April 8, 1941. G. T. MUSKOVIN 2,237,496

GRINDING MACHINE

Filed May 23, 1940 2 Sheets-Sheet 1

Fig. 1

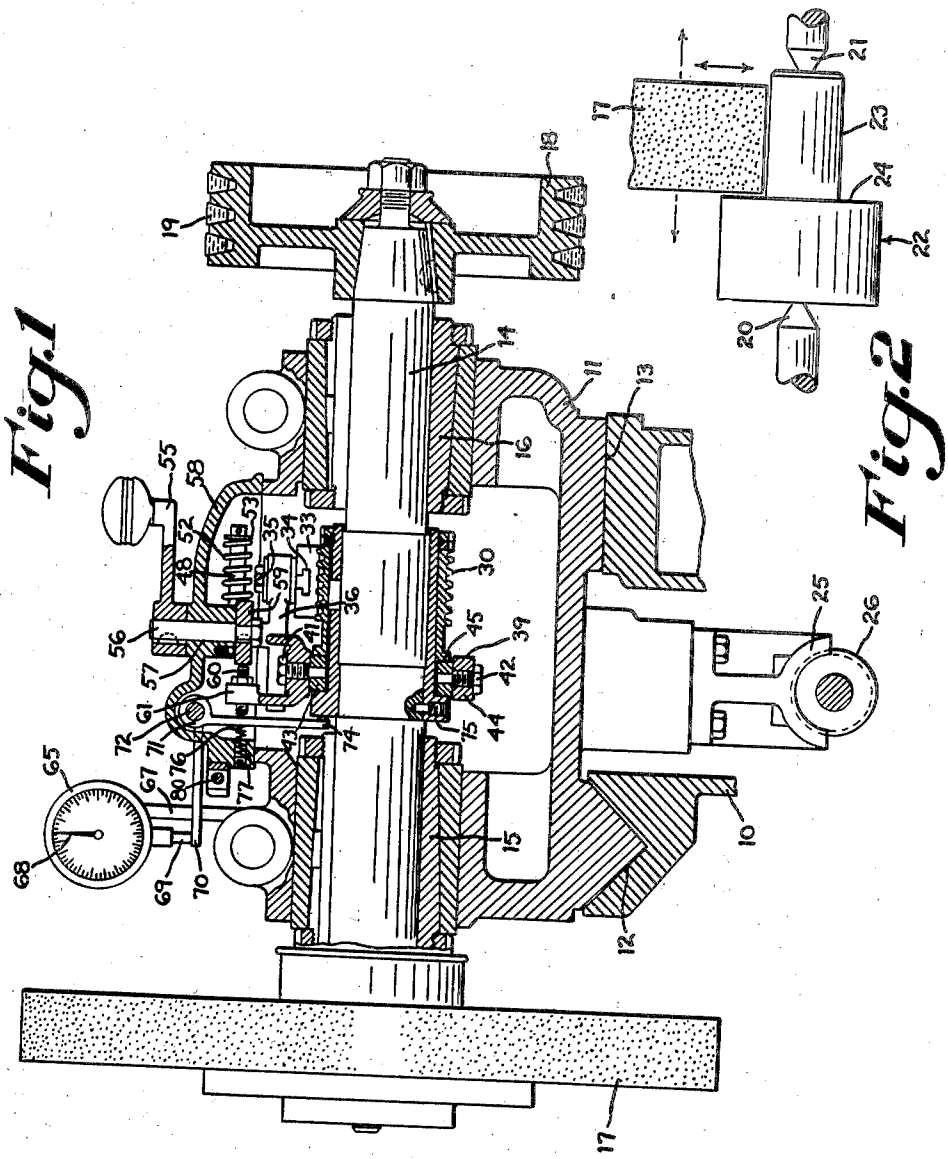


Fig. 2

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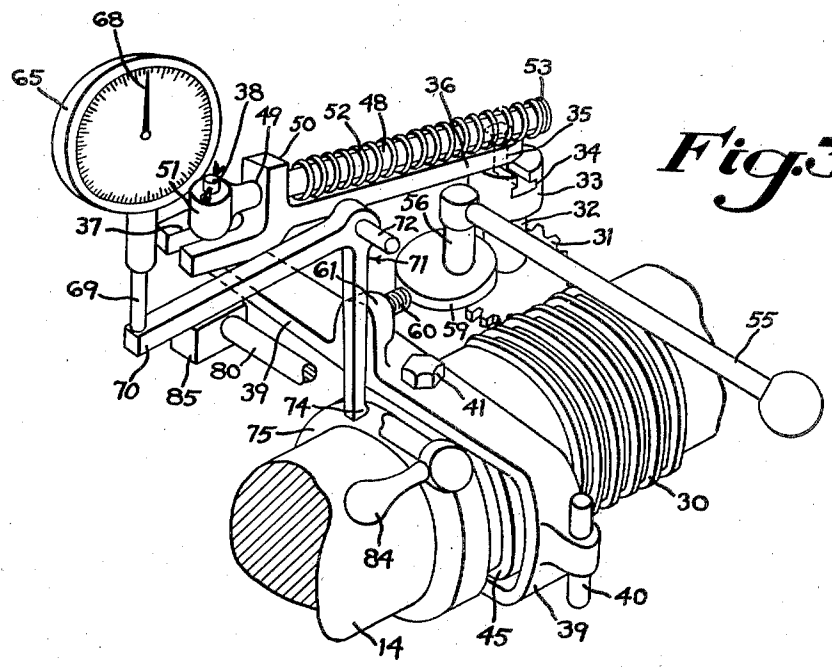


Fig.3

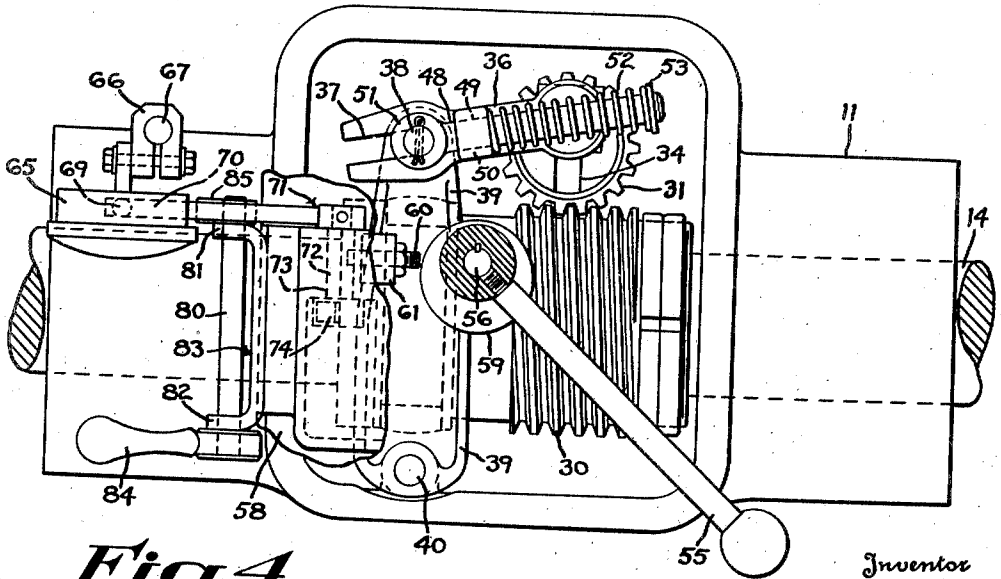


Fig.4

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UNITED STATES PATENT OFFICE

2,237,496

GRINDING MACHINE

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Application May 23, 1940, Serial No. 336,811

2 Claims. (Cl. 51—34)

The invention relates to grinding machines, and more particularly to a mechanism for precisely moving the grinding wheel spindle within its bearings for a shoulder grinding operation.

One object of the invention is to provide a simple and thoroughly practical grinding wheel spindle reciprocating mechanism for reciprocating the grinding wheel spindle axially within its bearings. Another object of the invention is to provide a wheel spindle reciprocating mechanism with a manually operable cam actuated mechanism for stopping the wheel spindle reciprocation.

