April 21, 1959 R. E. PRICE 2,882,651

POSITIONING ABRASIVE DISCS FOR DRESSING

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Fig 1

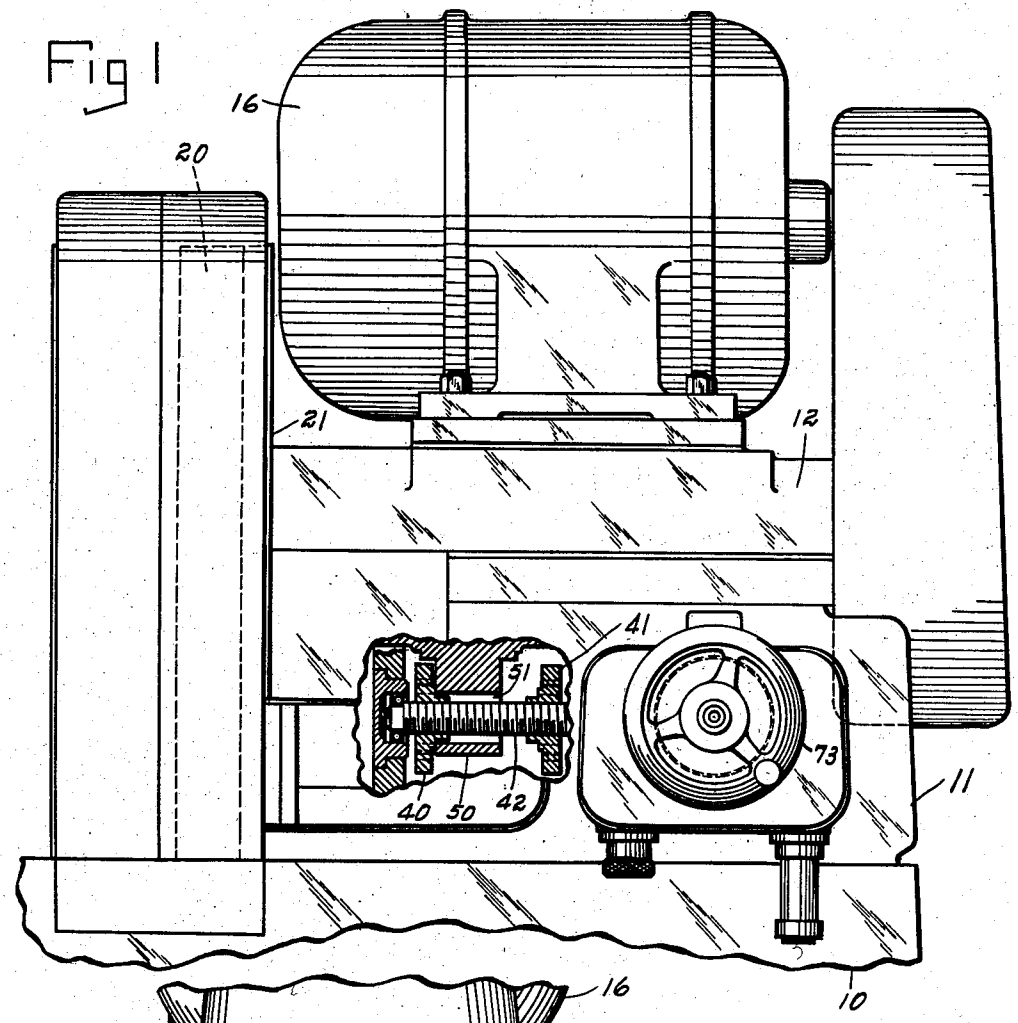
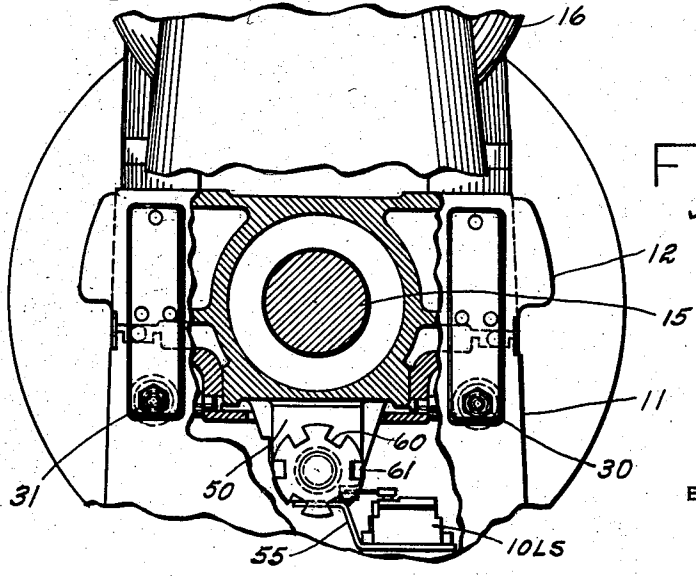


