

Nov. 17, 1931.

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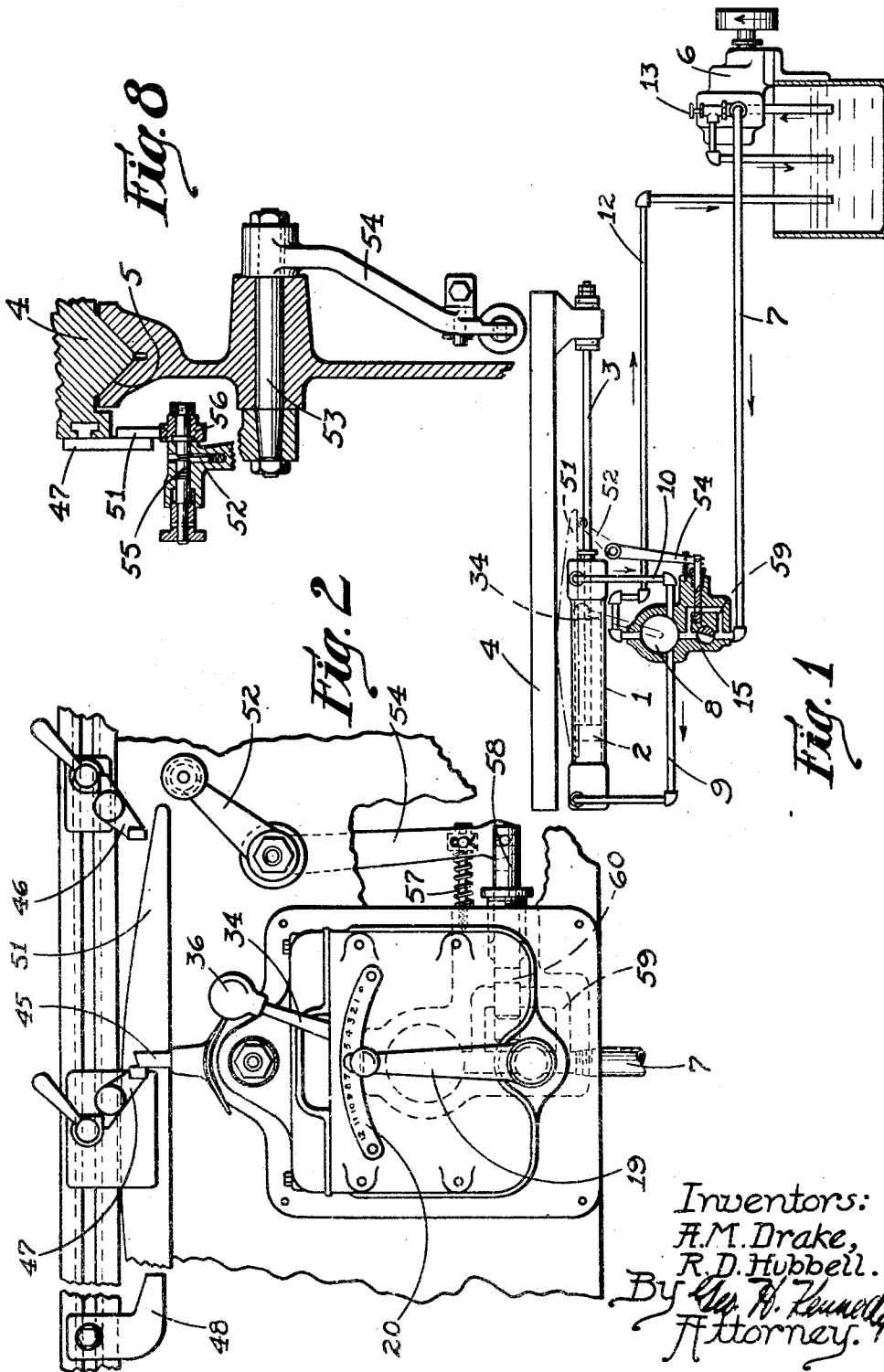
1,832,365

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FOR GRINDING MACHINES AND THE LIKE

