Feb. 29, 1944. J. I. GARSIDE 2,342,854

GRINDING MACHINE-SHOULDER GRINDING APPARATUS

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FIG. 1

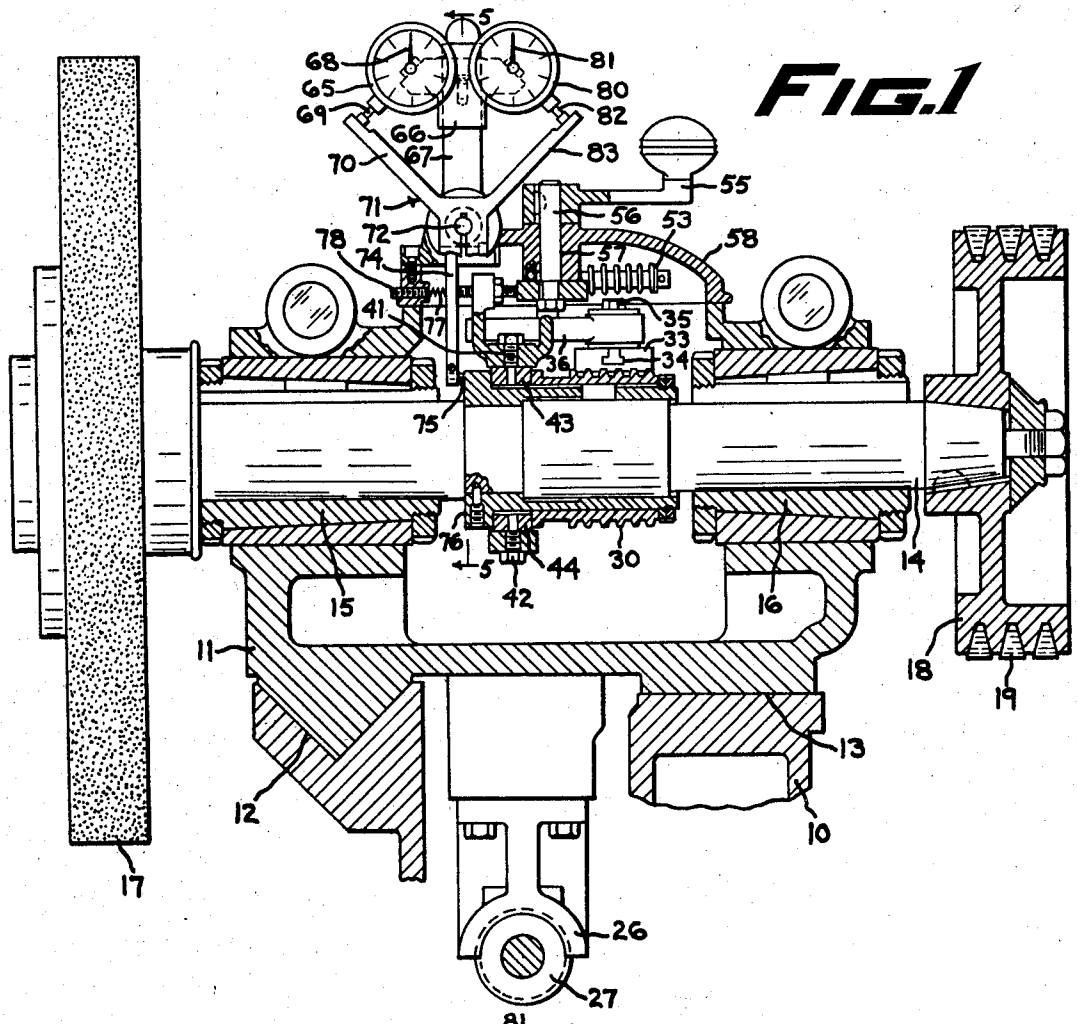
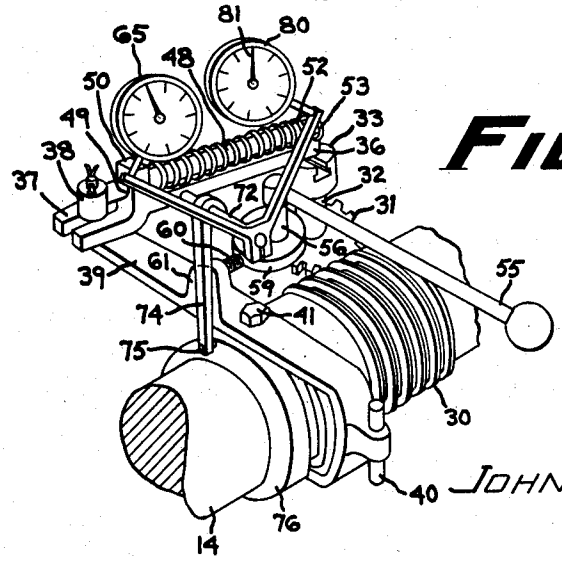


