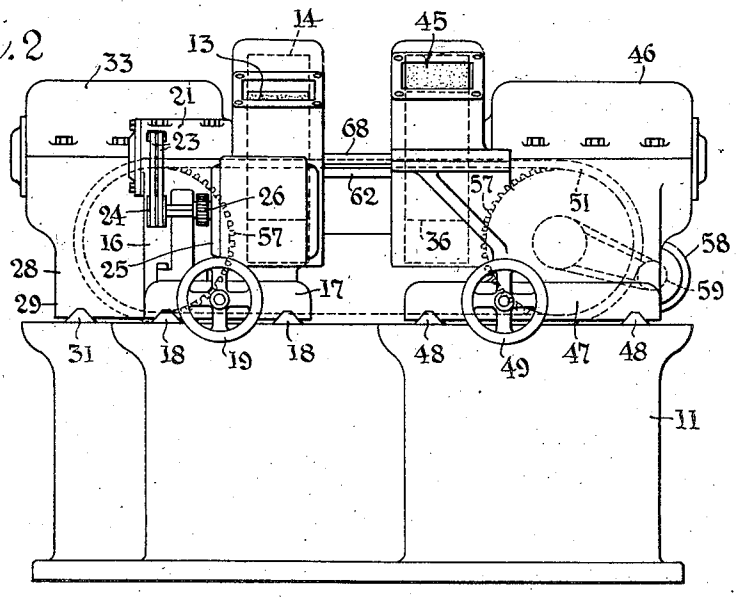


Fig. 2



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Fig. 3

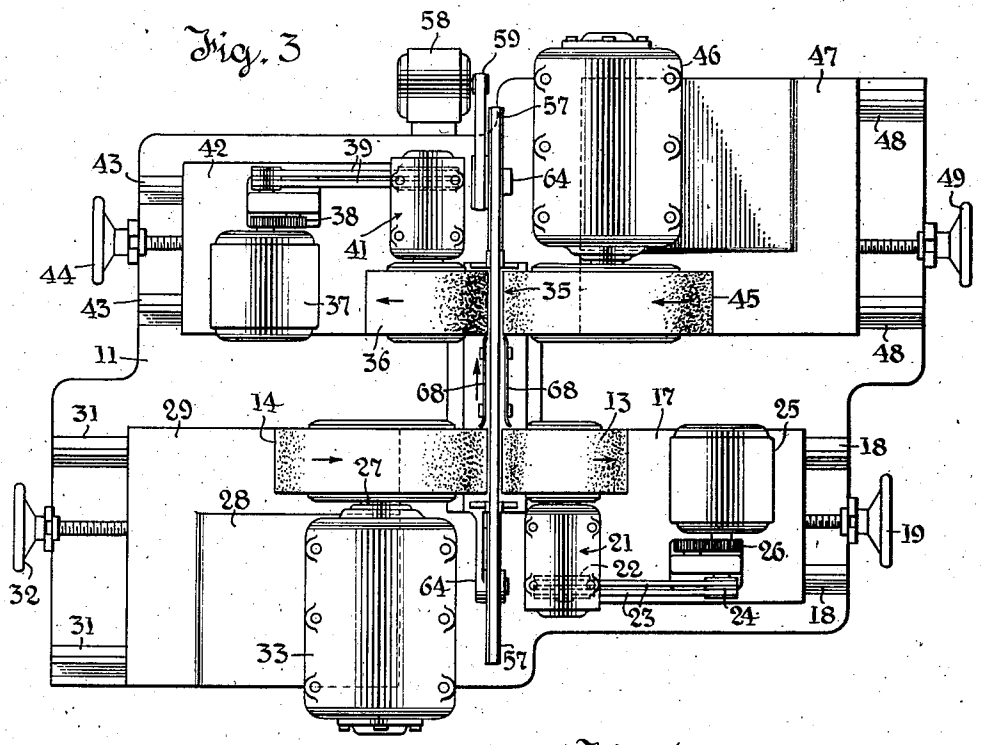


Fig. 4

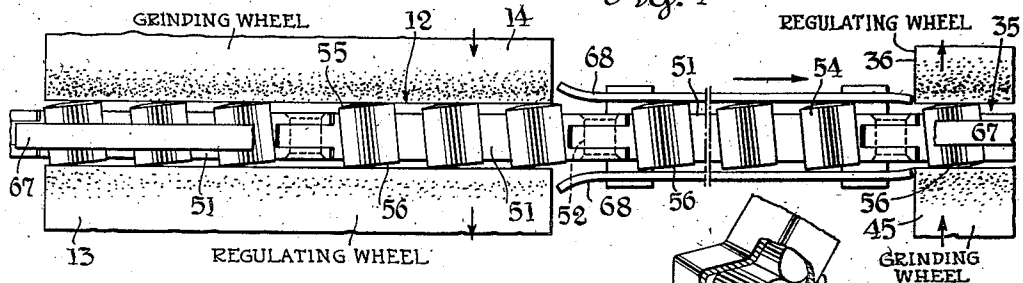
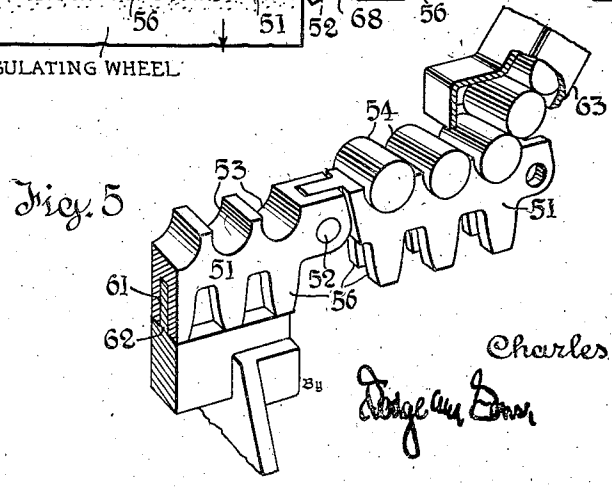


Fig. 5



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GRINDING MACHINERY

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Application January 8, 1938, Serial No. 184,067

3 Claims. (Cl. 51—103)

This invention relates to grinding machinery, and particularly to machines of the type known in the art as centerless grinding machines.

In devices of the prior art it has been the usual practice to feed the work manually, either piece by piece or by employing carriers in which a plurality of work pieces are loaded for manual transfer to and removal from the grinding throat. Magazine feeds have been used to a limited extent but these feeds have met with difficulty in that the work is not held in accurate relation to the grinding and regulating wheels. Methods so far known are not well suited to high speed production, nor do they lend themselves to effective use in extremely accurate work or in operations where each work piece must be subjected to a plurality of grinding operations in order to finish a plurality of its surfaces.

While the present invention is directed more particularly to mechanisms for grinding bearing rollers, it is not limited to such use. It is designed with the idea of making the grinding operation fully automatic so that the work can be fed from a magazine to a continuous work carrier which is subjected to continuous movement between the grinding elements of one or more grinding machines.

The main object of this invention is to produce a centerless grinding machine for continuous operation and capable of grinding a plurality of surfaces without removing the work from the work carrier. Furthermore, it is proposed to produce a compact assembly of grinding units, each capable of individual adjustment on a common bed and being so arranged that each rotating element has a separate driving motor capable of individual adjustment. It is further proposed to provide the work carrier with a fixed guide so that the work traverses the grinding throat or grinding throats in accurate predetermined relation to the grinding and regulating wheels.

