Jan. 27, 1970 W. P. FLOHR, JR 3,491,741

PROFILE DRESSING MECHANISM FOR GRINDING WHEELS

Filed Dec. 26, 1967 3 Sheets-Sheet 1

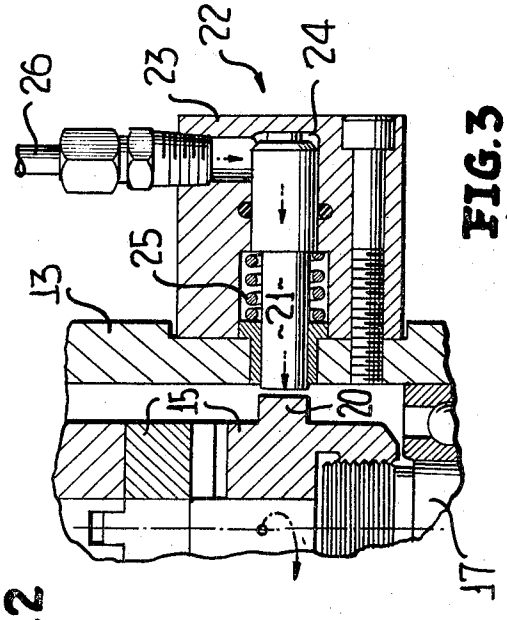


FIG. 2

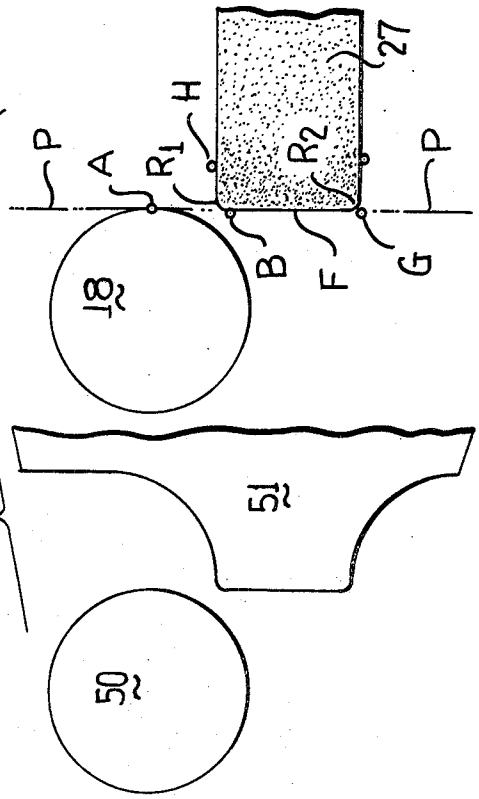


FIG. 3

