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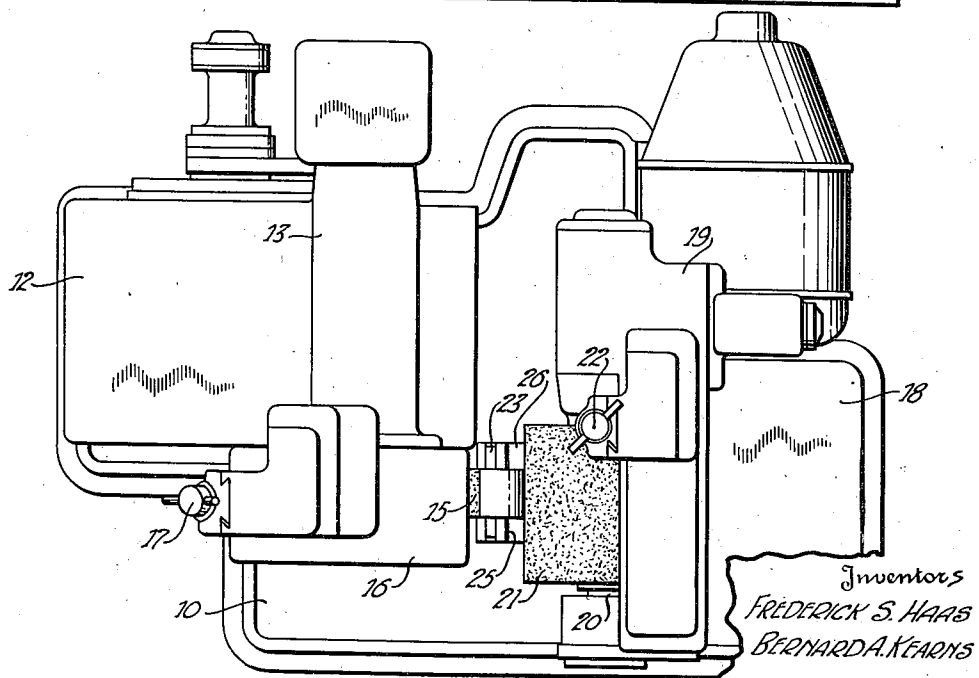
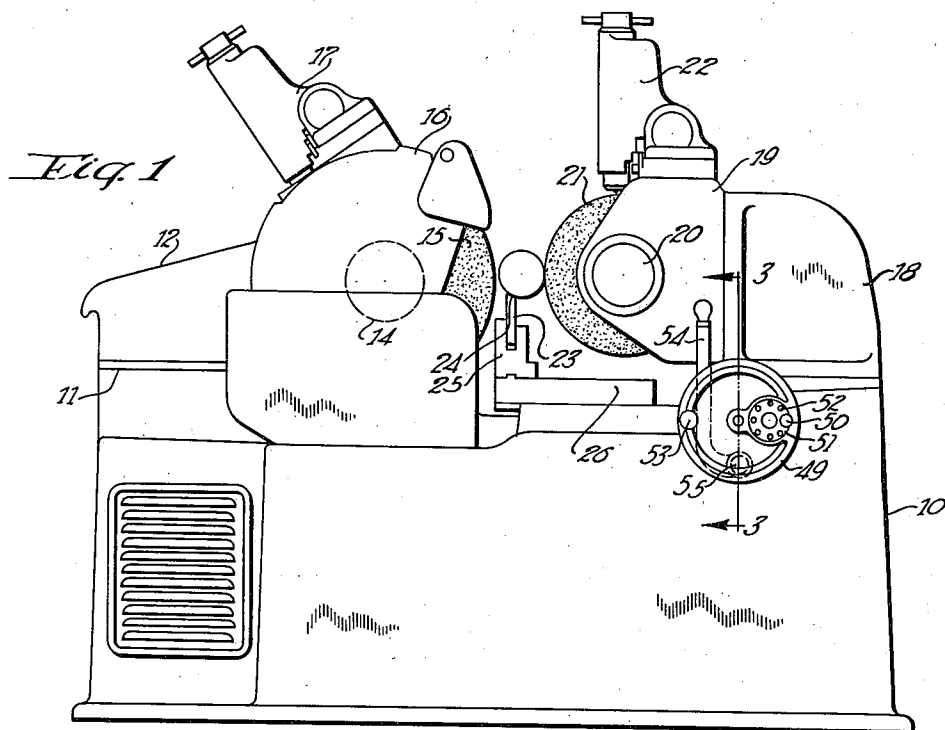
F. S. HAAS ET AL

