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GRINDING MACHINE

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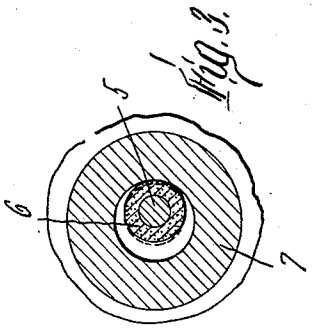


Fig. 3.

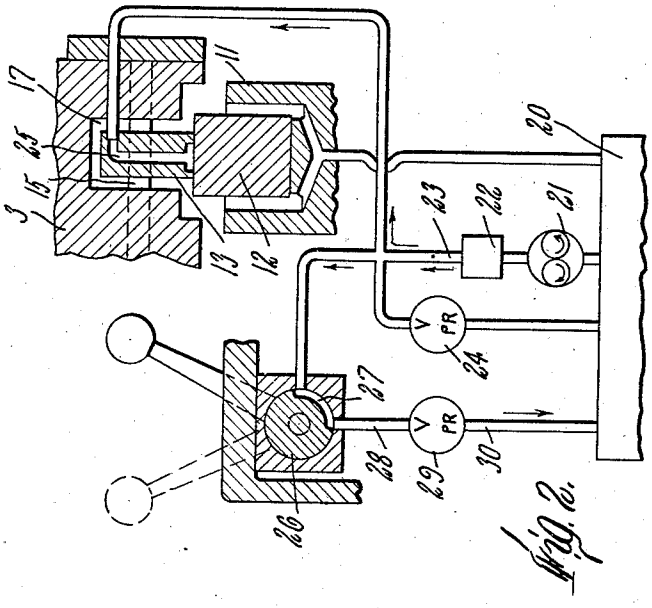


Fig. 2.

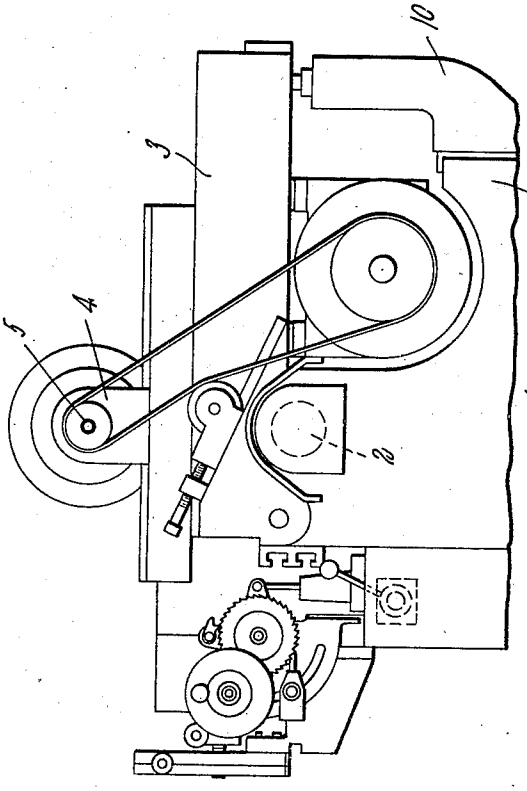


Fig. 1.

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GRINDING MACHINE

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2 Claims. (Cl. 51—2)

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In the operation of grinding work, it is important to relatively retract the grinding wheel and the work before they are separated or brought together axially in order to prevent overgrinding of that end of the work toward and from which the wheel is moved during such relative axial motion due to the longer time of contact between the wheel and work at that end than elsewhere and the spring of machine parts which causes deeper cutting as the effective cutting area of the wheel decreases. The amount of relative retracting motion necessary to prevent contact between the work and the wheel is ordinarily very small, only slightly more than is necessary to compensate for springing of the parts under working pressure.

The object of the present invention, therefore, is to provide simple and easily controlled means for producing the relief between the wheel and the work and by which the return to normal working conditions may be accurately insured.

Commonly the carriage which is movable to effect relative traverse between the wheel and work and which supports either the grinding wheel or the work, is mounted to traverse fixed ways, and to facilitate such traverse the ways are lubricated. Lubricant is introduced between the ways and the cooperating parts of the carriage, and in order to provide the desired relief, in accordance with this invention the pressure of the lubricant introduced between one of these ways and its cooperating carriage part is changed from normal pressure, this way being a sufficient distance from the part, either the wheel or the work, so that slight changes of position of the cooperating part of the carriage due to the pressure change is effective to produce the desired relative retraction between the wheel and the work.

For a complete understanding of this invention, reference may be had to the accompanying drawing in which

Figure 1 is a fragmentary end elevation of an internal grinding machine to which the invention is applied.

Figure 2 is a fragmentary cross sectional view through the rear support for the carriage of the machine shown in Figure 1, together with a diagrammatic view of the pressure control system.

Figure 3 is a detail sectional view through the work piece and grinding wheel in normal grinding relation, the retracted portion of the wheel relative to the work being shown in dotted lines.

Referring to Figure 1 of the drawing, at 1 is indicated a grinding machine bed which slidably

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and rockably supports a bar 2. On this bar is supported a traversing carriage 3. This carriage 3 carries a grinding wheel suport 4 in which is journaled a grinding wheel shaft 5 having a grinding wheel 6 at one end. This grinding wheel cooperates with a piece of work, such as shown at 7 on Figure 3, which is rotatably supported in any well known manner on a work support which is fixed to the bed 1, so that when the carriage 3 is moved lengthwise of the axis of the bar 2, the grinding wheel is caused to traverse lengthwise of the work. The supports for the bar 2 constitute one set of ways for supporting the carriage for traversing motion.