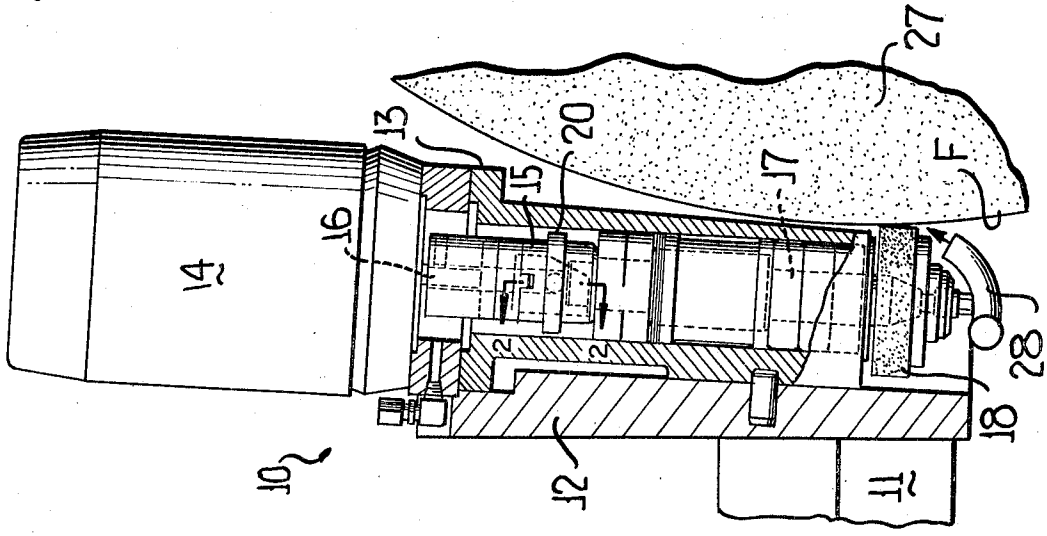


FIG. 1

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PROFILE DRESSING MECHANISM FOR GRINDING WHEELS

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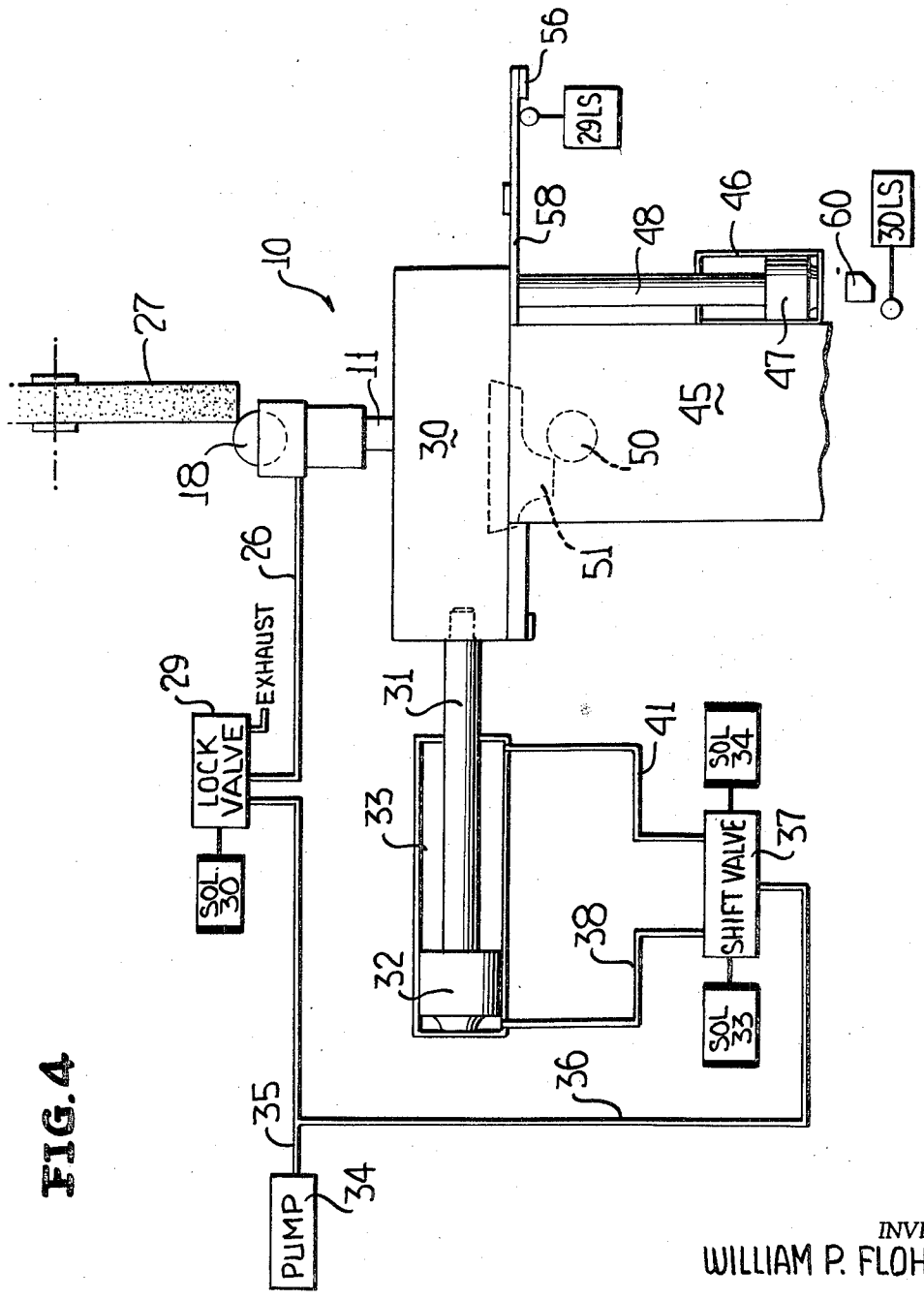