FIG. 3



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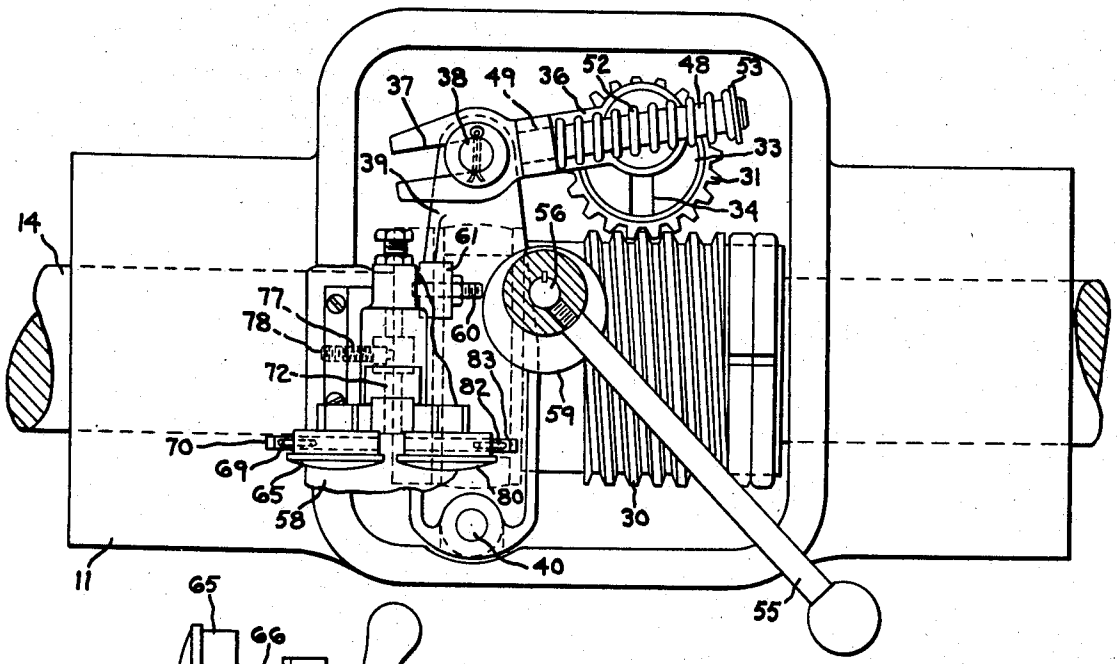
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GRINDING MACHINE-SHOULDER GRINDING APPARATUS