Another object of the invention is to provide a manually operable mechanism for precisely moving a grinding wheel spindle within its bearings accurately to position the grinding wheel for a shoulder grinding operation. A further object of the invention is to provide a wheel spindle locating and positioning mechanism with a visible indicating medium, such as a dial gauge whereby the wheel may be precisely moved into operative relation with a shoulder on the work piece in such a manner that the shoulder grinding operation may be accurately accomplished by visible indication. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of the mechanical features of this invention,

Fig. 1 is a sectional view through a grinding wheel slide, showing the grinding wheel reciprocating and positioning mechanism;

Fig. 2 is a fragmentary diagrammatic view, showing the arrangement of the grinding wheel relative to a shoulder work piece to be ground;

Fig. 3 is a fragmentary perspective view, on an enlarged scale, of the wheel spindle positioning and reciprocating mechanism together with the visible indicating mechanism; and

Fig. 4 is a fragmentary plan view, on an enlarged scale, of a wheel slide having a portion of the cover broken away to more clearly show the wheel spindle actuating mechanism.

A portion of a grinding machine has been illustrated in the drawings, comprising a base 10 which supports a transversely movable wheel slide 11. The wheel slide 11 is mounted on a transversely extending V-way 12 and a flat way 13 formed on the base 10. The wheel slide 11 serves as a support for a rotatable grinding wheel spindle 14 which is journalled in spaced bearings 15 and 16 which are supported by the wheel slide 11.

The wheel spindle 14 supports a grinding wheel 17 at its left-hand end (Fig. 1). A multi-groove driving pulley 18 is mounted on the right-hand end of the wheel spindle 14 and is arranged to be driven by multiple V-belts 19 from any suitable source of power, such as an electric motor (not shown) mounted on top of the wheel slide 11.

A rotatable work support has been diagrammatically illustrated in Fig. 2, comprising a headstock center 20 and a footstock center 21, which serves as a rotatable support for a work piece 22. A cylindrical portion 23 of the work piece 22 and a shoulder 24 adjacent thereto are to be ground in accordance with the invention set forth herein.

The grinding wheel 17 and its supporting slide 11 may be fed transversely toward the work axis to grind the cylindrical portion 23 of the work piece 22 while the wheel spindle 14 is reciprocated axially within its bearings, after which the wheel spindle is manually moved toward the left (Figs. 1 and 2) to shift the left-hand side face of the wheel 17 into grinding engagement with the shoulder 24 to grind the shoulder to the required and predetermined extent.

The wheel slide 11 may be fed transversely by means of the well known nut and screw feed mechanism comprising a half nut 25 depending from the wheel slide 11 which meshes with or engages a rotatable cross feed screw 26 which is in turn rotatably supported in the base 10. The details of the wheel feeding mechanism have not been illustrated in the present case since this feeding mechanism is old and well known in the art. For details of disclosure of the wheel feeding mechanism, reference may be had to the prior expired patent to C. H. Norton, No. 762,838 dated June 14, 1904, to which reference may be had for details of disclosure not contained herein.

A suitable mechanism is provided for reciprocating the wheel spindle 14 axially within its supporting bearings 15 and 16. This mechanism may comprise a worm 30 which is fixedly mounted on the wheel spindle 14. The worm 30 meshes with a gear 31 which is supported at the lower end of a rotatable shaft 32. The upper end of the shaft 32 is provided with a disc-shaped head 33 having a transversely extending T-slot 34

formed therein. The T-slot 34 serves as a support for an adjustable pitman or crankpin 35. The pin 35 is pivotally connected to one end of a lever 36. The other end of the lever 36 is provided with a yoke-shaped portion 37 which straddles a stud 38. The stud 38 is fixedly mounted adjacent to one end of a pivotally mounted lever 39 which is pivotally supported on a stud 40 on the wheel slide 11. The lever 39 is preferably yoke-shaped and is provided with diametrically opposed studs 41 and 42. The studs 41 and 42 support rollers or shoes 43 and 44 which ride in a groove 45 formed adjacent to one end of the worm 30.

A yieldable connection is provided between the stud 38 carried by the lever 39 and the yoked member 37. A rod 48 is slidably mounted in a bearing surface 49 formed in an upwardly extending boss 50 which is formed integral with the lever 36. The rod 48 is provided with an enlarged head 51 which has an aperture fitting the stud 38. The rod 48 extends toward the right from the boss 50. A compression spring 52 surrounds the rod 48 and is interposed between the boss 50 and a collar 53 which is fixedly mounted on the right-hand end of the rod 48. The compression of the spring 52 is sufficient normally to maintain the stud 38 in engagement with the end surface of a yoke-shaped member 37, so that when the gear 31 is rotated to impart a planetary movement to the pitman 35 the lever 36 will impart an oscillatory movement to the stud 38 and lever 39 to reciprocate the wheel spindle 14 axially within its bearings.