FIG. 4

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PROFILE DRESSING MECHANISM FOR GRINDING WHEELS

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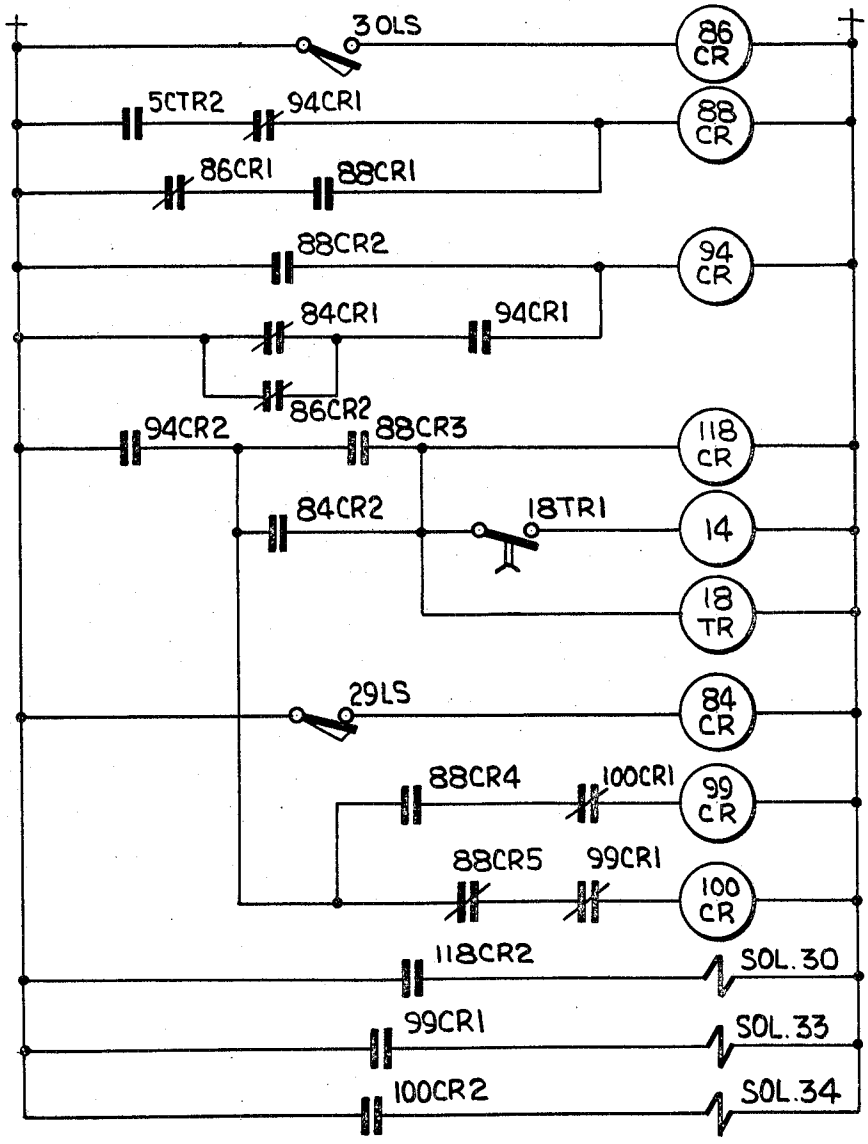


FIG. 5

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PROFILE DRESSING MECHANISM FOR GRINDING WHEELS

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Int. Cl. B28d 1/16
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ABSTRACT OF THE DISCLOSURE

This disclosure relates to a mechanism for dressing a peripheral grinding face of a grinding wheel or wheels and consists of a motor driven diamond impregnated roller mounted on a dresser bar which is movable along a path corresponding to the profile of the grinding wheel. At the beginning of a dressing operation, the roller is rotated as it first passes across the peripheral face of the grinding wheel. Thereafter, the direction of movement is reversed and the roller is held stationary as it passes across the peripheral face of the grinding wheel in the opposite direction. Where the grinding wheel has rounded corners, the rollers is rotated as it passes first across the peripheral face and one of the corners of the grinding wheel. Thereafter, the direction of movement is reversed and the roller is held stationary as it passes across the peripheral face of the grinding wheel in the opposite direction. Where the grinding wheel has rounded corners, the roller is rotated as it first passes across the peripheral face and one of the corners of the grinding wheel. Thereafter, the direction of movement is reversed and the roller is held stationary as it passes across the peripheral face of the grinding wheel in the opposite direction until the point of merger of the other corner and the peripheral face is reached, at which time, rotation is again imparted to the dressing roller as it passes around said corners.

