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GRINDING WHEEL FEEDING MECHANISM

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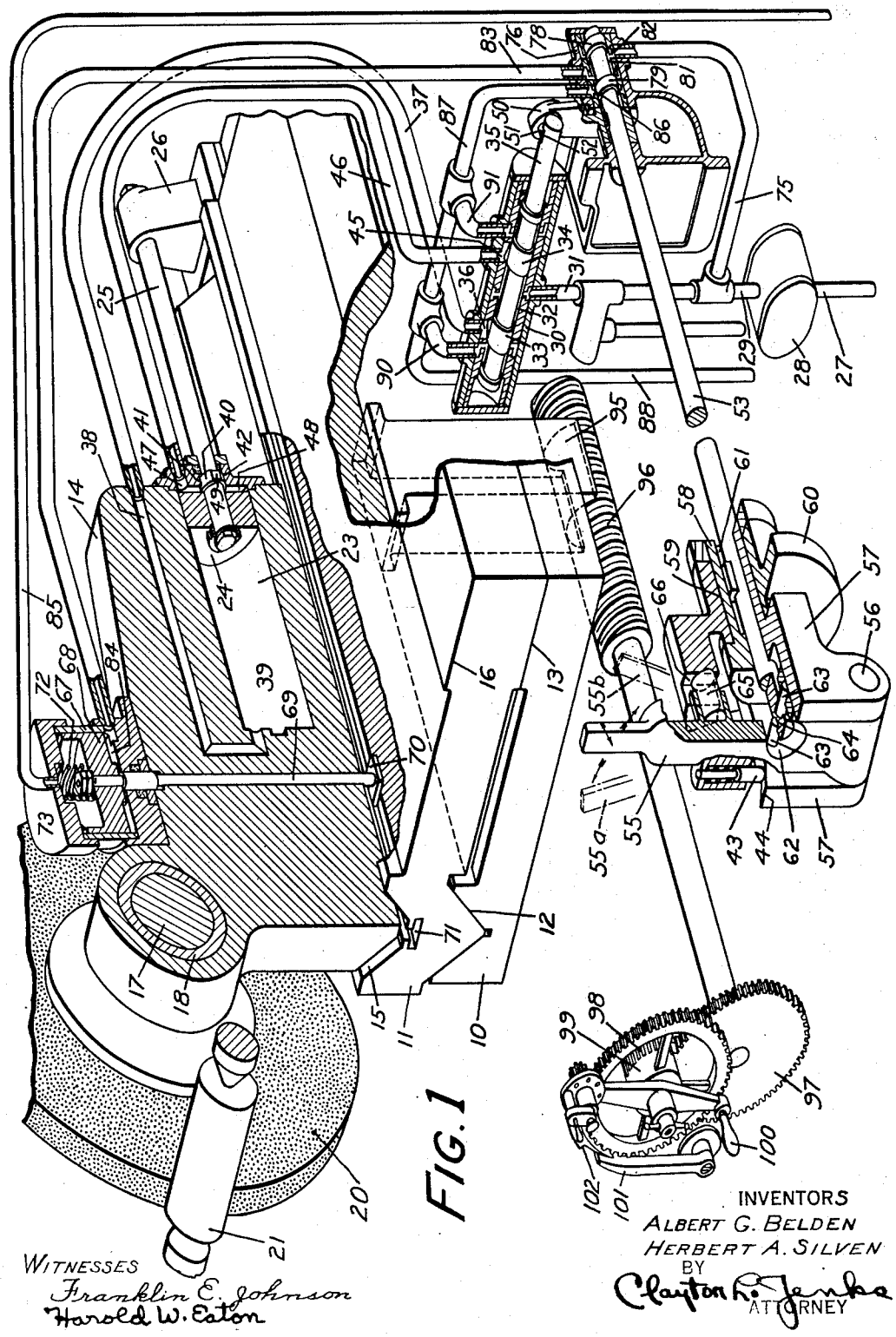

FIG. 1

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GRINDING WHEEL FEEDING MECHANISM

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This invention relates to a grinding machine and more particularly to a wheel feeding and positioning mechanism.