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Filed Jan. 9, 1922

2 Sheets-Sheet 1



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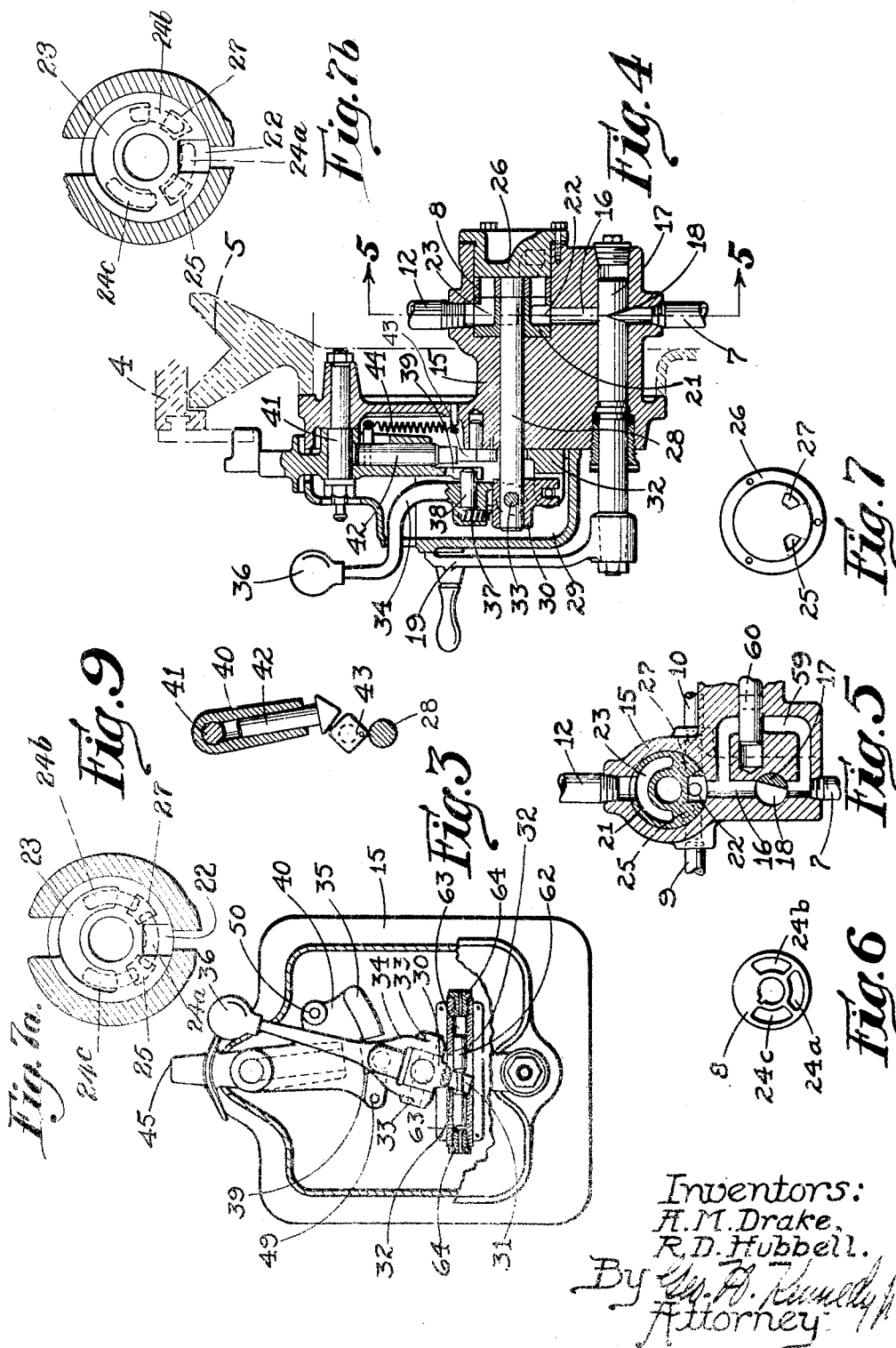
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FLUID PRESSURE CONTROLLING AND REVERSING MECHANISM FOR GRINDING
MACHINES AND THE LIKE

Application filed January 9, 1922. Serial No. 528,118.