Fig 2



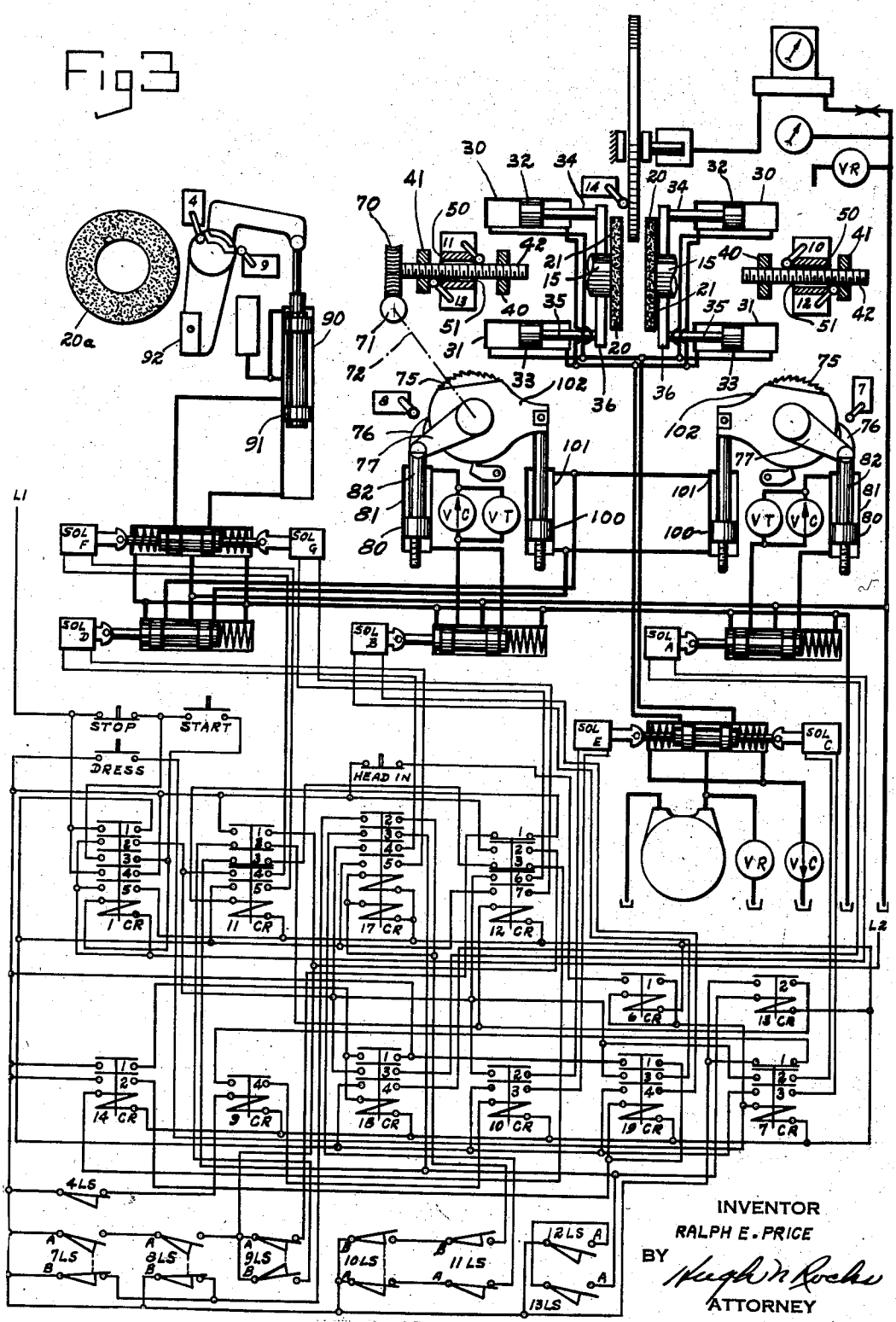
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Fig 3



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United States Patent Office 2,882,651 Patented Apr. 21, 1959

2,882,651

POSITIONING ABRASIVE DISCS FOR DRESSING

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Application October 18, 1957, Serial No. 691,027

5 Claims. (Cl. 51—118)

This invention relates to surface grinding machines of the type known as disc grinders, particularly double disc grinders in which parallel surfaces of a workpiece may be ground at the same time.