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FIG. 4



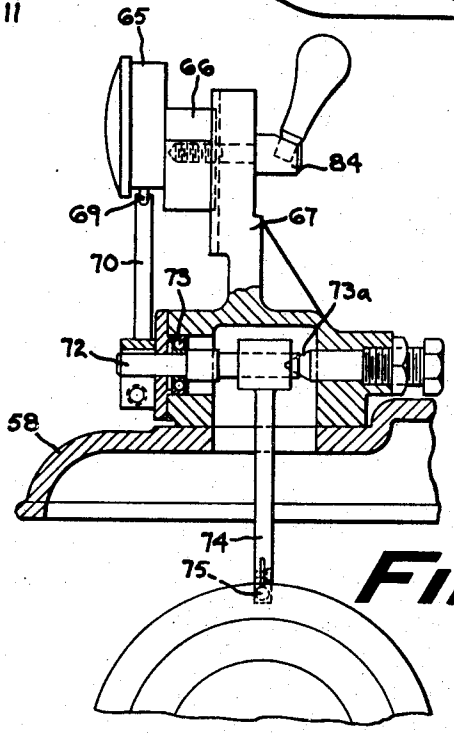


FIG. 5

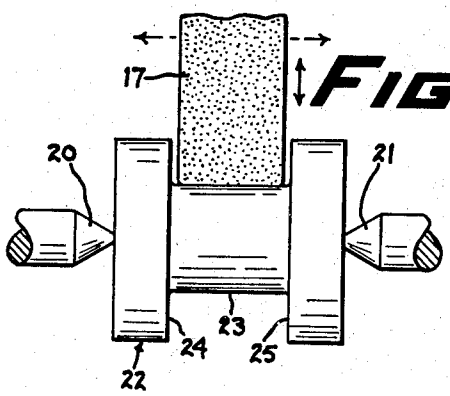


FIG. 2

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2,342,854

GRINDING MACHINE-SHOULDER GRINDING APPARATUS

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Application May 13, 1942, Serial No. 442,745

3 Claims. (Cl. 51—34)

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

Another object of the invention is to provide a manually operable wheel spindle positioning mechanism accurately to position the grinding wheel for grinding a cylindrical work piece between two spaced shoulders. A further object of the invention is to provide a wheel spindle locating and positioning mechanism for grinding a work piece between two spaced shoulders with a visible indicating mechanism, such as a dial gauge mechanism whereby the grinding wheel may be precisely located accurately to grind a cylindrical work piece between spaced shoulders thereon. 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 longitudinal vertical 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 work piece having spaced shoulders 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;

Fig. 4 is a fragmentary plan view, on an enlarged scale, of a wheel slide having a portion of the cover plate broken away to more fully illustrate the wheel spindle reciprocating and locating mechanism; and

Fig. 5 is a fragmentary sectional view, on an enlarged scale, taken approximately on the line 5—5 of Fig. 1, showing the mounting of the visible indicating mechanism.

A portion of a grinding machine has been illustrated in the drawings, comprising a base 10 which supports a transversely movable grinding wheel slide 11 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 adjustable bearings 15 and 16 supported by the wheel slide 11.

The grinding wheel spindle 14 serves as a support for a rotatable grinding wheel 17 which is mounted on the left-hand end thereof (Fig. 1). A multiple V-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 illustrated diagrammatically in Fig. 2, comprising a headstock center 20 and a footstock center 21 which serve as a rotatable support for a work piece 22. A cylindrical portion 23 of the work piece 22 has two spaced shoulders 24 and 25 to be ground.

The grinding wheel 17 and its supporting slide 11 may be fed transversely toward the work axis to grind the cylindrical portion 23 on the work piece 22 while the wheel spindle 14 is rotated and is either held against axial movement or is reciprocated axially within its bearings, after which the wheel spindle 14 may be manually moved toward the right (Figs. 1 and 2) to shift the right-hand side face of the grinding wheel 17 into grinding engagement with the shoulder 25, after which the left-hand face of the grinding wheel 17 may be shifted toward the left into engagement with the shoulder 24 to grind both of the spaced shoulders precisely to the desired and predetermined extent.

Th wheel slide 11 may be fed transversely by means of the well known nut and screw feeding mechanism, comprising a half nut 26 depending from the wheel slide 11 which meshes with or engages a rotatable cross feed screw 27 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 and is not considered to be a part of the present invention. For details of disclosure of the grinding wheel feeding mechanism, reference may be had to the expired U. S. 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 wheel spindle reciprocating 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 worm gear 31 which is supported at the lower end of a rotatable shaft 32 (Fig. 3). The upper end of the shaft 32 is provided with a disk-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 (Fig. 1). The studs 41 and 42 support rollers or shoes 43 and 44, respectively, which ride in a groove 45 formed adjacent to one end of the worm 30.