The present invention relates to fluid pressure mechanism for controlling and reversing the movements of reciprocatory machine elements,—being here shown and described, by way of example, in connection with a grinding machine table. The invention, however, is susceptible of application to numerous other and different uses, wherein fluid under pressure, through the common form of a hydraulic cylinder and piston device, is employed as the actuating medium to procure and control the reciprocatory movements of various parts of machinery.

The features of the invention are fully set forth hereinafter, reference being had to the accompanying drawings, wherein—

Fig. 1 is a diagrammatic view of a fluid pressure actuating system applied to the table of a grinding machine, and showing our invention in connection therewith.

Fig. 2 is an exterior view, in side elevation, of the control mechanism for the fluid pressure system.

Fig. 3 is a similar view, with certain parts broken away, or removed, to disclose the interior arrangement.

Fig. 4 is a transverse sectional view of said control mechanism.

Fig. 5 is a sectional view on the line 5—5 of Fig. 4, showing the valve passages for the fluid pressure medium.

Fig. 6 is a detail view of the oscillating valve member.

Fig. 7 is a detail view of the valve cap or closure.

Figs. 7a and 7b are diagrammatic views of the valve ports and associated passages, and shown respectively in neutral and in one operative position.

Fig. 8 is a fragmentary detail view of certain of the parts shown in Fig. 2.

Fig. 9 is a fragmentary detail view of certain of the parts shown in Fig. 4.

Like reference characters refer to like parts in the different figures.

Referring first to Fig. 1, there is shown, diagrammatically, a fluid pressure cylinder 1, the latter containing the usual double acting piston 2 which is suitably connected, as by rod 3, with the element 4 to be reciprocated,—

here shown as the table of a grinding machine, which table is slidable in ways 5, 5, (Figs. 4 and 8) provided by the machine framework. The piston 2 is actuated by the admission of a fluid under pressure to one end or the other of the cylinder 1, said pressure fluid being forced by pump 6 into a supply pipe 7, the latter leading to a valve device 8, the position which, as hereinafter described, determines the admission of pressure medium to one end or the other of cylinder 1, by way of pipe 9 or pipe 10, as the case may be.

Said pressure medium makes its return to the pump from the cylinder by way of exhaust pipe 12, leading directly from the valve device 8 to the supply tank. By the arrangement of mechanism above described, the movement of table 4 is obtained, it being understood that travel in each direction of the piston 2 is directly under the control of the valve device; the movement of the latter into its different positions procuring, in the manner well known in the grinding machine art, the starting, stopping and reversal of the pressure actuated devices.

The valve device 8 is shown most clearly in Figs. 5, 6 and 7, 7a and 7b and its appurtenant parts, whereby its actuation is controlled by the operator and by the movement of the table, are shown in Figs. 2, 3 and 4. These parts are conveniently disposed in a casting 15 bolted to the front of the machine frame, said casting providing a passage 16 to the valve member proper from the fluid pressure supply pipe 7. The passage 16 is provided with a rotatable throttle valve 17, the latter having a cutaway portion 18 where it crosses the passage 16, as shown in Figs. 4 and 5. The valve 17 is adapted to be manipulated by a handle 19, the latter swinging over a scale 20 into different positions, indicative of a greater or less flow of pressure medium through the passage 16, whereby to speed up or slow down, as desired, the reciprocations of the piston 2.

The passage 16 opens into a stationary member 21, Figs. 4 and 5, constituting a seat for the rotatable reversing valve 8, hereinafter referred to. Said seat 21 has one recess

22 in constant communication with passage 16 and a separate independent recess 23 in constant communication with the return pipe 12 to the supply tank. The oscillating valve 8, as shown in Fig. 6, has three apertures, 24a, 24b and 24c therethrough; in the right hand extreme position of the valve handle, the aperture 24a connects seat recess 22 with the opening 25 in end closure cap 26, Figs. 4, 5 and 7, making direct connection from passage 16 to the left hand cylinder supply pipe 9, as shown diagrammatically in Fig. 7b. At the same time aperture 24b connects the opening 27 in end cap 26 with the recess 23 in valve seat 21, thus making a direct connection from the right hand cylinder pipe 10 to exhaust pipe 12, as shown diagrammatically in Fig. 7b. Under these conditions, the pressure fluid passes from the pump through the valve 8 and the left hand pipe 9, driving the piston 2 and thereby the table 4 to the right, the fluid in the right hand end of the cylinder escaping through pipe 10, opening 27, aperture 24b, recess 23 and pipe 12 to the supply tank.