The dressing operation in this type of machine is effected by a pair of diamonds or other type of dressing tool usually mounted in a single supporting member and passed across the operative surfaces of a grinding disc to dress both discs at the same time. In order to perform such a dressing operation automatically, the diamonds must be spaced by an exact amount, bearing a known relation to the space between the surfaces of the work to be ground. The discs must then be retracted accurately to a position in which the dressing operation may be initiated without further adjustment of the discs. The discs should be advanced toward grinding position by a predetermined increment for each pass of the dressing tool in order to compensate for the amount of abrasive removed from the operative surface of the disc. Correction for wear is inherent in the spacing of the dressing tools.

After the dressing operation, the discs must be returned accurately to a position in which they are both at equal distances from the center of the piece to be ground and spaced apart by a distance which is exactly the dimension of the workpiece to be ground. If there were no lost motion between the moving parts of the feed mechanism and all the parts were perfectly rigid, compensation for wear and dressing would be sufficient to return the discs to the desired position. The separating of the discs for dressing and returning them to grinding position causes changes in the relation between the various parts of the feeding mechanism and the wheel support both in the form of lost motion and in the form of stresses set up in the various parts of the feeding mechanism.

It is therefore an object of this invention to provide means whereby the discs of a double disc grinder may be separated, dressed and adjusted to compensate for wear and dressing and returned to grinding position with the operative faces of the discs spaced by a distance equal to the finished dimension between the surfaces to be ground.

Another object is to provide means for compensating for lost motion and for relieving stresses in the feed mechanism.

Figure 1 is a front elevation of the right hand wheel support of a double disc grinder.

Figure 2 is a partial end elevation of said support.

Figure 3 is a hydraulic and electric diagram.

Numeral **10** indicates the bed of a disc grinder. **11** is an intermediate slide in which the feed mechanism is mounted. **12** is a spindle housing slidably mounted for longitudinal movement on said intermediate slide **11**. A spindle **15** rotatably mounted in said spindle housing **12** is driven through suitable connections by a motor **16** mounted on said spindle housing **12**. A grinding wheel or disc **20** is mounted on a plate **21** attached to spindle **15**. The means for moving disc **20** toward and from operative position includes a pair of hydraulic motors consisting of cylinders **30** and **31**, having pistons **32** and **33** slidably mounted in said respective cylinders. Pistons

32 and **33** are connected through piston rods **34** and **35** to a portion **36** of spindle housing **12**.

The grinding position and the dressing position of the spindle housing **12** are determined by an inner feed nut **40** and an outer feed nut **41** on a feed screw **42**. A yoke member **50** extending downwardly from spindle housing **12** has an opening **51** through which the feed screw **42** passes. The longitudinal movement of spindle housing **12** is determined by the engagement of yoke member **50** with one or the other nut **40** or **41**. Each of said nuts has a plurality of peripherally spaced notches **60**. A key member **61** removably attached to yoke member **50** passes through the aligned notches **60** in both nuts **40** and **41** to prevent rotation of said nuts once they have been adjusted. Two limit switches **10LS** and **12LS** are attached to yoke member **50** by means of bracket **55**. Corresponding switches **11LS** and **13LS**, respectively, on the opposite spindle housing **12** are mounted in the same manner.

Means for turning feed screw **42** consists of a worm wheel **70** on the end of feed screw **42** and a worm gear **71** in operative engagement with said worm wheel **70**, said worm gear **71** being mounted on shaft **72**. Shaft **72** may be rotated by means of a hand wheel **73** or by a pawl and ratchet mechanism consisting of a ratchet wheel **75** and a pawl **76**. Pawl **76** is pivotally attached to an arm **77** also mounted on shaft **72**. Arm **77** and pawl **76** may be actuated by a piston **80** in cylinder **81**, and having a piston rod **82** attached to arm **77** and pawl **76**.