In case it is desired to stop the reciprocation of the grinding wheel 17, the lever 39 may be swung in a counterclockwise direction against the compression of the spring 52 so that the stud 38 moves toward the left within the yoke 37. The pitman 35 continues to revolve and impart an oscillating or reciprocating movement to the lever 37 but due to the fact that the end of the yoke 37 does not contact the stud 38, no oscillating movement will be imparted to the lever 39.

A manually operable device is provided for moving the lever 39 in a clockwise direction to stop the oscillation of the wheel spindle. This mechanism may comprise a manually operable lever 55 which is mounted on the upper end of a shaft 56 which is journalled in a bearing surface 57 (Fig. 1) formed in a cover plate 58 which is in turn fixedly mounted to the upper surface of the wheel slide 11. A cam or eccentric 59 is fixedly mounted on the lower end of the shaft 56. The eccentric 59 is positioned in the path of an adjustable stop screw 60 which is supported in an upwardly extending boss 61 formed integral with the lever 39. The length of the reciprocatory stroke of the spindle 14 may be varied by adjusting the position of the pin 35 on the head 33.

When it is desired to stop the wheel spindle reciprocation, the lever 55 is swung in a clockwise direction and the eccentric or cam 59 engages the stop screw 60 and swings the stop screw 60 together with the lever 39 in a counterclockwise direction so that the stud 38 is moved toward the left (Figs. 3 and 4) out of effective engagement with the end of the yoke 37, thus moving the spindle 14 a slight distance toward the left and holding it stationary. During the time interval when the wheel spindle 14 is held stationary, the worm 30 continuously rotates the gear 31 which in turn continuously imparts a revolving movement to the pitman 35 so that a continuous oscillatory or reciprocatory movement is imparted to the lever 36.

In the grinding of a work piece 22 having a cylindrical portion 23 and a shoulder 24 adjacent thereto to be ground, it is desirable to provide a suitable mechanism whereby the cylindrical portion 23 may be ground to the desired and predetermined size, after which the grinding wheel may be moved into engagement with the shoulder 24 to grind the same to the desired and predetermined extent.

In order to attain one of the main objects of the invention, a visible indicating device is provided whereby the shoulder grinding operation may be accurately and precisely performed. In the preferred construction, a dial indicating mechanism is operatively connected so that when it is desired to grind the shoulder 24 on the work piece 22, the manually operable lever 55 may be utilized to produce an endwise movement of the spindle 14 and grinding wheel 17 toward the left to move the grinding wheel 17 into grinding engagement with the shoulder 24 on the work piece 22. In order that the shoulder 24 may be ground to the desired and predetermined extent, a visible indicating mechanism is provided comprising a dial indicator or gauge 65 which is supported by a clamping block 66 on a vertically extending supporting member 67 which is in turn fixedly supported on the wheel slide 11. The dial gauge 65 may be any of the standard and well known dial indicators having an indicating needle 68 which is operatively connected to be actuated by an actuating plunger 69. The actuating plunger 69 engages an arm 70 of a bell crank lever 71 which is pivotally supported on a shaft 72 which is journalled in a bearing surface 73 formed within the cover plate 58 which is fixedly attached to the wheel slide 11. The bell crank lever 71 has a downwardly extending arm 74 which is arranged to engage an end face 75 of the worm assembly which is fixedly mounted relative to the wheel spindle 14 and which rotates and moves axially therewith during a grinding operation. A compression spring 76 is supported in an aperture 77 formed in the cover plate 58 (Fig. 1). The compression spring 76 bears against the downwardly extending arm 74 of the bell crank lever 71 and tends to rock the bell crank lever 71 in a counterclockwise direction so that the downwardly extending arm 74 is maintained in operative engagement with the surface 75.