Wheel feeding mechanisms, such as commonly used in the grinding industry, have depended upon slow-moving mechanisms, such as a nut and screw or a rack and pinion, to move the grinding wheel slide to and from an operating position. In certain types of grinding, such as the grinding of crankshafts, where it is necessary to move the wheel slide rearwardly a considerable distance so that the wheel clears the projecting arms of the crankshafts, it requires turning the feed screw through many revolutions to move the wheel rearwardly to the desired extent. This operation required considerable time when the grinding wheel is moved rearwardly or forward into an operating position. In these days of modern machining methods requiring rapid production, it is desirable and essential that the loss of time be reduced to a minimum, and that the parts of a machine be moved rapidly during their idle movement so as to minimize the loss of time and to increase the productivity of the machine.

It is therefore one object of this invention to provide a grinding wheel mount which permits the wheel to be moved rapidly and accurately to a desired position by a fluid pressure mechanism and then to be further moved manually as desired for a grinding operation.

It is another object of this invention to provide a grinding machine having the grinding wheel carried by a transversely movable slide and arranged for movement relative thereto by a fluid pressure mechanism, and to provide such adjustments and stopping devices as will serve to make the machine capable of precision grinding and rapidly moving the wheel towards and from the work and positioning it accurately relative thereto.

It is still another object of this invention to provide a micrometer feeding mechanism for controlling the grinding feed of the wheel and to provide a rapid positioning movement to move the grinding wheel to and from an operative position adjacent to the surface of the work.

It is a further object of this invention to provide a fluid pressure mechanism for moving the grinding wheel slide rapidly to and from an operating position adjacent to but out of contact with the work.

It is still a further object of this invention to provide a fluid pressure mechanism for moving the wheel slide relative to an intermediate slide, and a micrometer nut and screw mechanism for moving the intermediate slide relative to the base to produce the desired positioning and feeding movement.

It is still another object of this invention to provide a suitable fluid pressure clamping mechanism for locking to its support that slide which is moved by the fluid pressure mechanism.

Other objects will be apparent from the foregoing disclosure.

One embodiment of this invention has been illustrated in the drawing, in which like reference numerals indicate like parts.

Fig. 1 is a fragmentary perspective view of a grinding wheel slide mounting and wheel feeding mechanism having parts broken away and shown in section to more clearly show the construction.

In accordance with this invention, a slide is provided for moving the grinding wheel transversely towards and from the work and a fluid pressure mechanism is provided for moving the wheel transversely relative to the slide. This is preferably accomplished by means of an upper and a lower slide, the upper one of which is moved by fluid pressure mechanism and the lower manually adjusted relative to the base. Means are also provided for stopping this transverse movement at a desired position and for adjustably positioning the grinding wheel relative to the work. Also, in our preferred embodiment, we provide a fluid pressure-operated clamping device for clamping to its support that slide which is moved by the fluid pressure mechanism.

As illustrated in the drawing, a portion of a grinding machine has been disclosed comprising a base 10 which supports a slide 11 for transverse movement on the V-way 12 and flat way 13. This slide 11 in turn carries a grinding wheel which is mounted for movement transversely relative thereto, and this movement may be accomplished by mounting the wheel on an upper slide 14 which is arranged to slide on the V-way 15 and flat way 16 on the intermediate or lower slide 11. A grinding wheel spindle 17 is rotatably supported in bearings 18 in the wheel slide 14, and carries at its outer end a grinding wheel 20 which is arranged to engage and grind a work piece 21. The work piece 21 may be supported on the centers on any well-known head and footstock (not shown).