In the extreme left hand position of the valve handle, i. e., the reverse position from that illustrated in Fig. 7b, the aperture 24a connects recess 22 with the opening 27 in the end cap 26, making a direct connection from passage 16 to the right hand cylinder supply pipe 10, thus forcing the piston to the left. The fluid in the left hand end of the cylinder returns to the tank through pipe 9, openings 25, 24c, recess 23 and pipe 12.

In the intermediate or neutral position of the valve 8, as shown diagrammatically in Fig. 7a, connection is made from recess 22 through aperture 24a to both ports 25 and 27 and also around the partitions in valve 8 to recess 23 and return pipe 12. In this neutral position, the narrow partition between valve apertures 24a and 24b is across the cap opening 27, but does not completely cover it, and the similar narrow partition between apertures 24a and 24c is across the cap opening 25 and likewise does not completely cover it; thus the valve 8 in this neutral position establishes direct communication between the inlet seat recess 22 and the outlet seat recess 23. This gives what may be called a bleeding valve, as it allows the fluid to be pumped around through the supply pipe 7 and return pipe 12 without building up an excessive pressure. In other words, the flow of fluid, in this neutral position, is not discontinued, as is the case in certain prior constructions, and consequently, the relief valve 13 on the pump 6 is called upon for much less service than would otherwise be the case, so that a smaller valve will suffice.

Since the pressure is equal in this neutral position through the ports 25 and 27, no effort is exerted by the fluid to move the table, which is thus in a balanced condition. This

secures the further advantage that if it should be desirable to move the table at any time by a hand wheel, or other mechanical means, the fluid is not locked in the cylinder by the valve, but can pass out freely in either direction so that in the neutral position of the valve, as illustrated diagrammatically in Fig. 7a, the table can be moved freely in any way desired.

The shaft 28 of valve 8 has its free end projecting into a lubricant containing box 29, mounted on the front of casting 15, and said free end has secured thereto a block 30. The block 30 has a downward projection 31 which works between a pair of fixed spaced stops 32, 32, which limit the oscillation of valve 8 on its axis in both directions. The stops 32 have aligned opposing openings 63, 63 for a plunger 62, these openings being closed at their outer ends by screw caps 64, 64, each having a small bleed hole. The plunger 62 is made smaller in the middle to receive the end 31 of the block 30, and it serves to control the speed at which the valve 8 swings over, producing a dash-pot effect at each end of the travel of the valve.

At right angles to the axis of the valve shaft 28 are provided trunnions 33, 33 for the pivotal attachment of a control lever 34, having a knob 36 in convenient reach of the operator. A spring 37, disposed in a suitable recess of the lever 34, yieldingly maintains said lever in the position illustrated in Fig. 4, whereby an inwardly projecting pin 38 of said lever is normally disposed in a notch 39 of an oscillating segment 40, Fig. 3. When the knob 36 of direction control lever 34 is depressed, against the force of spring 37, the rocking of lever 34 about the trunnions 33 withdraws the pin 38 from notch 39, thereby freeing the lever 34 from the segment 40, and allowing the valve shaft 28 to be rocked by hand in either direction.

The oscillating segment 40 is pivoted on a shaft 41, and is recessed on its rear side to provide a slideway for pin 42, which, as shown in Fig. 9, has its end enlarged in triangular form to provide flattened angular surfaces for cooperation with similar surfaces of a stationary member 43. The pin 42 is held in contact with the member 43 by a spring 44; the movement of oscillating segment 40 in either direction, causes the pin 42 to recede in its socket, thus distending the spring 44, and as said pin is carried over dead center, the spring 44 acts to carry the segment 40 through the last half of its movement which procures the reversal of valve 8.