2,033,335

GRINDING MACHINE

Filed April 4, 1932

3 Sheets-Sheet 1



Inventors
FREDERICK S. HAAS
BERNARD A. KEARNS

By

OK Parsons

Attorney

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3 Sheets-Sheet 2

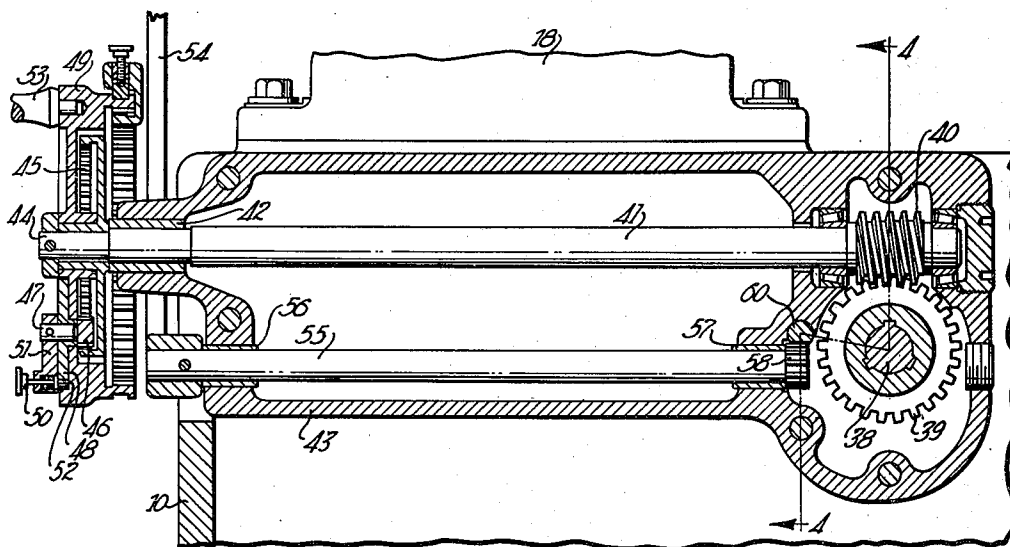


Fig. 3

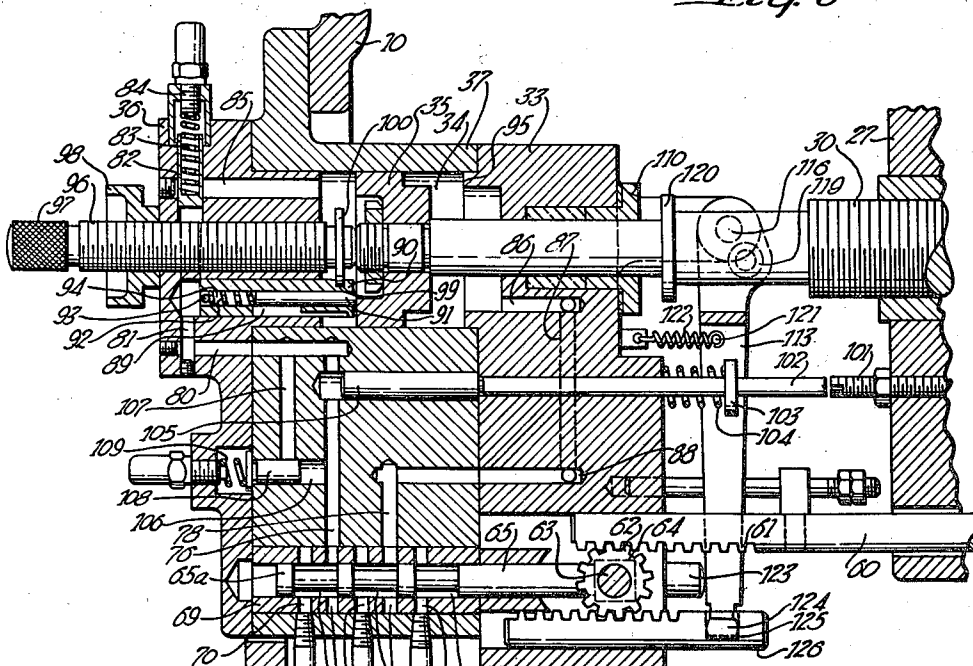
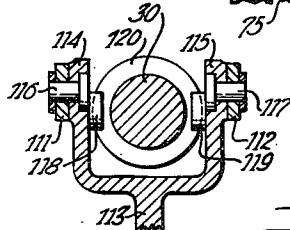