Numerous other advantages of the present invention will be apparent from a reading of the following description in connection with the accompanying drawings, in which:

Figure 1 is a side view of one form of centerless grinding machine embodying the present invention;

Fig. 2 is an end view of the machine of Fig. 1;

Fig. 3 is a plan view of a grinding machine embodying the present invention with the superstructure removed to make clear the relation between the work carrier and the grinding throats, and showing the individual adjustments of the various rotating elements;

Fig. 4 is an enlarged plan view of the work carrier showing its relation to the grinding throats and the work guides;

Fig. 5 is a partial perspective view of the continuous work carrier together with its guide, and a portion of the feeding magazine.

In the drawings, the reference character designates a machine bed having mounted thereon, by means of slides, a plurality of centerless grinding machines or units. A grinding throat 12 is formed between regulating wheel 13 and grinding wheel 14. The regulating wheel 13 is mounted on a shaft 15 carried in brackets 16 upstanding from slide 17, and adapted to move on ways 18 along which it may be adjusted by hand wheel 19. Also mounted on the shaft 15 is a gear box 21 constructed and arranged to permit different rates of drive for the regulating wheel 13, in accordance with usual practice, and including a pulley 22 connected by belt 23 with a pulley 24 driven by motor 25 through reduction gearing 26. The motor 25 forms an individual drive for the regulating wheel 13 and is mounted on the slide 17 so as to be adjustable toward and away from the grinding throat 12 by manipulation of wheel 19.

The grinding wheel 14 is mounted on a shaft 27 carried on brackets 28 and slide 29. The slide 29 is movable on ways 31 and the slide may be adjusted by means of hand wheel 32. Also mounted on the slide 29 is an individual driving motor 33 directly connected with the wheel 14. In accordance with the usual practice, the grinding wheel 14 has associated with it a wheel truing mechanism designated generally by reference character 30, this mechanism being generally similar to truing mechanism 34 associated with regulating wheel 13.

