Oct. 10, 1961 A. D. C. STUCKEY 3,003,291

MECHANISM FOR SHOULDER GRINDING

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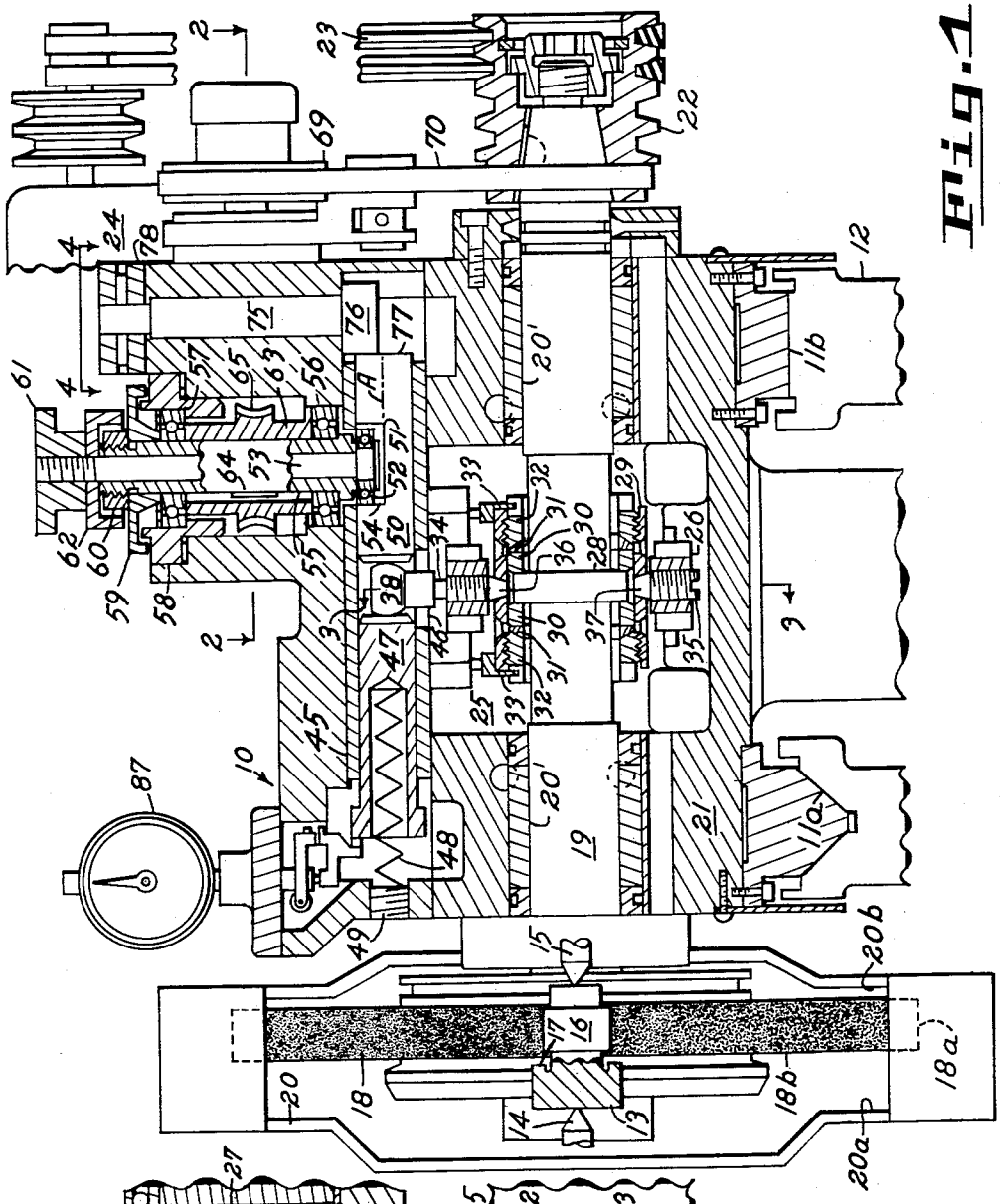