Fig. 5



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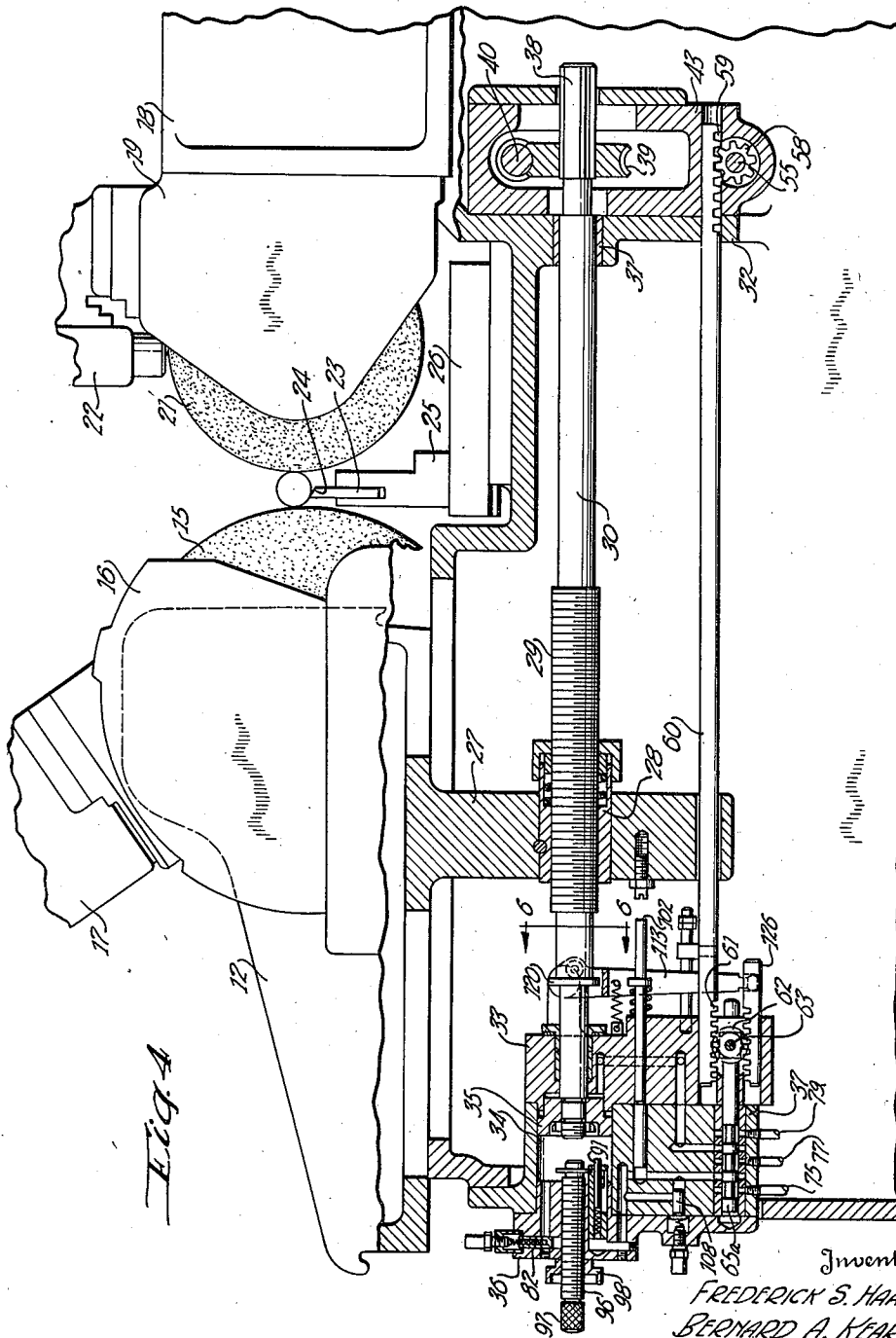
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GRINDING MACHINE

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3 Sheets-Sheet 3



288-65a Inventors
FREDERICK S. HAAS
BERNARD A. KEARNS

By

OK Parsons

Attorney

UNITED STATES PATENT OFFICE

2,033,335

GRINDING MACHINE

Frederick S. Haas and Bernard A. Kearns, Cincinnati, Ohio, assignors to Cincinnati Grinders Incorporated, Cincinnati, Ohio, a corporation of Ohio

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11 Claims. (Cl. 51—103)

This invention relates to improvements in machine tools and especially to improvements in machine tools having a movable or shiftable part adapted to be actuated relative to the tool at feeding and rapid traverse rates, such as the slide carrying a work piece or a tool adapted to be fed one relative to the other.