Also mounted on the bed 11 of the grinding machine shown in Fig. 3 is a second pair of wheels, forming a second grinding throat 35. Associated with the throat 35 is a regulating wheel 36 driven by a motor 37 through reduction gearing 38, belt drive 39 and speed adjusting gearing 41. The motor 37 as well as the regulating wheel 36 are mounted on a slide 42 movable on ways 43 on the machine bed, and capable of adjustment toward and away from the grinding throat 35 by hand wheel 44.

In opposed relation to the regulating wheel 36 is a grinding wheel 45 driven by an individual motor 46 to which it is direct-connected. Wheel 45 and motor 46 are mounted on a slide 47 movable on ways 48 on the machine bed and adjusta-

ble toward and away from the grinding throat 35 by means of hand wheel 49.

It will be apparent from the above that the two regulating wheels 13 and 36 are mounted on opposite sides of their respective grinding throats so as to act in opposite directions upon the work which is passing through said throats. Similarly, the grinding wheels 14 and 45 are oppositely disposed so that work traversing the two throats 12 and 35 in succession (see Fig. 3) will be ground on one face in throat 12 and on the other face in throat 35. Inasmuch as each of the four wheels is driven by a separate motor and each such motor is mounted on an individual slide capable of individual adjustment, it will be clear that any one wheel may have its position changed in accordance with requirements without affecting the adjustment of any of the other wheels. It will also be clear that by means of gear boxes 21 and 41 the speeds of the regulating wheels may be altered to suit conditions in accordance with usual practice.

The location of two centerless grinders on a single machine bed with an individual driving motor for each of the wheels eliminates a major portion of the usual gearing and belting required by such machines, and makes it possible to design a single work carrier arranged for continuous operation so as to carry work from one grinding throat to the other uninterruptedly, and without requiring any handling of the work whatsoever.

Referring now to Figs. 4 and 5 of the drawings it will be seen that the carrier consists of a plurality of links 51 joined together as at 52 and containing pockets 53 to receive elements to be ground, these elements being here shown as bearing rollers 54. The pockets 53 are inclined with respect to the direction of travel of the carrier as indicated in Fig. 4, so that the end faces of the bearings are ground at an angle, the bearings in Fig. 4 having the faces 55 ground by grinding wheel 14 and the faces 56 ground by the grinding wheel 45. The carrier elements or links are slotted longitudinally of the carrier on their lower faces at 61 to straddle the guide bar 62, and are provided with teeth 56, so that the carrier may be driven by gears such as 57 (Figs. 2 and 3). A gear is provided at each end of the carrier and the carrier is driven from a motor 58 and a belt connection 59 as shown in Fig. 3.

With the arrangement just described it is possible to feed the rollers 54 into the carrier from a magazine as indicated at 63 (Fig. 5). This magazine or chute is arranged so as to feed the rollers one by one in parallel relation to the pockets 53. This is accomplished by inclining the magazine not only with respect to the horizontal plane of the carrier, but also with respect to the vertical plane of the carrier, the inclination with respect to the vertical plane being the same as the inclination of the axes of the pockets 53 with respect to the vertical plane of the carrier.

Gears 57 are mounted in suitable brackets such as 64, carried by the machine bed. The guide rail 62 extends upwardly from the machine bed from one grinding throat to the other so as to insure a proper relation between the elements to be ground and the two grinding throats. The guide rail 62 is carried by suitable supporting brackets secured to the bed of the machine and so related to the endless carrier as to permit free and uninterrupted movement of the same.

Associated with each of the grinding throats is a narrow resilient bar element 67 designed to hold the rollers in their pockets during the grinding operation. Although this bar is shown of substantial width in Fig. 4, it may consist merely of a knife edge bearing downwardly against the ends of the rollers adjacent the regulating wheel 13 and counteracting the usual tendency of that wheel to lift the work. The guide bar associated with throat 35 will cooperate with wheel 36 in a similar manner. During travel of the carrier from one grinding throat to the other, the rollers are not subjected to any lifting tendency. Consequently, no bar need be present above the rollers between the two grinding throats. However, during this travel from one grinding throat to the other, the ends of the rollers are exposed and it is, therefore, necessary, in order to prevent lateral displacement of these rollers, to provide some means such as guide bars 68, preferably inclined at the incoming end as indicated in Fig. 4. These two bars 68 are separated by an interval sufficient to maintain the rollers in alinement with the two grinding throats, but not to impose appreciable friction on the rollers as they make the traverse. While the guide bar 67, in connection with the grinding throat 12, is located in the vicinity of regulating wheel 13, it will be understood that in connection with grinding throat 35 the guide bar is located in juxtaposition to the regulating wheel 36, which contacts with the previously ground faces of the rollers which have been formed by grinding wheel 14.