As shown in Fig. 2, the segment 40, above its pivotal point, has a projection 45, the latter adapted to be engaged by stops or table dogs 46, 47 and 48, such as are usually carried by a grinding machine table, or other reciprocating machine element. The stops

or dogs 46 and 47 are here indicated as those which are ordinarily adjustable, along the edge of the table, to engage the projection 45 alternately, whereby to reverse the direction of travel at each engagement and to fix the throw or length of table travel, for any given operation. The third stop or dog 48 is adapted to be engaged by the projection 45 at the outer limit of the return movement of the table, in order to bring said table to rest at this point. In the normal operation of the mechanism, the stops 46 and 47 being set the desired distance apart, the travel of the table 4 to the left, Fig. 2, brings the stop 46 ultimately against the projection 45, rocking the segment 40 in a counterclockwise direction and causing the notch 39, by its engagement with pin 38, to throw the direction control lever 34 to the right; this movement, being continued by the spring pressed pin 42, rocks the valve shaft 28, causing the valve 8 to reverse, and admit pressure medium to the other or left hand side of piston 2. Coincident with this shifting of the direction control lever to the right, the table begins to move in the right hand direction, ultimately bringing the stop 47 against the projection 45, so as to rock the segment 40 clockwise; this in turn, in the manner above described, rocks the direction control lever to the left, thereby reversing the valve again and causing admission of pressure medium to the right hand side of piston 2.

If for any reason it is desired to interrupt or change in any way this normal automatic operation of the mechanism, the operator has merely to seize the handle 34 of the direction control lever and depress the same so as to remove the pin 38 from its notch 39; and then he is at liberty to move it to neutral to stop the motion of the table, or secure its immediate reversal, although this last mentioned function can be secured without withdrawing pin 38. When handle 34 is depressed, with the segment 40 at either end of its travel, the pin 38 rests on the surface 35 of segment 40 when in neutral position, and will remain there with the table stationary until handle 34 is thrown in either direction, at which time the table will immediately begin to move in that same direction. Whichever direction is selected, the normal position of the parts is automatically restored, either immediately or after the first reversal of segment 40, by cooperation of the pins 49, 50 projecting from the face of the segment 40, which engage the lever 34 to move it into the position of registration of pin 38 with notch 39.

The projection 45, as ordinarily made, is bevelled away at the upper end, as shown in Fig. 2, to make it possible for the stop 47 to pass over said projection, when it is desired to procure the full right hand movement of the table for the purpose of inspecting or

gauging the work. Under these conditions, the lever 34 is depressed as the table moves to the right, and as the stop 47 acting upon projection 45 does not reverse the valve 8 because pin 38 has been withdrawn from notch 39, the table continues to move to the right, segment 40 swinging over till stop 47 passes over projection 45. Finally the stop 48 strikes projection 45, whereupon the segment 40 is rocked sufficiently so that pin 50 forces lever 34 to a vertical and thereby neutral position, thus stopping the further motion of the table.

This extended movement, taking place while no work is being done, need not occur at the relatively slow speed of the working strokes; for this reason, it is proposed, in order to save time, that such movement be at the maximum speed of the table, irrespective of the setting of speed control lever 19. As shown in Figs. 2 and 8, the stop 47 carries a bar 51, the latter adapted to engage the upper end of a rocking lever 52 immediately after stop 47 has passed over projection 45. The lever 52, as shown in Fig. 8, has a pivoted stud 53 to which is secured an arm 54. The engagement of projection 51 with the end of lever 52 may be obtained or not, as desired; the end of said lever, as shown in Fig. 8, has a transverse bore in which is received a plunger 55, the latter carrying a portion 56 which, when the plunger is withdrawn to its outer limit as shown in Fig. 8, stands in the path of the bar 51. In this position of the plunger, the engagement of the bar 51 is assured; when the plunger is pushed in, however, no engagement takes place and there is no change in the speed of the table as it moves to its extreme outward position.