An object of the invention is the provision of improved feeding and control means for a machine tool organization.

Another object of the invention is the provision of a feeding mechanism for actuating a part of a machine tool organization that is comparatively heavy and would normally require considerable exertion on the part of the operator to move same whereby the total exertion necessary is simply to move a light control element.

A further object of the invention is the provision of an hydraulically controlled feeding mechanism that is substantially automatic in its operation, requiring simply the shifting of a valve on the part of the operator and in which the rate of feed takes place at the same rate and amount the valve is shifted.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification considered in conjunction with the accompanying drawings forming a part thereof and it is to be understood that any modifications may be made in the structural details there shown and described within the scope of the appended claims without departing from or exceeding the spirit of the invention.

In the drawings:

Figure 1 is an elevational view of a machine tool such as a grinding machine, embodying the improvements of this invention.

Figure 2 is a top plan view of the machine shown in Figure 1.

Figure 3 is a fragmentary sectional view taken on line 3—3 of Figure 1.

Figure 4 is a longitudinal sectional view through the machine showing the feeding mechanism in development as seen substantially from line 4—4 of Figure 3.

Figure 5 is an enlarged developed view of the hydraulic actuating and control means showing the parts in a different position from that shown in Figure 4.

Figure 6 is a view as seen from line 6—6 of Figure 4 and forming a detail in the valve operating mechanism.

Throughout the several views of the drawings

similar reference characters are employed to denote the same or similar parts.

In the past machine tools have been utilized in which one of the members, such as the tool or the work, was movable relative to the other to effect a feed or other movement between the said tool and work. These members were frequently shifted or actuated by manual means through a direct screw and nut connection, one of said elements being manually actuated throughout the entire movement of the said member. These members are frequently of considerable weight, requiring considerable effort and energy on the part of the operator to effect the desired movement, and the member is moved only to the extent that the operator actually adjusted it so that upon the cessation of the actuating motive force the member stopped. Also, the member is actuated at the rate that the operator actually adjusted the screw or nut element, which was frequently at not the most desired rate, but a compromise thereof depending upon the skill of the operator and the weight or cumbersomeness of the member. By this invention the operator is relieved of actually shifting the member, he being required solely to actuate or trip a simple element such as a valve in an hydraulic control unit, retaining however the complete control of the rate and amount of movement of the member.

The invention has been shown in the drawings as applied to a centerless grinder, but it is to be understood that it has equal application to other types of machine tools in which the sole requirement is a relative movement between a tool and a work piece or other members thereof which are to be moved relative to one another. The machine shown in the drawings comprises a bed 10 having formed on the upper surface thereof a guideway 11 for the grinding wheel support or carriage 12 and guides said carriage during its movement longitudinally of the bed 10. The carriage 12 has formed integral therewith or secured thereto a bearing portion 13 forming the head in which is journaled a spindle 14 for the grinding wheel 15. The spindle 14 and wheel 15 are adapted to be rotated at a high grinding rate of speed in a clockwise direction. The grinding wheel 15 is substantially enclosed in a hood or guard 16 to confine the coolant normally directed on the grinding wheel. This hood 16 is provided with suitable support and guideway for guiding a truing tool 17 transversely of the wheel to true the operative face thereof.

The bed 10 is further provided on its upper surface with a bracket or support 18 to which is secured in any desirable manner a head 19 having journaled therein a spindle 20. Secured to the spindle 20 is a wheel 21 rotated in a clockwise direction at a comparatively slow work controlling rate of speed. The head 19 substantially encloses the regulating wheel 21 and has formed on its upper surface a guideway for guiding a truing tool 22 transversely of the wheel 21 to maintain the said wheel in a true, clean condition.

The wheels are spaced from one another a distance to form a grinding throat through which the work passes while being reduced in diameter. This is especially true of work pieces that are of a uniform diameter throughout their length and are ground by the through feed method, namely while passing continuously through the grinding throat. Work pieces having two or more diameters or a shoulder intermediate their length are ground by the infeed method which consists in opening the grinding throat to permit insertion of the work therein, whereupon the throat is contracted to reduce the work to the ultimate final size and then the throat opened to permit a withdrawal of the work therefrom. The work, while being operated upon, is peripherally supported by a work rest blade 23 having its upper surface inclined as at 24 and inclining in the general direction of the operative face of the regulating wheel 21 and forming therewith a work receiving trough. The blade 23 is carried by a block 25 secured in any desirable manner to the forward end of a slide 26 mounted on and secured to the upper surface of the bed 10.