Fig. 1

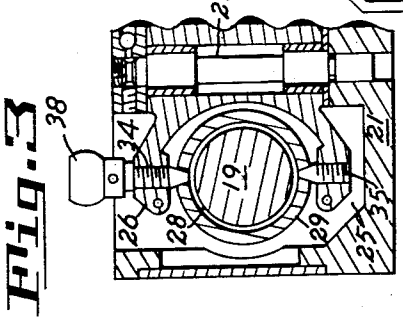

Fig. 3

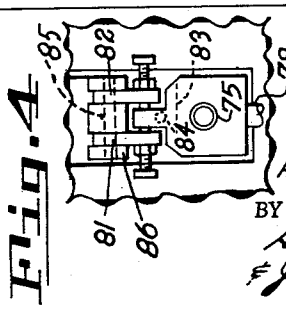

Fig. 4

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Fig. 2

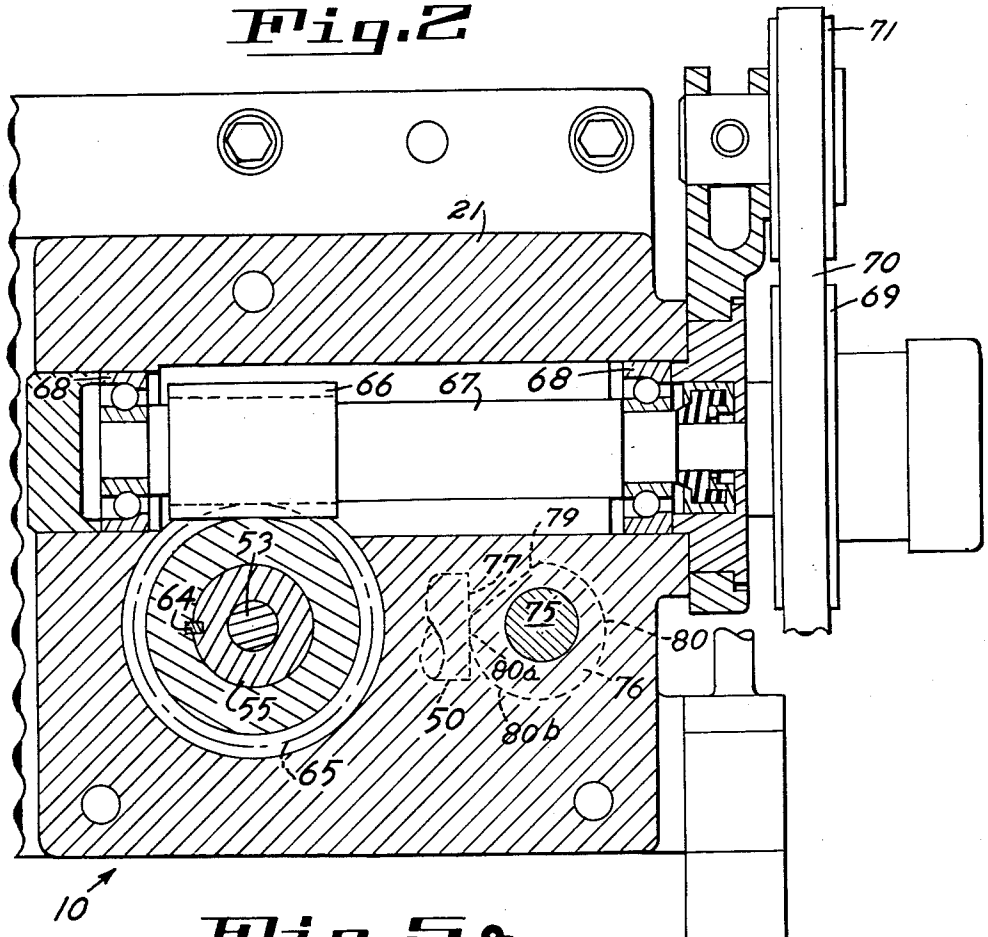


Fig. 5a

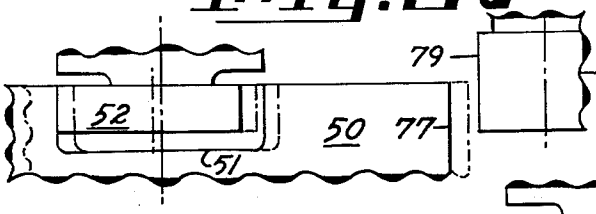


Fig. 5b

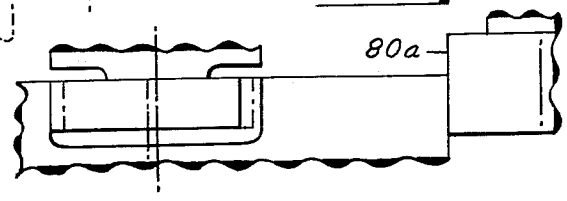
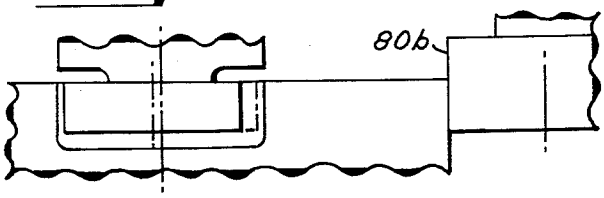


Fig. 5c



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MECHANISM FOR SHOULDER GRINDING

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Mar. 23, 1959, Ser. No. 801,243
1 Claim. (Cl. 51—34)

The present invention relates to an improved mechanism for a center-type grinding machine particularly suitable for successive reciprocating plunge cut grinding and shoulder grinding.

In plunge cut grinding on a center-type grinding machine, where a surface parallel to the axis of the wheel and no longer than the width of the wheel is ground by the peripheral surface of the wheel as the wheel is fed into the work, it is often desirable to reciprocate the wheel relative to the workpiece during grinding, in short longitudinal strokes parallel to the axis of the wheel, to produce a smoother surface on the workpiece. In many applications it may be desired, after said surface has been ground, to grind a shoulder surface on the workpiece with the side of the grinding wheel, which shoulder surface on the workpiece may, for example, be normal to the axis of the wheel.

Heretofore, in operations of this kind where a relative reciprocation between two members such as a grinding wheel and a workpiece is followed by a relative feeding movement between said members in a direction parallel to the reciprocating motion and beyond one of the limits of the reciprocation, it has been usual to effect reciprocation by movement of one of said members, such as the grinding wheel and to effect the subsequent feeding by movement of the other member, the workpiece. This has required actuation of two controls, one to stop the reciprocation of said one member and the other to effect feeding movement of the other member.