This invention relates to a grinding wheel dressing mechanism of the type disclosed in commonly assigned U.S. Patent No. 3,121,423 in the name of R. E. Price et al. granted Feb. 18, 1964. Dressing mechanisms of the type disclosed in the above-noted patent employ a continuously rotating diamond impregnated roller which moves along a path determined by one or more profile bars and a follower. The path followed by the dressing roller corresponds generally to the profile of the grinding wheel face and corners, and during a typical dressing operation the dressing roller is first moved across the cylindrical grinding face and one of the corners. Upon the return pass the dressing roller again passes across the cylindrical face and then around the opposite corner to complete the dressing operation. However, during both the initial and the return pass the dressing roller is continuously rotated and therefore, a relativley heavy or coarse cut is taken during the dressing operation. This is highly undesirable because particularly the cylindrical grinding face of the grinding wheel is not dressed to the degree necessary to maintain the close tolerances required for such components as the crankpins of automotive crankshafts. In order to maintain such close tolerances it is, therefore, imperative to dress grinding wheels as perfectly as is commercially practical.

In accordance with this invention it has been found that by maintaining the diamond dressing roller stationary during the return pass thereof across the cylindrical face of the grinding wheel one or at most a few of the impregnated diamonds contact the cylindrical face, as opposed to the conventional practice of rotating the dressing roller during the return pass at which time many more of the diamonds engage the cylindrical face resulting

in the coarse dressing cut heretofore noted. However, by holding the dressing roller stationary only one or a few of the diamonds contact the cylindrical face of the grinding wheel and a very light finishing dressing cut is produced.

It is, therefore, a primary object of this invention to provide a novel dressing mechanism which includes means for terminating the rotation of a dressing roller prior to the return pass thereof across the cylindrical face of a grinding wheel to produce a light dressing cut which correspondingly effects an accurate dressing of the grinding wheel.

A further object of this invention is to provide a novel dressing mechanism of the type aforesaid wherein the dressing roller is maintained in a non-rotatable condition only upon the return pass thereof across the cylindrical grinding face of the grinding wheel, and control means are provided for rendering the dressing roller rotatable during the movement of the dressing roller around each of the grinding wheel corners.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings:

In the drawings:

FIGURE 1 is a side elevational view partly in section of a grinding wheel dressing mechanism, and illustrates a diamond impregnated dressing roller carried by the grinding machine dresser bar.

FIGURE 2 is an enlarged fragmentary sectional view taken generally along line 2—2 of FIGURE 1, and illustrates a brake mechanism for preventing rotation of the dressing roller, and means for actuating the brake mechanism for stopping the rotation of the dressing roller.

FIGURE 3 is a highly schematic top plan view of a profile bar and follower, and illustrates the manner in which the profile bar and follower cooperate for imparting movmeent to the dressing roller along a predetermined path relative to the grinding wheel during a dressing operation.

FIGURE 4 is a diagrammatic top view of the grinding wheel dressing mechanism of this invention, and illustrates hydraulic control means and associated switches for controlling the movement of the dressing roller during a dressing operation.

FIGURE 5 is an illustration of the control circuit for the grinding wheel dressing mechanism.

A dressing mechanism constructed in accordance with this invention is best illustrated in FIGURES 1 and 4 of the drawings, and is generally designated by the reference numeral **10**. The dressing mechanism **10** includes a dresser bar **11** to which is secured a bracket **12** (FIGURE 1) which in turn carries a housing **13**. A motor **14** is secured atop the housing **13** and includes a coupling **15** connecting a drive shaft **16** of the motor **14** to a shaft **17** carrying a diamond impregnated dressing roller **18**. The coupling **16** includes a peripheral flange **20** which is in alignment with a plunger **21** of a braking or locking mechanism **22** (FIGURE 2). The locking mechanism **22** includes a housing **23** secured to the housing **13**, and has a fluid chamber **24** into which is introduced a control fluid, such as pressurized air, for shifting the plunger **21** to the left against the force of a spring **25**. A solenoid valve SOL **30** (FIGURE 4) is connected to a valve **29** in a conduit **26** opening into the chamber **24**. Upon the starting of the motor **14** the solenoid valve SOL **30** is operated to vent the line **26** to the atmosphere whereupon the spring **25** moves the plunger **21** to the non-braking or unlocked position shown in FIGURE 2. However, when the motor **14** is stopped the solenoid SOL **30** is shifted to direct fluid under pressure into the chamber **24** to shift the piston **21** to the left as viewed

in FIGURE 2 causing the contact of the end thereof with the flange **20** to thus prevent rotation of the dressing roller **18** in a manner and for a purpose which will be more fully described hereinafter.