The operation of the machine just described is as follows:

The grinding and regulating wheels associated with the two grinding throats are first adjusted to proper relation, and the motors started so that all four wheels are rotating and the carrier is also moving. Rollers to be ground are then dropped into the magazine 63, which feeds them down into the pockets 53 of the carrier. They are then advanced to grinding throat 12 where the ends 55 are ground by the grinding wheel 14 as they are rotated by regulating wheel 13. Continuous motion of the carrier takes place during this grinding operation so that the rollers leave the throat 12, pass between the guides 68, and enter the throat 35 where the opposite ends are ground by the grinding wheel 45. When the rollers leave the grinding throat 35 they are angle ground on both ends and may be dropped out into any suitable container or chute for transferring them to another part of the factory or to another machine.

It will be understood that while two pairs of grinding throats are illustrated, more than two such pairs may be utilized if the elements to be ground have more than two surfaces which require such treatment. It will also be understood that the grinding throats may be adjusted individually and the speeds of the regulating wheels varied to suit conditions, the change speed gearing 21 and 41 being available for this purpose. The guide rail 62 holds the work in accurate operative relation to the grinding throats at all times, and the bar 67 and guides 68 prevent the rollers from being displaced at any time from the pockets in which they are carried. Consequently, the machine is entirely automatic in its operation, and is capable of producing accurate work at a very high rate of speed and without manual control, other than to keep the magazine 63 filled and to maintain proper adjustment between the elements of the grinding throats.

The machine illustrated eliminates a large part of the belting and gearing which are usually re-

quired in connection with a plurality of grinding throats, and the machine is reduced to the utmost in simplicity and a few small motors accomplish the result which formerly required a very large motor of high capacity. The use of individual driving motors cuts down the friction of the system and materially reduces the amount of power consumed in driving and operating the machine.

Although only one form of the invention has been illustrated, it will be obvious that various changes and modifications may be made within the scope of the appended claims without departing from the spirit and scope of the invention.

What is claimed is:

1. A continuous centerless grinding machine for angle grinding the ends of cylindrical members comprising a bed; a plurality of grinding and regulating wheels mounted on said bed with each grinding wheel operatively associated with a regulating wheel to form at least two grinding throats in alignment in a common plane, the grinding wheel of one throat being in reversed relation to the grinding wheel of the other throat; an endless work conveyor member operatively associated with said throats and comprising hinged links having transverse work receiving pockets disposed in inclined relation to the direction of travel of said conveyor to bring the ends of the work into operative relation with the grinding wheels as the conveyor passes through the grinding throats; rigid means for guiding said conveyor in its travel through said throats; means for feeding cylindrical work pieces to said conveyor; and means associated with the conveyor for preventing displacement of the work pieces therefrom by the regulating wheels as the conveyor travels through the grinding throats.

2. A grinding machine for performing successive grinding operations on different portions of work pieces having surfaces of revolution on which the pieces rotate during a grinding operation, comprising a grinding and a regulating wheel arranged to form a first grinding throat; a grinding and a regulating wheel arranged to form a second throat, the second throat being in longitudinal alignment with the first throat and the grinding wheel of one throat in reverse relation to the grinding wheel of the other throat; an endless conveyor extending through said throats, said conveyor containing work piece receiving pockets having their axes in skewed relation to the grinding wheels of said throats and arranged to constrain said pieces with respect to the conveyor; and means for actuating said conveyor to bring one end of a work piece into operative relation with the grinding wheel of one of said throats, and then to bring the other end of the same work piece into operative relation with the grinding wheel of the other throat.

3. A grinding machine for performing successive grinding operations on different portions of work pieces having surfaces of revolution on which the pieces rotate during a grinding operation, comprising a grinding and a regulating wheel arranged to form a first grinding throat; a grinding and a regulating wheel arranged to form a second throat, the second throat being in longitudinal alignment with the first throat and the grinding wheel of one throat in reverse relation to the grinding wheel of the other throat; an endless conveyor movable through said throats successively, said conveyor containing work piece receiving pockets having their axes in inclined relation to the direction of conveyor movement and skewed with respect to the grinding wheels; and means for moving the conveyor through said throats successively to cause movement of the work pieces in a plane common to the planes of the axes of the wheels of the throats and to bring one end of a work piece into contact with the grinding wheel of one of said throats, and then to bring the other end of the same work piece into contact with the grinding wheel of the other of said throats.

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