In the present invention a mechanism is provided which permits a quicker and more easily effected operation of this kind than has been heretofore possible. With the mechanism of the present invention the same member which has been reciprocated, for example, the grinding wheel, is also fed into the shoulder surface of the workpiece. With one movement of one control the longitudinal reciprocation of the grinding wheel is terminated and the grinding wheel is fed longitudinally into the shoulder surface beyond the limit of reciprocation.

In brief, in the preferred embodiment of the present invention, the grinding wheel spindle is operatively connected to a follower which is normally reciprocated by an oscillating driver. The driver comprises a roller eccentrically mounted on a drive shaft, the driver engaging one surface of the follower. The surface of the follower engaged by the driver is normally held in contact therewith by a spring and as long as such engagement is maintained, the grinding wheel is reciprocated between normal limits. A manually operable cam is positioned in registration with the follower and, when actuated, urges the follower, against the action of the spring, out of contact with the driver to terminate reciprocation of the grinding wheel. Further actuation of the cam urges the follower beyond the limits of normal reciprocation by the driver and thereby moves the grinding wheel in one direction beyond its normal limit of reciprocation. In this manner the side cutting surface of the grinding wheel is gradually fed into the shoulder surface of the workpiece for grinding thereof.

It is therefore an object of the present invention to provide an improved mechanism for successive reciprocating grinding and shoulder grinding.