The depending arm 54 is acted upon by spring 57, which maintains the end of lever 56 in the path of projection 51, and also yieldingly urges to the right, Fig. 2, a slidable member 58, to which the lower end of arm 54 is yoked. The slidable member 58 enters the casting 15 containing the valve mechanism, and its bore intersects a passage 59, parallel to the passage 16, and by-passing the speed control valve 17, as shown in Figs. 1, 2 and 5. The member 58 in its normal position, as illustrated in Figs. 2 and 5, closes this passage 59; however, when the lever 52 is rocked by engagement therewith of the projection 51, said member 58 is forced inwardly, bringing a passage 60 thereof into register with the by-pass 59. This admits the full unthrottled supply of pressure fluid to the valve 8, irrespective of the position of speed control valve 17, and thus allows the outward movement of the table to take place at maximum speed until it is finally brought to rest at the limit of said outward movement by the operation of dog 48 bringing lever 34 to a middle or neutral position.

In this way no time is lost in rendering the work available for inspection or gauging by the operator. Furthermore, no time is lost bringing about a resumption of the automatic reciprocations of the table, since the operator has merely to throw the direction control lever 34 to the left, whereupon the table will immediately start in the same direction also at maximum speed, the passage 60 still being in register with the by-pass 59. However, as soon as the stop 47 has moved past the projection 45, the engagement of bar 51 with lever 52 ceases, and the parts return to normal operation, so that the regular working reciprocations of the table as determined by the distance between the stops 46 and 47 are resumed at once at the throttled down speed controlled by lever 19 and valve 17.

It is to be noted that this restoration of normal operation takes place automatically, as the reduction in speed is also effected without the necessity of any intervention by the operator, except to start the table by moving the control lever or handle 34 in the first named instance—thereby distinguishing from previous constructions wherein the increased or maximum speed on this withdrawal movement of the table is obtainable by the manual operation of a fluid pressure by-pass valve. With such prior constructions, the operator must exercise extreme care, as the table on its return movement approaches the work, and must make sure that the maximum speed of the table is discontinued, before operation on the work is resumed. According to the present construction, the necessity for this watchfulness is eliminated, since the speed of the table is throttled automatically at the instant that the bar 51 moves off of lever 52,—or just before the regular working stroke of the table is resumed.

We claim:

1. Apparatus of the class described, comprising a table reciprocable by fluid under pressure, a reversing valve for the pressure fluid, adjustable stops on said table for operating said valve, to procure the reversals of said table, and means for adjusting the flow of pressure fluid to control the speed of said table, in combination with an operating lever for said valve, said lever in its normal position being actuated by said stops, means responsive to deflection of said lever from said normal position for causing the inoperative traverse of one of said stops, and means responsive to the ensuing movement of said table, beyond the normal reciprocatory path determined by said stops, for rendering said speed adjusting means ineffective.

2. Apparatus of the class described, comprising a table reciprocable by fluid under pressure and carrying adjustable valve-operating stops, and a reversing valve for the pressure fluid, actuated alternately by said

stops, to change the direction of travel of said table, in combination with an operating lever for said valve adapted in its normal position to transmit thereto the motions imparted by said stops, said lever being movable, without disconnection from said valve, from said normal position, to discontinue the operation of said valve by one of said stops, thereby procuring the travel of said table beyond the reciprocatory path determined by said stops.

3. In apparatus of the class described, a reciprocating element actuated by fluid pressure, a reversing valve for the pressure fluid, and a lever by which said valve is moved, in combination with a swinging member engageable by dogs on said element, and having a connection with said valve lever adapted to be rendered inoperative to permit independent movement of the latter, and means carried by said member for automatically restoring said connection.

4. In apparatus of the class described, a reciprocating element actuated by fluid pressure and having a predetermined working stroke, a throttle valve for the pressure fluid to control the speed of said element, and means for automatically by-passing said throttle valve when said element is moved to and from its working position.

5. In apparatus of the class described, a reciprocating element actuated by fluid pressure and having a predetermined working stroke, a throttle valve for the pressure fluid to control the speed of said element, means for procuring movement of said element at maximum speed, unaffected by said throttle valve, when travelling toward its working position, and means responsive to the travel of said element for automatically discontinuing said maximum speed, in advance of the resumption of said working stroke.