In the form of machine shown, another way, also supporting the carriage and spaced from the first set of ways, comprises a bracket 10 projecting from the rear face of the machine bed and carrying at its upper end a trough shaped portion 11 as shown best in Figure 2. This trough shaped portion is arranged to carry a supporting control plate 12 upon which slidably engages a shoe 13 carried by the carriage 3. For example, this shoe may be pivoted on an axis element 15 extending across a slot 17 in the under side of the carriage 3. The control plate 12 thus constitutes a second way spaced from and parallel to the set of ways which supports the fulcrum bar 2. These several ways properly support the carriage for its traverse sliding motion. In order that this motion may be easy, lubricant is introduced between the slide shoe 13 and the control plate 12. The ways which support the bar 2 are also lubricated by any suitable means (not shown).

Under normal grinding conditions the work holder and carriage are so related that the grinding wheel engages the inner face of the work, as shown in Figure 3 in full lines, and under these conditions a lubricant is introduced between the slide shoe and the control plate at a pressure only sufficient to insure good lubrication. However, by increasing the fluid film pressure the slide shoe 13 may be lifted slightly from its normal position in lubricated sliding relation to the control plate 12, rocking the carriage about the axis of the bar 2 and retracting the grinding wheel from the full to the dotted line position of Figure 3 out of contact with the work. Means for doing this are shown diagrammatically in Figure 2. Lubricant is taken under pressure from a tank 20, as by the pump 21 through a strainer 22 into the pressure pipe 23. This pressure pipe has one branch leading to a pressure relief valve 24 discharging back into the tank 20. Another branch of this pipe 23 leads to a passage 25 in the slide shoe 13 and

opens out at the foot of this shoe. Another branch of this pipe **23** leads to a hand operated valve **26** located in convenient position for the operator. This valve has a valve plug provided with a peripheral slot **27**, and in the position shown in Figure 2, the fluid under pressure may pass from the pipe **23** through the valve passage **27** into the pipe **28** which has a relief valve **29** discharging through a pipe **30**, back into the tank. The relief valve **29** is set for a lower pressure than the relief valve **24**, the relief valve **29** being so set as to maintain the pressure in the pipe **23** only at its relatively low lubricating value, this being the condition of normal traverse of the carriage while the grinding wheel is acting upon the work. If now, it is desired to retract the grinding wheel from the work, as, for example, when the wheel is to be retracted axially, or is to be moved up axially into work contact, it is only necessary to turn the plug of valve **26** from the full line position of Figure 2 to the dotted line position, whereupon communication with the low pressure relief valve **29** is cut off and the pressure in the pressure pipe **23** is determined by the setting of the higher pressure relief valve **24**. The pressure in the pipe **23** then builds up and is communicated between the slide shoe **13** and the control plate **12**, thus lifting the back end of the carriage **3** sufficiently to rock the grinding wheel forwardly until it is relieved from the work. The wheel may then be retracted or returned to grinding position axially of the work while out of contact therewith so that no over-grinding of the work is produced. When the wheel has been returned to operative lengthwise relation of the work, the handle of the valve **26** is turned to the full line position, whereupon the lubricant under pressure in excess of that for which the pressure relief valve **29** was set is relieved through this valve and back to the tank, thus reducing the lubricant pressure between the slide shoe **13** and the control plate **12** and allowing the slide shoe to drop to its normal work grinding position, so that grinding is then begun. Since the lubricant for the fulcrum bar **2** remains unaffected, the effect of pressure changes between the slide shoe and the control plate is to rock the carriage about the axis of the fulcrum bar **2**, to bring the wheel either from or toward the work as may be desired.

While as shown the grinding wheel is carried by the traversing carriage and the work is supported by the bed, it will of course be evident that the traversing carriage might carry the work and the grinding wheel shaft be journaled in position in a fixed wheel support carried by the bed, as is well known in the art.

It will also be evident to those skilled in the art that various other changes and modifications might be made without departing from the spirit or scope of this invention.

We claim:

1. In a grinding machine, a carriage, spaced ways for supporting said carriage for sliding motion, said machine having a work support and a grinding wheel support, one of said supports being carried by said carriage and movable by the sliding of said carriage to cause a grinding wheel on said grinding wheel support to traverse work on said work support, a pair of sources of lubricant under two different pressures, and means for selectively introducing such lubricant from either of said sources between said carriage and one of said ways to cause, by change from one to the other pressure, change in relative positions of said wheel and work laterally of the direction of sliding motion of said carriage.

2. In a grinding machine comprising a bed, a bar mounted for axial sliding motion in said bed, a carriage supported on said bar, a guide carried by said bed spaced from and parallel to said bar, said carriage having a shoe slidably resting on said guide, a grinding wheel support, a work support, one of said supports being carried by said carriage and the other of said supports being carried by said bed, sliding motion of said carriage producing relative traverse between a wheel carried by said wheel support and work carried by said work support, two sources of lubricant under different pressures, and means for selectively introducing lubricant from either source between said shoe and guide whereby the change of pressure of lubricant between said shoe and guide changes the angular position of said carriage about the axis of said bar and the corresponding relation of the wheel and work laterally of the direction of slide of said carriage.

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