It is another object of the present invention to provide a mechanism to terminate relative reciprocation of a grinding wheel relative to a workpiece and operable to effect movement of the grinding wheel in one direction beyond the limit of said reciprocation.

It is another object of the present invention to provide a mechanism operable with a single actuation to terminate automatic reciprocation of the grinding wheel on one surface of a workpiece and feed the grinding wheel into another surface thereof.

It is another object of the present invention to provide a simply constructed, effective, easily operated mechanism for both reciprocating plunge cut grinding and shoulder grinding.

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 claim, without departing from or exceeding the spirit of the invention.

In the drawings:

FIG. 1 is a view of the wheelhead, partly in cross-section;

FIG. 2 is a view taken on the line 2—2 of FIG. 1;

FIG. 3 is a view taken on the line 3—3 of FIG. 1;

FIG. 4 is a view taken on the line 4—4 of FIG. 1; and

FIGS. 5*a*, 5*b*, and 5*c* are somewhat schematic views of the relative positions of the driver, follower, and manually actuated cam: when the follower is reciprocated between normal limits by the driver; when the follower is held at one of its normal limit positions by the cam to terminate reciprocation of the wheel; and when the follower is moved beyond said normal limit position by the cam to move the grinding wheel beyond its normal limits of reciprocation, respectively.

There is shown in FIGS. 1 and 2, the wheelhead **10** of a center type grinding machine which is mounted on the ways **11***a* and **11***b* of the bed **12** of the machine for movement towards and away from a workpiece **13** by mechanism which may be similar to that shown in U.S. Patent 2,641,876 of J. Decker and B. A. Kearns dated June 16, 1953, or any conventional mechanism. The workpiece **13** is mounted between centers **14** and **15** defining a workpiece supporting means which may, for example, be similar to the headstock and tailstock structures, respectively, shown in U.S. Patent 2,641,876 and mounted similarly thereto. The grinding wheel **18** has a peripheral cutting surface **18***a* and a side cutting surface **18***b*. The workpiece **13** shown in the present disclosure has cylindrical surface **16** which is ground by surface **18***a* of the wheel and a shoulder surface **17** which is ground by surface **18***b* of said wheel. While the headstock and the tailstock may be movably mounted to reciprocate a workpiece longitudinally relative to the grinding wheel **18** (to the right and left as viewed in FIG. 1) the present invention is particularly suited for plunge cut grinding where the workpiece is rotated in a fixed position and the wheel **18** is fed into the workpiece (toward the viewer of FIG. 1) and reciprocated longitudinally relative to the rotating stationary workpiece. With the mechanism of the present invention the longitudinal reciprocation of the grinding wheel can be terminated and the side cutting surface **18***b* thereof fed manually into the shoulder **17** for grinding.

The grinding wheel **18** is mounted on a spindle **19** in a conventional manner for rotation inside casing **20** connected to the wheelhead. The spacing inside the casing is sufficient to allow a limited longitudinal reciprocation of the wheel therein between the sides **20***a* and **20***b* thereof. The spindle is mounted in bearings **20'** in the wheelhead body **21** and extends through the body. A pulley **22** is mounted on the spindle outside the body oppo-

site the grinding wheel for connection through drive belt **23** to a motor **24** mounted on the wheelhead. The spindle **19** passes through a recess **25** in the body and is positioned between the arms of a yoke **26** therein (see FIG. 3. The yoke is pivotally connected to the body **21** by pin **27**.

The spindle **19** has a collar **28** integral therewith. A sleeve **29** encircles the spindle within the recess **25** and receives therein two rings **30** which straddle the collar. Each ring **30** is held against the collar by a second ring **31** which, in turn, is held in position by an externally threaded nut **32** in threaded engagement with the interior wall of the sleeve, the nut being held against rotation by a lug **33** screwed into the sleeve. The nuts **32** are secured tightly enough to minimize play between collar **28** and sleeve **29** but not so tight that rotation of the spindle **19**, and collar **28** thereof, is prevented relative to the sleeve. Clearance is provided between the spindle **19**, and the nuts **32** and rings **30**, **31**.