In order to attain one of the objects of this invention, namely, to provide a rapid positioning and withdrawing movement to the grinding wheel, a fluid pressure mechanism is operatively

connected between the wheel slide 14 and the intermediate slide 11. This mechanism may comprise a cylinder 23 which, as illustrated, is formed as an integral part of the wheel slide 14. A piston 24 is slidably mounted within the cylinder 23 and is connected by a piston rod 25 to an upwardly extending bracket 26 on the intermediate slide 11.

Any suitable source of fluid pressure is provided for supplying fluid under pressure to the cylinder and piston, such as a reservoir (not shown) in the base, having an intake pipe 27 extending therein. A geared pump 28 pumps fluid from the reservoir through the pipe 27 and pipe 29 to a reversing valve 30 which controls the admission of fluid to either end of the cylinder 23. Fluid passes through the pipe 31 into valve chamber 32 and, in the position of the valve as illustrated in the drawing, serves to balance the pressure between the valve piston 33 and valve piston 34.

When the valve stem 35 is moved towards the left, as viewed in the drawing, the port 36 is uncovered and allows fluid under pressure to pass from the chamber 32 into a pipe 37, through a passage 38, in the wheel slide into a cylinder chamber 39 to move the wheel slide forward into an operative position, such as shown in the drawing. This mechanism may be utilized for a positioning movement to rapidly move the grinding wheel into an operative position adjacent to but out of contact with the surface of the work to be ground.

A stop collar 40 on the piston rod 25 closely fits within a dash pot cylinder 41 in the cylinder head 42. The collar 40 and cylinder 41 serve as a dash pot to slow down the movement of the wheel slide at the end of the stroke. The collar has a flat slabbed-off surface 49 which allows the fluid to slowly escape from the cylinder 41. This slow movement of the slide may if desired be utilized as a grinding feed. Engagement of the collar 40 with the bottom of the dash pot cylinder 41 serves to definitely limit the forward movement of the slide. A similar construction is provided at the other end of the cylinder 23 to cushion the rearward movement of the slide.

Similarly, when the valve stem 35 is moved toward the right from the position illustrated in the drawing, the port 45 is uncovered and fluid under pressure is admitted from the valve chamber 32 through a pipe 46, a port 47, into a cylinder chamber 48 to move the grinding wheel slide 14 rearwardly to an inoperative position.

A manual control is provided for manually shifting the valve stem 35 to move the valve so as to produce a forward or reverse positioning movement of the grinding wheel or to throw the valve into a neutral position to hold the wheel slide against movement. This mechanism may comprise a rock arm 50 having a pin 51 engaging a slot 52 in the valve stem 35. The arm 50 is slidably keyed to a rod 53. The rod 53 carries at its outer end a manually operable control lever 55. The lever 55 is pivotally mounted on a stud 56 which is carried by a yoked member 57. The yoked member 57 is provided with an oppositely extending cylindrical portion 58 which is rotatably supported in a bearing 59 in a supporting member 60. The member 60 is fixed to the front of the machine base. The rod 53 is slidably keyed within a central aperture 61 in the portion 58. The rod 53 extends within a clearance hole 62 in the lever 55 and is connected thereto by a pair of opposed pins 63 which are fixed to the lever and engage slots 64 in the rod 53. It will be readily apparent from the foregoing description that the lever 55 may be rocked in two planes at substantially right angles to each other. The stud 56 serves as one pivot to permit a swinging movement of the lever 55 towards and from the base, and the portion 58 serves as the other pivot to allow a lateral movement of the lever 55. Movement of the lever 55 towards the left, into position 55a, moves the valve stem 35 towards the left and admits fluid to cause a forward approaching movement of the grinding wheel slide. Similarly, movement of the lever 55, towards the right, into position 55b, moves the valve stem 35 towards the right and admits fluid through port 45, pipe 46, port 47, into chamber 48 to cause a rearward movement of the grinding wheel to an inoperative position.