Operation

Machine start switch closes to energize **1CR**. **1CR3** provides a holding circuit and **1CR1** provides a circuit for the entire machine.

Dresser start switch is closed to energize **7CR**. **7CR** energizes valve solenoid C which shifts valve **1** to direct fluid under pressure to the rod ends of head cylinders **30** and **31**.

As soon as the heads move out, **10LS** and **11LS** are released. **10LS—B** and **11LS—B** complete a circuit to energize **17CR**. **17CR4** and **17CR5** complete a circuit to energize valve solenoid D. The valve directs fluid under pressure to the head ends of cylinders **101**, moving pistons **100** upwardly and turning ratchet shields **102** in the direction to expose a greater number of teeth to pawl action on ratchet wheels **75** for dressing.

17CR2, along with normally closed **7LS—B** and normally closed **8LS—B**, provides a holding circuit for **17CR**.

When the heads or spindle housings **12** reach dressing position, normally open **12LS** and **13LS** are closed to complete a circuit through normally closed **11CR3** and normally closed **12CR3** to energize **14CR**. **14CR1** and **14CR2** complete a circuit to energize **18CR** and **19CR** respectively. **18CR3** and **18CR4** complete a circuit to energize valve solenoid A, and **19CR3** and **19CR4** complete a circuit to energize valve solenoid B.

Valve solenoids A and B shift the valves to the right to direct fluid under pressure to the head ends of ratchet cylinders **81**, moving ratchet pistons **80** upwardly to cause pawls **76** to engage feed ratchets **75** which, in turn, turn feed screws **42** to advance nuts **41** to force the advance of discs **20** against the pressure in the rod ends of cylinders **30** and **31** to compensate for wear and the amount of stock to be removed by the first pass of the diamond holder **92** across the wheels.

Pawls **76** actuate **7LS—A** and **8LS—A** to complete a circuit through **9LS—A** and normally closed **12CR1** to energize dresser relay **11CR**. A holding circuit around **7LS—A** and **8LS—A** is provided through **11CR1** to hold **11CR**.

11CR4 and **11CR5** complete a circuit to energize valve solenoid F, shifting the valve to the left and directing fluid

under pressure to the rod end of cylinder **90**, moving piston **91** downwardly and swinging diamond holder **92** in a clockwise direction to make the first pass across the disc **20**. Normally closed **11CR3** opens to deenergize **14CR** which, in turn, deenergizes **18CR** and **19CR** and valve solenoids A and B which are shifted by their springs **A1** and **B1** to the left to retract pawls **76**.

At the end of the first inward dressing stroke, **9LS** is released. **9LS—A** opens the circuit to **11CR**, closing normally closed **11CR2** to complete a circuit from **9LS—B** to **12CR**. **11CR1**, in the same circuit, is opened and **12CR** remains deenergized. Normally closed **11CR3** and normally closed **12CR3** complete a circuit through **10LS—A**, **11LS—A** and **17CR3** to energize **14CR**.

14CR1 and **14CR2** act through **18CR** and **19CR** to again energize valve solenoids A and B, and provide a feed impulse to the feed ratchets of spindle housings **12**. **11CR4** and **11CR5** open to deenergize valve solenoid F.

Normally closed **11CR2** closes to energize **12CR**. **12CR6** and **12CR7** energize valve solenoid G which shifts the valve to the left to direct fluid to the head end of cylinder **90** to rotate or swing diamond holder **92** in a counter-clockwise direction to move the diamond to the out or start position. At the end of this movement, the counter **1CTR** counts out for one cycle or for a predetermined number of cycles. **1CTR2** closes, energizing **13CR**. **13CR2** keeps **12CR** energized until **1CTR** counts out. When counted out, the diamond holder **92** moves to close **4LS—A**. It also closes **9LS—A** and opens **9LS—B**. Closing **4LS—A** energizes **9CR**. **9CR4** closes to energize **10CR**. **10CR2** and **10CR3** energize valve solenoid E. The valve is shifted to the right to direct fluid under pressure to the head ends of cylinders **30** and **31** to return the heads to grinding position, and **12LS** and **13LS** open.