The sleeve **29** is pivotally secured between the arms of the yoke **26** by pins **34** and **35** threadedly engaged with the arms of the yoke, the pins having shanks **36** and **37**, respectively, received in the sleeve. The pin **34** also has a head **38**. As the head **38** is moved a short distance parallel to the spindle **19** the yoke **26** swings through a small arc and the spindle is moved axially through the rotating connection formed between the collar **28** and sleeve **29**. The sleeve is free to pivot on pins **34** and **35** and tends to remain aligned with the spindle **19**, the clearance between the spindle and the parts received within the sleeve preventing contact between the rotating spindle and those parts as the sleeve is swung by the yoke. Thus longitudinal reciprocation of the head **38** (left and right as viewed in FIG. 1) will reciprocate the spindle and hence the grinding wheel longitudinally relative to the workpiece.

The wheelhead body **21** has a sleeve **45** extending therethrough parallel to the spindle **19**, the sleeve having an opening **46** in communication with the recess **25** through which the head **38** of pin **34** extends. On one side the head **38** is engaged by a pin **47** urged thereagainst by a spring **48** under compression, one end of which is received in the pin **47** and the opposite end of which is engaged with adjustable plug **49** in the body **21**. On the opposite side the head **38** is engaged by an axially movable round shaft **50** having a flat forming a slot **51** therein. A roller **52**, eccentrically mounted on drive shaft **53**, is received in the slot **51** in registration with the wall surfaces thereof, including the surface **54** which is normal to the longitudinal axis A of the shaft and towards the head **38**. The longitudinal span of the slot is greater than the limits of travel of the periphery of the eccentrically mounted roller **52** so that the follower may be moved beyond the reach of the roller even though the roller remains in the slot. In the absence of other forces on the shaft **50** the surface **54** will be yieldingly urged against the eccentric roller **52** by the spring urged pin **47** acting through the movable head **38**. The roller **52**, when drive shaft **53** is rotated, will define an oscillating driver, and the shaft **50** will constitute a follower to which reciprocating motion is imparted by the driver. The reciprocating motion will be transmitted to the head **38** of pin **34** since it is urged into contact with the follower by the spring urged pin **47** and hence this motion will be transmitted to the grinding wheel **18**.

The drive shaft **53** is snugly received in a sleeve **55** which is rotatably mounted in bearings **56** and **57**, bearing **56** being mounted in body **21** and bearing **57** being mounted in an insert **58** secured in the body **21** by screws (not shown). A ring **59** keyed to sleeve **55** is received over bearing **57**, and nut **60** is threadedly engaged with sleeve **55** over ring **59**. A knob **61** and skirt **62** are received on the shaft **53** over nut **60**. A second sleeve **63** is received over sleeve **55** between the bearings **56** and **57** and is keyed to sleeve **55** at **64** so that rotation of sleeve **63** will rotate shaft **53**. The sleeve **63** has a worm gear **65** integral therewith which is engaged with worm **66** on shaft **67** (see FIG. 2). This latter shaft is supported in body **21** by bearings **68** and extends outside that body where it receives a pulley **69** which is connected by belt **70** to pulley **22** for driving by motor **24**. An adjustable idler pulley **71** is provided for adjustment by knob **71***a* of the tension in the belt **70**. It will therefore be evident that the shaft **53** will be continuously driven and roller **52** will define an oscillating driver capable of reciprocating follower **50** between predetermined positions established by the eccentricity of the roller **52** when the surface **54** is urged against the driver. Thus the grinding wheel, when surface **54** is urged against roller **52**, will be reciprocated between predetermined limits.