It is desirable to provide means for locating the valve in a neutral position so that the operator may readily shift the valve to and from a neutral position so as to stop the forward or rearward feed when desired. The lever 55 is provided with a projecting pin 65 which in a neutral position engages a slot 66 so that the lever 55 is held against sidewise movement. To permit a sidewise movement of the lever, it is necessary to move the pin 65 out of engagement with the slot 66 so that the pin and lever 55 may be rocked either towards the right or towards the left, depending upon the direction of movement of the wheel slide desired. It will be readily apparent from this disclosure, that when the operator desires to move the grinding wheel rearwardly, from the position of parts shown in the drawing, the lever 55 is first pulled in a forward direction towards the operator to disengage the pin 65 from the slot 66, and then rocks the lever 55 into position 55b, moving the valve stem 35 towards the right and admitting fluid from the valve chamber 32 through port 45, pipe 46, port 47, into cylinder chamber 48 to move the grinding wheel rearwardly to an inoperative position.

Similarly, when it is desired to produce a forward positioning movement of the grinding wheel, the operator moves the lever 55 forward to disengage the pin 65 from the slot 66 and then swings the lever into the dotted line position 55a which shifts the valve stem 35 towards the left and admits fluid through port 36, pipe 37, passage 38, into cylinder chamber 39 to move the wheel slide forward into a position adjacent to but out of contact with the work. If desired, the fluid pressure may be left on to retain a definite pressure between the parts so that the oil film is always squeezed to a predetermined extent to accurately position the wheel slide relative to its support on each successive grind.

It may be desirable, however, in certain grinding operations, to provide a suitable locking device to clamp the wheel slide rigidly to the intermediate slide after it has been positioned adjacent to but out of contact with the work. To attain this object of the invention, a clamping mechanism is provided having a fluid pressure cylinder 67 mounted on the top of the wheel slide. A piston 68 is slidably mounted in the cylinder 67 and is operatively connected to a rod 69 having a head 70 slidably mounted in a T-slot 71 in the intermediate slide 11. A spring 72 is interposed between the cylinder head 73 and the upper surface of the piston to retain the piston in its lower position to allow free movement of the wheel slide on the intermediate slide. Fluid under pressure is passed through a pipe 75 from the gear

pump 28 through a control valve 76. In the preferred construction, the control valve 76 is arranged so that it may be controlled by movement of the lever 55. As illustrated in the drawing, the rod 53 serves as a valve stem and has valve pistons 78 and 79 mounted integrally therewith. It will be readily appreciated from this construction that movement of the lever 55 either towards or from the machine base moves the rod 53 endwise and shifts the valve pistons 78 and 79 so as to open or close the valve 76.

The valve for actuating the clamping mechanism is preferably arranged to operate in timed relation with the reverse valve for controlling the positioning movement of the grinding wheel so that the clamping mechanism may not be operated during the positioning movement but can only be operated when the reverse valve is in a neutral position. As shown in Fig. 1 of the drawing, the valve stem 35 is in a neutral position, and the valve pistons 78 and 79 of the valve 76 are positioned so that fluid under pressure passing through the pipe 75 enters a chamber 81 within the valve 76 and admits fluid through the port 82 and pipe 83 to a cylinder chamber 84 on the lower side of the piston 68. Admission of fluid under pressure into the chamber 84 moves the piston 68 upwardly and gives a corresponding movement of the rod 69 and the head 70 so as to lock or clamp the wheel slide 14 rigidly to the intermediate slide 11. An exhaust pipe 85 is provided to carry off any fluid leaking by the piston 68 and returning it to the reservoir in the base.

When the lever 55 is moved towards the operator to draw the pin 65 from the slot 66, a corresponding movement is transmitted to the rod 53 which moves the valve pistons 78 and 79 towards the left, as viewed in the drawing. This forward movement of the rod 53 moves the valve piston 78 over the port 82 and cuts off the fluid pressure from the pipe 83 and at the same time opens a port 86 so that fluid within the chamber 84 may pass back through the pipe 83 and out through port 86 and a pipe 87 and be returned through pipe 88 into the reservoir of the machine. The released tension of spring 72 moves the piston 68 and rod 69 downwardly and unclamps the slide 14. The lever 55 is normally held with the pin 65 in engagement with the slot 66 by means of a spring pressed plunger 43, on the lever 55, engaging a cam surface 44 on the yoked member 57.