When heads reach grinding position and lugs **50** contact nuts **40**, **10LS—A** and **11LS—A** close, and **10LS—B** and **11LS—B** open. **17CR** is held through **7LS—B**, **8LS—B** and **17CR2**. **10LS—A**, **11LS—A** and **17CR3** complete a circuit through normally closed **11CR3** and normally closed **12CR3** to energize **14CR** for a final feed impulse to compensate for the backlash, windup and other changes which take place in a feed mechanism. The amount of this feed increment is equal to the dressing feed increment, and is predetermined and adjusted to exceed the amount of the hand wheel rotation required to correct the setting of the feed mechanism. **7LS—B** and **8LS—B** open during the final feed adjustment and deenergize **17CR** and valve solenoid D.

Valve solenoid D and the feed control valve are shifted to the left by the valve spring to direct fluid under pressure to the rod ends of cylinders **101** to shift ratchet shields **102** to compensating feed position for grind size control.

I claim:

1. A grinding machine having annularly opposed grinding discs rotatably mounted thereon, means for adjusting said discs toward and from one another including a feed screw and nut, means for effecting a rapid positioning movement of said discs toward and from one another, a dressing device comprising a diamond holder having spaced oppositely positioned diamonds thereon, the spacing of said diamonds being greater than the spacing between the grinding discs during a grinding operation, means for actuating said rapid positioning means to separate said discs for a dressing operation, means responsive to said rapid positioning movement to advance said adjusting means by a predetermined amount, means actuated by said adjusting means to actuate said dressing device to make a dressing pass across said opposed discs, means operable at the end of said dressing pass to automatically actuate said feed adjusting mechanism to advance said discs to compensate for the amount to be dressed by the diamonds on the return pass of the dressing device across the wheel, means actuated after a predetermined dressing operation to actuate said rapid positioning means to return said discs to said operative position, and control means to effect a final operation of said feed adjusting mechanism to compensate for strain and backlash in the feed mechanism during the dressing operation.

2. In a grinding machine having axially opposed grinding discs rotatably mounted thereon, means for adjusting said discs toward and from one another including a feed screw and nut, means for effecting a rapid positioning movement of said discs toward and from one another, a dressing device comprising a diamond holder having spaced oppositely positioned diamonds thereon, means to actuate said dressing device to make a dressing pass across said opposed discs, means responsive to movement of said dresser to automatically actuate said feed adjusting mechanism to advance said discs to compensate for the amount to be dressed by the diamonds on the return pass of the dressing device across the wheel, means including a counting device to actuate said rapid positioning means to return said discs to said operative position after said dressing operation, and means responsive to return movement of said discs to effect a final operation of said feed adjusting mechanism to compensate for changes occurring in the feed mechanism as a result of the movement to and from dressing position.

3. In a grinding machine having annularly opposed grinding discs rotatably mounted thereon, means for adjusting said discs toward and from one another including a feed mechanism, means for effecting a rapid positioning movement of said discs toward and from one another, means for actuating said rapid positioning means to separate said discs for a dressing operation, means to effect said rapid positioning means to return said discs to operative position after said dressing operation, and means operable upon return of said discs to said operative position to effect operation of said feed adjusting mechanism to compensate for changes occurring in said feed mechanism as a result of said movement to and from dressing position.

4. In a disc grinder, a bed, a wheel supporting member slidably mounted on said bed, a grinding wheel or disc rotatably mounted in said wheel supporting member, means for effecting an axial positioning movement of said disc including a hydraulic motor, means for determining the extent of movement of said disc by said motor including a feed screw, a pair of feed nuts mounted in axially spaced relation on said feed screw, an abutment on said wheel supporting member extending into the space between said feed nuts, and means for adjusting said feed screw to change the axial position of said feed nuts and therefore the zone of movement of said wheel supporting member.

5. In a disc grinder, a bed, a wheel supporting member slidably mounted on said bed, a grinding wheel or disc rotatably mounted in said wheel supporting member, means for effecting an axial positioning movement of said disc including a hydraulic motor, means for determining the extent of movement of said disc by said motor including a feed screw, a pair of feed nuts mounted in axially spaced relation on said feed screw, an abutment on said wheel supporting member extending into the space between said feed nuts, and means for effecting a relative adjustment between said feed screw and said feed nuts to change the axial position of said feed nuts and therefore the zone of movement of said wheel supporting member.

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