The bracket **12** of the dresser bar **11** supports the dressing roller **18** at a slight angle to the vertical in the direction of a grinding wheel **27** so that, as the dresser bar **11** advances the roller **18** towards the grinding wheel **27**, the initial contact of the roller **18** with a face F of the grinding wheel **27** will be at its upper peripheral edge leaving a small space between the remainder of the dressing roller face and the grinding wheel face. Coolant from a nozzle **28** is directed into this space, as indicated by the unnumbered headed arrow in FIGURE 1, to maintain the dressing roller **18** and the grinding wheel **27** relatively cool during a dressing operation. The flow of the coolant into the space is also augmented by the pumping action developed by the grinding wheel **27** as the peripheral or cylindrical surface F thereof moves upwardly at this point.

The manner in which the transverse and longitudinal movement is imparted to the dressing roller **18** by the dressing mechanism **10** is similar to that disclosed in the aforementioned patent and includes a carriage member **30** mounted on a portion of the grinding wheel support (not shown) for sliding movement in a plane parallel to the axis of the grinding wheel **27**. A piston rod **31** is connected at one end of the carriage member **30** and an opposite end thereof carries a piston **32** which is reciprocally mounted in a cylinder **33**. Fluid from a conventional pump **34** is introduced to the left of the piston **32** as viewed in FIGURE 4 by a conduit **35**, a conduit **36**, a conventional spool valve **37** and a conduit **38** to impart left-to-right movement to the piston **32** and the carrier member **30** upon the actuation of a solenoid SOL **33** in a manner which will be more apparent hereinafter. Movement of the carriage member **30** from right-to-left in this same figure is effected by introducing fluid into the cylinder **33** to the right of the piston **32** over a path defined by the conduit **35**, the conduit **36**, the valve **37** and a conduit **41** upon the actuation of a solenoid valve SOL **34**.

The movement of the dressing bar **11** toward and away from the grinding wheel **27** consists of a cylinder **46** attached to a dresser slide **45** and having a piston **47** on a rod **48** attached by means of a bracket (not shown) to the carriage member **30**. Fluid introduced into the cylinder **46** continually urges the dresser slide **45**, the dresser bar **11** and the dressing roller **18** carried thereby toward the grinding wheel **27**, and functions to maintain contact between a follower **50** and a profile bar **51** (FIGURES 3 and 4) in a manner more fully described in the latter-noted patent. Fluid is also introduced into the cylinder **46** to move the dressing roller **18** away from the grinding wheel **27**.

A limit switch **29LS** controls the transverse movement of the carriage member **30** while the in-and-out movement of the dresser slide **45** is controlled by switch **30LS**. The switch **29LS** is actuated by abutment **56** carried by the bracket **58** which is, in turn, secured to the carriage member **30**. The switch **30LS** is likewise actuated by abutment member **60** carried by the dresser slide **45**.

A dressing operation of the drawing mechanisms **10** will now be described in conjunction with the circuit of FIGURE 5, it being assumed that the dressing roller **18** is stationary and is situated at position A in FIGURE 3 at which a plane P of the cylindrical grinding wheel face F is generally tangential to the face of the dressing roller **18**. In this position of the dressing roller **18** the follower **50** is, of course, correspondingly positioned relative to the profile bar **51**, as is also shown in FIGURE 3.