There is provided a simple manual control effective to terminate reciprocation of the grinding wheel and move the grinding wheel beyond one of its predetermined limits to grind the shoulders **17**. A shaft **75** rotatably mounted in body **21** has connected at one end a cam **76** positioned adjacent the end **77** of follower **50** opposite the end which engages head **38** of pin **34**. Shaft **75** has a lever **78** connected thereto outside the housing to actuate the cam (see FIG. 4). The lever **78** is held in the center, or intermediate, position shown in FIG. 4 when the arms **81** and **82** are both lowered as shown, the arms being pivotally mounted by pin **85** between upstanding ears **86** connected to body **21**, for swinging in a vertical plane. When the arms are raised the lever is rotatable in either direction to predetermined limits defined by contact of the shoulder **83** of the lever with the pin **84** carried in body **21**.

As shown best in FIG. 2, the cam **76** has a flat surface **79** and a curved surface **80** of varying radius. When the lever, as viewed in FIG. 4, is in the extreme counterclockwise position, the flat surface **79** of the cam, which constitutes the low portion thereof, is in registration with, and spaced from, the end **77** of the follower, permitting reciprocation of the follower between normal predetermined positions, as shown in FIG. 5*a*, in response to the rotation of the driver **52**. When the lever **78** is rotated clockwise to the intermediate position as shown in FIG. 4, the point **80***a* of surface **80**, which constitutes an intermediate portion thereof, is swung into contact with the end **77** of the follower **50** and the follower is urged to the left, as viewed in FIG. 1, against the spring **48**, to the predetermined position where the follower is held at the limit of travel of the eccentric roller **52**, as shown in FIG. 5*b*, so that reciprocation of the follower by the eccentric roller is terminated. As the lever **78** is swung towards its extreme clockwise position, as viewed in FIG. 4, the point **80***b* which constitutes the high portion of the cam surface is swung into contact with end **77** of the follower, urging the follower beyond the predetermined position to which it is driven by the driver, as shown in FIG. 5*c*, and thereby feeding the grinding wheel beyond its limit of reciprocation and into the shoulder surface **17**.

In operation a workpiece **13** is placed between centers **14** and **15** and infeed of the grinding wheel **18** toward the workpiece is begun. The lever **78** is placed in its extreme counterclockwise position and the grinding wheel is automatically reciprocated as it is fed into surface **16** of the workpiece. When the grinding of surface **16** is completed, the lever **78** is swung through the intermediate position, at which time reciprocation of the grinding wheel stops, toward the extreme clockwise position. This feeds the grinding wheel **18** longitudinally relative to the workpiece to bring the side cutting surface **18***b* into grinding contact with shoulder surface **17**. The centers **14** and **15** may be located so that surface **17** is ground to size when the lever **78** reaches its clockwise limit, or, if the centers are not so set, longitudinal feeding may be terminated when gage **87** operatively connected to plunger **47**, and hence to the grinding wheel **18**, indicates the shoulder is ground to desired size.

For operations involving no shoulder grinding where selective reciprocation is desired, arm **82** may be lowered and lever **78** actuated between its intermediate position and its extreme counterclockwise position, as viewed in FIG. 4. For operations where reciprocation is not required and selective shoulder grinding is desired, arm **81** may be lowered and lever **78** actuated between the intermediate position and the extreme clockwise position as viewed in FIG. 4. If neither reciprocation nor shoulder grinding is required, both arms **81** and **82** may be lowered and lever **78** locked in the intermediate position as shown in FIG. 4.

What is claimed is:

In a grinding machine having a grinding wheel and a follower operatively connected to the grinding wheel, said follower normally urged in one direction against an oscillating driver for reciprocation between normal limits, the combination of a cam adjacent the follower having a manually operated lever connected thereto, said cam spaced from the follower when the lever is in one extreme position, said cam engaging the follower to move the follower oppositely to said one direction to disengage the follower from the oscillating driver when the lever is moved to an intermediate position, said cam moving the follower further in said opposite direction to feed the grinding wheel beyond one of said normal limits as the lever is moved to an opposite extreme position, a stop member selectively swingable into the path of the lever to engage the lever at the intermediate position and prevent movement of the lever in one direction from said intermediate position, and a second stop member selectively swingable into the path of the lever to engage the lever at the intermediate position and prevent movement of the lever in the other direction from said intermediate position.

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