It will be readily apparent from the foregoing construction that the manually operable control lever 55 is shifted in a clockwise direction (Figs. 3 and 4) to rotate the eccentric 59 in a clockwise direction, thus transmitting to the stop screw 60 a counterclockwise movement to the arm 39 to cause an endwise axial movement of the spindle 14 toward the left. Movement of the spindle 14 toward the left causes the surface 75 of the worm assembly which is in engagement with the arm 74 to rock the bell crank lever 71 in a clockwise direction (Figs. 1 and 3), which movement, through its integral arm 70, transmits a vertical movement to the plunger 69 of the dial indicator 65 so as to move the dial indicator needle 68, thus producing a visible indication of the extent of movement of the spindle 14 and also the grinding wheel 17. By utilizing this dial indicating mechanism above described, the grinding wheel 17 may be brought into grinding engagement with the shoulder 24 of the work piece 22 and a predetermined amount of material ground from the

shoulder so that not only the cylindrical portion 23 but also the shoulder 24 may be accurately ground to the desired and predetermined extent.

It is desirable to provide a mechanism for rendering the dial indicating means inoperative except when a shoulder grinding operation is to be performed. A manually operable mechanism is provided comprising a rock shaft 80 which is journalled in suitable bearings 81 and 82 formed in a bracket 83 which is in turn fixedly mounted to the cover plate 58. A manually operable handle 84 is mounted on the forward end of the rock shaft 80. A cam block 85 is mounted on the rear end of the shaft 80 and is arranged in the path of the arm 70 of the bell crank lever 71. In case it is desired to render the dial indicating means inoperative, the lever 84 is swung in a clockwise direction (Fig. 3) to rock the shaft 80 and the cam block 85 also in a clockwise direction, which movement rocks the lever 70 and bell crank lever 71 also in a clockwise direction to separate the lower end of the arm 74 from the surface 75, thus rendering the dial indicating means inoperative as the spindle moves endwise. By utilizing this latter mechanism, the visible indicating mechanism may be utilized only on the shoulder grinding operation, thus minimizing the wear on the engaging surfaces between the arm 74 and the surface 75.

The operation of this mechanism will be readily apparent from the foregoing disclosure. Assuming all of the adjustments to have been previously made, a work piece 22 is placed in position on the work supporting centers 20 and 21. The work is started rotating and the grinding wheel 17 is rotated and is fed transversely toward the portion 23 to be ground. The lever 55 is preferably moved in a counterclockwise direction so that the eccentric 59 is out of engagement with the stop screw 60 so that the rotary motion of the wheel spindle 14 is transmitted through the worm 30, the gear 31, and the pitman 35, to reciprocate the lever 36 and the lever 39 to impart an axial reciprocatory movement to the wheel spindle 14 during the grinding of the cylindrical portion 23 on the work piece 22. After the portion 23 has been ground to the desired and predetermined extent, the control lever 84 is rocked in a counterclockwise direction to render the dial indicating mechanism operative and the control lever 55 is also rocked in a clockwise direction so that the eccentric 59 engages the stop screw 60 to rock the lever 39 in a counterclockwise direction, thus imparting an endwise movement of the spindle 14 toward the left (Figs. 1, 3 and 4) to move the grinding wheel spindle 14 toward the left and also to move the grinding wheel 17 into operative grinding engagement with the shoulder 24 on the work piece 22. By visibly observing the movement of the dial indicator during the shifting movement of the control lever 55, the shoulder 24 may be ground to the desired and predetermined extent. The dial indicator 65 may be set so that when the dial indicator needle reaches zero, the shoulder has been ground to the desired and predetermined extent. If desired, however, a predetermined amount of stock may be removed from the shoulder by observing the indication of the needle 68 when the wheel 17 first engages the surface 24, and then continuing the endwise movement of the spindle until a predetermined amount of stock has been removed, as indicated on the dial indicator 65.

It will thus be seen that there has been provided by this invention apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a grinding machine having a transversely movable slide, a rotatable grinding wheel, a wheel spindle to support said wheel, bearings in said slide for said spindle, manually operable means to move said spindle axially within its bearings in one direction, a pivotally mounted bell crank lever, one arm of said lever engaging a shoulder on said spindle, and a dial gauge actuated by the other arm of said lever visibly to indicate the position of said spindle and grinding wheel.

2. In a grinding machine having a transversely movable slide, a rotatable grinding wheel, a wheel spindle to support said wheel, bearings in said slide for said spindle, manually operable means to move said spindle axially within its bearings in one direction, a pivotally mounted bell crank lever on said slide, one arm of said lever engaging said spindle, a dial gauge actuated by the other arm of said bell crank lever visibly to indicate the position of said spindle and grinding wheel, and a manually operable device to rock said bell crank lever so that its arm is out of engagement with said spindle to render said dial gauge inoperative.

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