The dressing operation is initiated when a counter (not shown) counts out and closes the contact **5CTR2** (FIGURE 5) to complete a circuit through normally closed contact **94CR1** which energizes the relay **88CR**. A contact **88CR1** of the relay **88CR** is a holding contact in the circuit with normally closed relay contact **86CR1**. The energized relay **88CR** also closes a contact **88CR2** in a circuit to energize a relay **94CR** which in turn establishes a holding circuit through a contact **94CR1**, a normally closed contact **84CR1**, and a parallel normally closed contact **86CR2**. With the closing of contact **94CR2** a circuit is completed through the previously closed contact **88CR3** to energize a relay **118CR** and a timer relay **18TR**. The contact **94CR2** also completes a circuit through a normally closed contact **100CR1** and now closed contact **88CR4** to energize a relay **99CR** closing contact **99CR1** and energizing the solenoid SOL **33** (FIGURES 4 and 5).

The solenoid SOL **33** shifts the valve **37** in a manner to direct fluid from the pump **34** and through the conduits **35**, **36** and **38** to the left side of the piston **32** to shift the piston **32**, the rod **31**, the carriage member **30** and the dressing roller **18** to the right, as viewed in FIGURE 4 which is downwardly as viewed in FIGURE 3. At the same time the contact **94CR2** completes a circuit with the closed contact **88CR3** to energize the timer relay **18TR** which closes contact **18TR1** after a predetermined interval to energize the dresser motor **14**, allowing enough time for the solenoid SOL **30** to release the braking plunger **21** upon the closing of the contact **118CR2** before the motor **14** is started. The solenoid SOL **30** shifts the valve **29** to its exhaust position thereby venting the conduit **26** to the atmosphere whereupon the spring **25** (FIGURE 2) shifts the plunger **21** to the right as viewed in this latter figure to unlock or release the dressing roller **18** whereupon the same is rotated by the energized motor **14**.

As the dressing roller **18** rotates and moves from position A downwardly as viewed in FIGURE 3 it engages the cylindrical face F of the grinding wheel **27** at a point B in advance of merger between a corner or radius R1 and the face F of the grinding wheel **27**. The motor **14** remains energized during the movement of the dressing roller **18** across the face F of the grinding wheel **27** and around the other corner or radius R2 until the radial inward movement of the dressing slide **45** closes the limit switch **30LS** by means of the abutment **60** to energize the relay **86CR**.

The contact **86CR1** opens to de-energize the relay **88CR** which opens the contact **88CR3** to de-energize the relay **18TR** and the motor **14**, thereby stopping the rotation of the dressing roller **18** while at point C. The de-energized relay **118CR** also opens the contact **118CR2** to de-energize the solenoid SOL **30** whereupon the fluid from the pump **34** is introduced behind the plunger **21** through the valve **29** and the conduit **26** to shift the plunger **21** to the left as viewed in FIGURE 2 to its unlocked position. At this point the dressing roller **18** is at point C. The dressing roller **18** is then shifted to point G in the manner described in the aforementioned patent at which position the face of the dressing roller **18** is again generally tangentially related to radius R2 and the face F of the grinding wheel **27** along the plane P.

At this time the contact **88CR4** opens to de-energize the solenoid SOL **33** permitting the valve **37** to return to its central position. However, at the same time the normally closed contact **88CR5** closes to complete a circuit through normally closed contact **99CR1** to energize relay **100CR** and the solenoid SOL **34**.

The fluid from the pump **34** is therefore introduced into the cylinder **33** through the conduit **36**, the valve **37** and the conduit **41** causing the piston **32**, the rod **31**, the carriage member **30** and the dressing roller **18** to move from point G across the face F of the grinding wheel **27** toward point B, during which time the dressing roller **18** remains stationary to take a light finishing dressing cut across the cylindrical face F of the grinding wheel.

As the dressing roller **18** moves with the carriage member **30** to the left as viewed in FIGURE 4 the limit switch **29LS** is closed by the abutment member **56** completing a circuit to energize relay **84CR** to start rotation of the dressing motor **14** at the time the dressing

roller **18** reaches the merging point B between the radius R1 and the face F, and during the remainder of the time the dressing roller **18** moves along this radius under the guidance of the profile bar **51** and the cam follower **50**. The radius R1 is therefore dressed while the dressing roller is rotating, and the rotation continues until the dressing roller **18** reaches point H at which time the limit switch **30**LS is actuated, energizing the relay **86**CR. The normally closed contact **86**CR1 opens to de-energize relay **88**CR which opens contact **88**CR2 to de-energize the relay **94**CR. The de-energized relay **94**CR causes the contact **94**CR2 to open thereby stopping the dressing motor **14**, applying the locking plunger **21** against the flange **20**, and also discontinues the traverse movement at point A by the de-energizing of the solenoids SOL **33**, SOL **34**. The dressing roller **18** is thereby again positioned as shown in FIGURE 3, and further dressing operations by the dressing mechanism **10** can again be performed in the manner just described.