An exhaust pipe 90 is connected between the valve 30 and pipe 88 and is arranged so that when the valve stem 35 is moved towards the right, as viewed in the drawing, to cause a rearward positioning movement of the grinding wheel slide, the valve piston 33 moves towards the right a sufficient distance to uncover the port 36 and permit fluid to exhaust from the cylinder chamber 39 through passage 38, pipe 37, and out through pipe 90 and pipe 88 into the reservoir. Similarly, an exhaust pipe 91 is connected at the other end of the valve 30 to the pipe 88 so that when the valve stem 35 is moved towards the left to cause a forward feeding movement of the grinding wheel, fluid may exhaust from the cylinder chamber 48 through port 47, pipe 46, port 45, and out through exhaust passage 91 and pipe 88 into the reservoir.

To obtain a fine feeding movement of the grinding wheel during the grinding operation, a manually operable micrometer feed mechanism is provided, comprising a nut 95 fixed to and depending from the intermediate slide 11. The nut 95 engages a feed screw 96 which is rotatably mounted in bearing (not shown) in the base of the machine. The forward end of the feed screw carries a gear 97 meshing with a pinion 98 mounted on the stud 99. The pinion 98 may be rotated by a manually operable hand wheel 100 so as to turn the feed screw to cause either a forward or rearward feeding movement of the grinding wheel. A pivotally mounted stop 101 is provided and arranged to engage an abutment 102 on the feed wheel 100. A suitable micrometer adjusting mechanism is provided so that the position of the abutment 102 may be adjusted angularly relative to the feed screw, to adjustably limit the forward feeding movement of the grinding wheel. This mechanism has been illustrated only as shown one embodiment of this feeding mechanism, since this micrometer mechanism does not in itself constitute a part of the present invention, and consequently has not been illustrated in detail. This mechanism may correspond to that shown in the expired patent to Norton, No. 762,838, dated June 14, 1904. For further details of the micrometer adjusting mechanism, reference may be had to the above-mentioned patent.

The operation of this mechanism is readily apparent from the foregoing disclosure. The operator first moves the control lever outwardly and towards the left into position 55a to shift the valve stem 35 and admit fluid pressure to the cylinder chamber 39 so as to move the parts into the position shown in the drawing, with the grinding wheel adjacent to but out of contact with the work. The operator then turns the feed wheel 100 in a counter-clockwise direction to feed the grinding wheel into the work. This feeding movement continues until the abutment 102 strikes the stop 101 which limits the forward feeding movement of the grinding wheel. During the feeding movement, the valve 76 may be in the position as illustrated in the drawing, with fluid under pressure passing through the pipe 83 into the cylinder chamber 84 so as to clamp the slide 14 rigidly to the intermediate slide 11. After the grinding operation has been completed, the operator backs the grinding wheel off by turning the feed wheel 100 in a clockwise direction to move the grinding wheel out of contact with the work and then pulls the lever 55 away from the base of the machine, to disengage the pin 65 from slot 66, and moves it into position 55b, shifting the valve stem 35 towards the right, as viewed in the drawing, to admit fluid through the pipe 46, port 47, into chamber 48, and causes a rearward positioning movement of the grinding wheel to rapidly move the grinding wheel away from the work.

Having thus described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. A grinding machine comprising a base, a support for rotatable work thereon, an intermediate slide mounted on the base for transverse movement relative to the work, a grinding wheel supporting slide supported solely by the intermediate slide and movable transversely relative thereto, fluid pressure mechanism for moving the wheel slide transversely relative to the intermediate slide, and means including an adjustable stop for moving the intermediate slide to locate the wheel in a predetermined position.

2. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said

wheel, a transversely movable intermediate slide interposed between said wheel slide and base, a fluid pressure mechanism connected to move one of said slides, means to move the other slide, and means including a fluid pressure mechanism to clamp to its support that slide which is moved by the fluid pressure mechanism.

3. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a transversely movable intermediate slide interposed between said wheel slide and base, a fluid pressure system including a cylinder and piston operatively connected between the wheel and intermediate slide to rapidly move the grinding wheel to and from an operating position relative to the work, and means including a second cylinder and piston which are operatively connected to said system and arranged to clamp the wheel slide rigidly to the intermediate slide.

4. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a transversely movable intermediate slide mounted on the base and supporting said wheel slide, a micrometer feeding mechanism including a nut and screw operatively connected between the intermediate slide and base to produce a fine feeding movement of the grinding wheel into the work to grind the work to a predetermined size, a fluid pressure system including a cylinder and piston operatively connected between the wheel and intermediate slide to rapidly position the grinding wheel, a dash pot cylinder formed in the end of said first cylinder and a dash pot piston fixed to said first piston, which are arranged to gradually slow down and stop the forward movement of said wheel slide to position the grinding wheel adjacent to but out of contact with the work, said parts being arranged so that fluid under pressure may be retained to hold the wheel slide in a fixed position relative to the intermediate slide during the grinding operation.

5. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a transversely movable intermediate slide interposed between said wheel slide and base, a fluid pressure system including a cylinder and piston operatively connected between the wheel and intermediate slides to rapidly move the grinding wheel to and from an operating position, a reversing valve arranged to admit fluid to either end of said cylinder so as to move the grinding wheel either towards or from the work, a second piston and cylinder which are operatively connected to said system and arranged to clamp the wheel slide rigidly to the intermediate slide, a valve arranged to admit fluid to said cylinder to clamp the wheel slide rigidly to the intermediate slide, and a single manually operable lever which is connected to control both of said valves so that the wheel slide may be moved either towards or from the work, or may be clamped rigidly into engagement with the intermediate slide.

6. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a transversely movable intermediate slide interposed between said wheel slide and base, a fluid pressure system including a cylinder and piston operatively connected between the wheel and intermediate slides to rapidly move the grinding wheel to and from an operating position, a valve arranged to admit fluid to either side of said cylinder to cause the wheel to be moved either towards or from the work, a second piston and cylinder in said system which are arranged to clamp the wheel slide rigidly to the intermediate slide, a valve to control the admission of fluid to said second cylinder, and a single control lever operatively connected to control each of said valves so that only one of said piston and cylinder mechanisms are operative at the same time.

7. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a transversely movable intermediate slide interposed between said wheel slide and base, a fluid pressure mechanism connected to move one of said slides, means to move the other slide, and means to secure to its support and hold immovable relative thereto that slide which is moved by the fluid pressure mechanism.

8. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, guiding and supporting ways on said wheel slide, a transversely movable intermediate slide which supports the wheel slide and is interposed between the wheel slide and the base, slideways on the top of said intermediate slide mating with the wheel slideways, mating supporting ways between the intermediate slide and base, a manually operable precision wheel feed mechanism operatively connected between the intermediate slide and base which is arranged to feed the grinding wheel into the work, and a fluid pressure system including a cylinder fixed to the wheel slide and a piston fixed to the intermediate slide to rapidly move the grinding wheel to and from an operating position relative to the work.

9. A grinding machine comprising a base, a work support, a rotatable grinding wheel, a transversely movable intermediate slide mounted on and supported solely by the base, a transversely movable grinding wheel slide supported solely by the intermediate slide and movable transversely relative thereto, a nut and screw feed mechanism operatively connected between the intermediate slide and the base, a micrometer wheel feed mechanism including a stop to rotate said screw to feed the grinding wheel into the work, and a fluid pressure means including a cylinder fixed to the wheel slide and a piston fixed to the intermediate slide to rapidly move the grinding wheel slide transversely relative to the intermediate slide so as to position the grinding wheel relative to the work.

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