A yieldable connecting rod 48 is provided between the stud 38 carried by the lever 39 and the yoke-shaped portion 37 of the lever 36. The rod 48 is slidably mounted in a bearing 49 formed in an upwardly extending 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 the yoke-shaped member 37, so that when the worm 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 the lever 39 to reciprocate the wheel spindle 14 axially within its bearings 15 and 16.

In case it is desired to stop the reciprocatory movement of the grinding wheel 17, the lever 39 may be swung in a counterclockwise direction (Figs. 3 and 4) 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 to 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 counterclockwise direction to stop the reciprocation of the wheel spindle 14. This mechanism may comprise a manually operable lever 55 which is mounted on the upper end of a vertically mounted rock shaft 56 which is in turn journalled in a bearing 57 (Fig. 1) formed in a cover plate 58 which is in turn fixedly mounted on the upper surface of the wheel slide 11. A cam or eccentric 59 is fixedly mounted on the lower end of the shaft 56 and is positioned in the path of an adjustable stop screw 60. The stop screw 60 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 pitman 35 on the head 33.

When it is desired to stop the wheel spindle reciprocation, the lever 55 may be swung in a clockwise direction (Figs. 3 and 4) so that 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 spindle 14 is held stationary, the worm 30 continuously rotates the worm gear 31 which in turn continuously imparts a revolving motion to the pitman 35 but no oscillatory or reciprocatory movement is imparted to the spindle 14.

In the grinding of a work piece 22 having a cylindrical portion 23 and a pair of spaced shoulders 24 and 25 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 17 may be moved toward the left (Fig. 2) into engagement with the shoulder 24 to grind the same to the desired and predetermined extent. The grinding wheel 17 may then be moved toward the right into engagement with the shoulder 25 to grind it 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 visible 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 the grinding wheel 17 toward the left to move the grinding wheel 17 into 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 gauge 65 which is fixedly supported on a vertically adjustable slide block 66 which is in turn adjustably supported on a bracket 67 formed integral with or fixedly mounted on the cover 58. 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 fixedly supported on the forward end of a rock shaft 72. The rock shaft 72 is journalled in suitable bearings 73 and 73a supported by the cover plate 58.

A downwardly extending arm 74 is fixedly mounted on the rock shaft 72. The lower end of the arm 74 is provided with a contact point or stud 75 which bears against an end face 76 (Figs. 1 and 3) which is in turn fixedly mounted relative to the worm 30 and the spindle 14. A compression spring 77 is interposed between the lever 74 and an adjustable screw 78 which is supported by the cover plate 58. By adjustment of the screw 78, the compression of the spring 77 may be varied as desired so as to maintain the contact point 75 in engagement with the shoulder 76 with the desired pressure. The arm 74 will be rocked as the spindle 14 is moved endwise within its bearings to transmit motion through the rock shaft 72 and the arm 70 to the actuating plunger 69 so that the position of the grinding wheel 17 when moved in an axial direction toward the shoulder 24 may be precisely determined so as to facilitate grinding the shoulder 24 to the desired and predetermined extent.

In order to facilitate the grinding of the shoulder 25 to the desired and predetermined extent, a second dial indicator 80 is mounted on the vertically adjustable block 66. The dial indicator 80 is provided with a needle 81 and an