6. In apparatus of the class described, a reciprocating element actuated by fluid pressure and having a predetermined working stroke, a throttle valve for the pressure fluid to control the speed of said element, means for procuring movement of said element at maximum speed, unaffected by said throttle valve when travelling away from its working position, and means responsive to travel of said element toward its working position for automatically discontinuing said maximum speed in advance of the resumption of said working stroke.

7. A grinding machine having, in combination, a carriage having an idle position and a position in which it reciprocates, a piston and cylinder unit for moving said carriage, a control valve connected to a source of pressure fluid and to said piston and cylinder unit, a valve operating device, means on said carriage for moving said device when the carriage is in its reciprocating position to automatically reverse said valve and effect

reciprocation of said carriage, and means on the carriage for operating said device when the carriage is at its idle position to move said valve to its neutral or inactive position and thereby stop reciprocation of said carriage.

8. A grinding machine having, in combination, a slidably mounted carriage, pressure fluid means for reciprocating said carriage including a control valve, a lever for operating said valve, and a stop on said carriage arranged to engage said lever and move said valve to neutral position to discontinue the movement of said carriage.

9. A grinding machine having, in combination, a reciprocatory carriage having an idle position and an operative position, pressure fluid means for moving said carriage including a control valve, an operating device for said valve, means on said carriage to actuate said operating device when the carriage approaches its idle position to move the valve to neutral position, and separate means on said carriage which automatically comes into operative relation to said operating device in the movement of said carriage from idle to operative position for automatically reciprocating said operating device to reverse said control valve and thereby effect continuous reciprocation of said carriage in its operative position.

10. A machine of the character described having, in combination, a carriage having an operative position and an idle position remote from said operative position, and mechanism arranged to reciprocate the carriage in its operative position to return the carriage to its idle position and to automatically stop the carriage at its idle position.

11. In a grinding machine, a grinding wheel, a slidably mounted carriage having reciprocatory movement in its working position, to produce a relative grinding traverse between the work and said wheel, speed-controlling means effective on said carriage in said working position, and means set in operation by travel of said carriage away from said working position to render said speed-controlling means ineffective on said carriage for substantially the length of said travel.

12. In a grinding machine, a grinding wheel, a slidably mounted carriage, means for reciprocating said carriage at a predetermined speed in its working position, to produce a relative grinding traverse between the work and said wheel, means for extending the movement of said carriage in one direction, to effect separation of wheel and work, and means brought into action by said extended carriage movement for increasing the speed of said carriage.

13. In a grinding machine, a slidably mounted carriage having a working position and an idle position, means for reciprocating said carriage in said working position at an adjusted speed, and means made effective by

travel of said carriage between said two positions for establishing a higher carriage speed, without disturbance of said speed adjustment.

14. In a grinding machine, a slidably mounted carriage having a working position and an idle position, means for reciprocating said carriage in said working position at an adjusted speed, means made effective by travel of said carriage between said two positions for establishing a higher speed, without disturbance of said adjustment, and means operative at a predetermined point in the travel of said carriage from idle position toward said working position, for restoring said adjusted speed.

15. In a grinding machine, a slidably mounted carriage having a working position and an idle position, fluid pressure means for moving said carriage, reversing devices co-operating with said fluid pressure means for reciprocating said carriage in said working position, a throttle valve to control the speed of said working reciprocations, means for disabling said reversing devices, thereby to make said fluid pressure means effective for the movement of said carriage away from working position, and means brought into action by said last named movement for rendering said throttle valve ineffective, thereby to procure travel of said carriage to its idle position at an increased speed.

16. In a grinding machine, a grinding wheel, a slidably mounted carriage, fluid pressure means for reciprocating said carriage in its working position, to traverse the work with said wheel, a throttle valve effective on the pressure fluid to control the speed of said working reciprocation, means for extending the movement of said carriage in one direction, to effect separation of wheel and work, and a by-pass for the pressure fluid, around said throttle valve, said by-pass being opened by said extended movement of said carriage, to increase the latter's speed when wheel and work are separated.

Dated this 4th day of January, 1922.

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