While preferred forms and arrangement of parts have been shown in illustrating the invention, particularly grinding wheels having rounded corners, it is to be clearly understood that various changes in details and arrangement of parts may be made without departing from the spirit and scope of the invention as defined in the appended claimed subject matter. For example, in many cases, the use of a brake to prevent rotation of motor **14** is unnecessary, the friction and inertia in the motor and roller mounting being sufficient to prevent rotation of said roller after the current to the driving motor **14** is cut off.

I claim:

1. A mechanism for dressing a grinding wheel having a peripheral grinding face merging with rounded corners comprising a dressing roller, means for moving said dressing roller along a path corresponding to the profile of the grinding face and corners, means for rotating the dressing roller during the movement thereof across at least one of the corners and the grinding face to thereby perform a relatively heavy cutting operation, and means for maintaining the dressing roller non-rotatable during another movement thereof across the grinding face to thereby perform a relatively light cutting operation.

2. The mechanism as defined in claim **1** wherein the movement of the rotating dressing roller across the grinding face is in a direction opposite to the movement of the non-rotating dressing roller across the grinding face.

3. The mechanism as defined in claim **1** wherein said rotating means is further operative for rotating the dressing roller during the movement thereof across the other of said corners.

4. The mechanism as defined in claim **1** wherein the movement of the rotating dressing roller across the grinding face is in a direction opposite to the movement of the non-rotating dressing roller across the grinding face, and said rotating means is further operative for rotating the dressing roller during the movement thereof across the other of said corners.

5. The mechanism as defined in claim **1** including first control means for activating said rotating means prior to the first-mentioned movement of the dressing roller, and second control means for activating said maintaining means prior to the second-mentioned movement of the dressing roller across the grinding face.

6. The mechanism as defined in claim **1** wherein said rotating means includes a rotatable shaft carrying said dressing roller, and said maintaining means is a brake mechanism for holding said shaft non-rotatable during said second-mentioned movement.

7. The mechanism as defined in claim **3** wherein the path followed by the dressing roller during the first-mentioned movement is in a first direction beginning adjacent said other corner and proceeding across the grinding face and then around said one corner, and during the second-mentioned movement is in an opposite direction beginning adjacent said one corner and proceeding across the grinding face and then around said other corner.

8. The mechanism as defined in claim **3** wherein said rotating means includes a rotatable shaft carrying said dressing roller, and said maintaining means is a brake mechanism for holding said shaft non-rotatable during said second-mentioned movement.

9. The mechanism as defined in claim **7** wherein said rotating means includes a rotatable shaft carrying said dressing roller, and said maintaining means is a brake mechanism for holding said shaft non-rotatable during the movement of the dressing roller in the opposite direction across the grinding face.

10. The mechanism as defined in claim **9** including control means for activating said brake mechanism to render said shaft non-rotatable after said dressing roller has moved around said one corner, and control means for deactivating said brake mechanism to render said shaft rotatable as said dressing roller begins its movement around said other corner.

11. A mechanism for dressing a grinding wheel comprising a dressing roller, a motor for rotating said roller, means for traversing said roller alternately in opposite directions across said grinding wheel during a dressing operation, means for effecting the rotation of said roller during traversing movement in one direction, and means for preventing the rotation of said roller during traversing movement thereof across the grinding wheel in the opposite direction.

12. The mechanism as defined in claim **11** wherein said dressing roller is mounted for rotation in a plane normal to the plane of the grinding wheel and inclined to the grinding face thereof so that initial contact with the grinding wheel is on one edge of said roller.

13. The mechanis mas defined in claim **11** wherein the grinding wheel has rounded corners, and means are provided for guiding said roller around said corners.

14. The mechanism as defined in claim **13** wherein control means are provided for maintaining said rollers rotating as the roller is guided around said corners.

15. The mechanism as defined in claim **1** wherein said dressing roller is mounted for rotation in a plane generally normal to the plane of the grinding wheel, and means are provided for supporting the dressing roller with its axis inclined to the face of said grinding wheel whereby the initial contact between the grinding wheel face and the dressing roller is at an edge of the dressing roller.

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