actuating plunger 82. The actuating plunger 82 is arranged in the path of an arm 83 which is formed as an integral arm of the bell crank lever 71. It will be readily apparent from the foregoing disclosure that when the spindle 14 is moved toward the right to shift the grinding wheel 17 into engagement with the shoulder 25, the compression of the spring 77 will move the lever 74 so as to maintain the contact point 75 in engagement with the surface 76 to rock the shaft 72 and the bell crank lever 71 in a counterclockwise direction so that the arm 83 will move the plunger 82 upwardly to register the position of the wheel on the dial gauge 80 so as to facilitate grinding the shoulder 25 to the desired and predetermined extent. It will be readily apparent from the foregoing disclosure that by moving the lever 55 in either a clockwise or counterclockwise direction, the wheel spindle 14 may be moved either toward the right or toward the left to shift the position of the grinding wheel 17 either into engagement with the shoulder 25 or the shoulder 24 to grind these shoulders to the desired and predetermined extent. The block 66 which supports the dial gauges 65 and 80 is slidably mounted on the bracket 67 in a vertical direction and may be clamped in adjusted position by means of a clamping screw 84 (Fig. 5).

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 of the work piece 22 to be ground. The grinding wheel 17 is fed inwardly by actuation of the feed screw 27 until the cylindrical portion 23 is ground to the desired and predetermined diameter, after which the lever 55 is rocked in a clockwise direction (Figs. 3 and 4) to move the grinding wheel 17 axially into operative engagement with the shoulder 24.

During this shoulder grinding operation, the operator visibly observes the dial gauge 65 to determine when the shoulder 24 has been ground to the desired and predetermined extent. After the shoulder 24 has been ground to the desired and predetermined extent, the lever 55 is rocked in a counterclockwise direction (Figs. 3 and 4) to shift the grinding wheel 17 axially into operative engagement with the shoulder 25 to grind the shoulder to the desired and predetermined extent. During this grinding operation, the operator may visibly control the grinding operation by observing the dial gauge 80. After the shoulder 25 has been ground to the desired extent, the lever 55 may be shifted slightly in a clockwise direction to shift the wheel 17 away from the shoulder 25, after which the grinding wheel 17 may be moved rearwardly to an inoperative position. The work piece 22 may then be removed from the work supporting centers 20 and 21 and replaced by a new piece to be ground.

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 on said slide to support said wheel, manually operable means to move said spindle axially within its bearings, a pair of independent spaced dial gauges, means including a pivotally mounted V-shaped lever each arm of which engages one of said plungers, and operative connections between said lever and said spindle to rock said lever when the spindle is moved in an axial direction, a zero reading on said dial gauges serving independently to precisely indicate predetermined positions of the grinding wheel when it is moved first in one direction and then in the opposite direction to grind a pair of spaced shoulders on a work piece.

2. In a grinding machine having a transversely movable slide, a rotatable grinding wheel, a wheel spindle supported on said slide to support said grinding wheel, manually operable means to move said grinding wheel and spindle axially, a pair of independent spaced dial gauges each having an independent actuating plunger, an adjustable slide to support said gauges, a V-shaped lever each arm of which engages one of said plungers, a rock shaft to support said lever, a downwardly extending arm fixedly mounted on said shaft, means to maintain the lower end of said arm in operative engagement with a portion of said wheel spindle, and means simultaneously to adjust both of said dial gauges relative to said lever and shaft, said gauges being so arranged that a zero reading on one of said gauges indicates precisely the position of said wheel when moved to a predetermined position in one direction and a zero reading on the other gauge indicates precisely the position of the wheel when moved to a predetermined position in the other direction.

3. 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, a manually operable means to move said spindle axially within its bearings to position said grinding wheel for a shoulder grinding operation, and a visible indicating mechanism for precisely locating the wheel for grinding a pair of spaced shoulders on a work piece including a pair of independent spaced dial gauges each having an independent actuating plunger, a vertically adjustable slide to support said gauges, a bell crank lever each arm of which engages one of said plungers, a rock shaft on said slide to support said lever, a downwardly extending arm fixedly mounted on said shaft, and means to maintain the lower end of said arm in engagement with a shoulder on the wheel spindle, said gauges being so arranged that a zero reading on one of said gauges serving to facilitate precise positioning of the grinding wheel when moved in one direction to grind a shoulder on the work piece and a zero reading on the other gauge serving precisely to locate the wheel when moved in the opposite direction for grinding a second spaced shoulder on the work piece.

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