This invention, when utilized with centerless grinders, is particularly useful while performing infeed grinding operations which as above noted requires successive opening and closing of the grinding throat. As above described the grinding wheel carriage 12 is adapted to be translated relative to the bed 10 toward and from the regulating wheel 21 and for which purpose it has depending interiorly thereof a lug or the like 27 in which is secured a nut 28 for threaded engagement with the threaded portion 29 of an adjusting screw 30. The screw 30 is rotatably journaled at its one end in a bearing 31 carried by a rib 32 depending interiorly of the bed 10. The other end of the screw 30 is journaled in a bracket or block 33 which forms one head for a cylinder 34. The screw 30 at its outermost end has secured thereto a piston 35 which is enclosed within the cylinder 34 for movement relative thereto. The cylinder 34 is closed on its other end by means of a head or block 36 and this head or block together with the head or block 33 and the intermediate block 37, in which the cylinder 34 is formed, constitute the feed actuation and control mechanism in which is mounted suitable valves and hydraulic ports all co-operating to effect the control and axial movement of the screw 30, which effects the movement of the grinding wheel carriage 12 in a manner that will later be described.

The screw 30 may be rotated for causing a movement of the nut 28 relative to the threaded portion 29 and thereby effect the translation of the grinding wheel carriage 12 and for which purpose it is formed on its innermost end beyond the bearing 31 with a splined portion 38 having a sliding connection with a worm wheel 39 meshing with a worm 40. The worm 40, see

Figure 3, is formed integral with or secured to a transversely extending worm shaft 41 which terminates outside of the forward wall of the bed 10 and is journaled near its end in a bearing 42 secured to and carried by a bracket 43 secured in any desirable manner to the web 32 which depends interiorly of the bed 10. The worm shaft 41 is provided beyond the bearing 42 with a reduced portion 44 to which is keyed or otherwise secured an internal gear 45 meshing with the pinion 46 on one end of a stud 47. This stud 47 is journaled in a micrometer adjusting plate 48 secured to a hand wheel 49. The plate 48 and stud 47 are locked against inadvertent movement by means of a spring pressed pawl 50, carried by an arm 51, and which pawl enters one of a series of perforations or holes 52 formed in the micrometer plate 48. The hand wheel 49 is journaled on the hub of the internal gear 45 and has projecting therefrom the handle 53.

From the foregoing it will be noted that the hand wheel 49 has secured to it the micrometer adjusting plate 48 to which is locked, through the plunger 50, a stud 47 and pinion 46 which is in turn in mesh with the gear 45 so that the parts, when actuated by the handle 53, move as a unit for rotating the worm 40 and consequently the screw 30. This, of course, causes the worm wheel 39 to be rotated one tooth for each rotation of the hand wheel 49. If desired to rotate the worm a fraction of a single tooth, the pawl 50 is withdrawn from the particular perforation or hole 52 with which it is engaged and advanced to a succeeding hole for very minutely rotating the gear 45 and very minutely rotating the worm shaft 41 and finely adjusting the parts.

After the parts have been adjusted as above described, resort is had during actual grinding operation to the lever 54 which is mounted, as seen in Figure 1, for actuation in a plane parallel to the plane of actuation of the hand wheel 49 and is positioned between the forward face of the bed 10 and the hand wheel. This lever is secured to the forward end of a transverse shaft 55 journaled in bearings 56 and 57 carried by the bracket 43. The shaft 55 has secured to it or formed integral therewith a rack pinion 58 meshing with, see Figure 4, rack teeth 59 formed on one end of a longitudinally shiftable rack bar 60. This bar 60 is journaled for sliding movement in the web 32 at one end and in the block 33 at the other end and may be intermediately supported by the lug 27 of the carriage 12. The inner end of the rack bar 60 is formed with rack teeth 61 meshing with a rack pinion 62 rotatably journaled on a pin 63 carried by a head 64 of valve stem 65. The valve stem 65 has secured to it or formed integral therewith a spool type valve 65a providing cannellures 66, 67 and 68 which valve 65a is axially shiftable through a sleeve 69 pressed into or carried by the intermediate block member 37. The sleeve 69 is provided with ports 70, 71, 72, 73 and 74 respectively registering with exhaust conduit or pipe 75, port 76, pressure conduit or pipe 77, port 78 and exhaust conduit or pipe 79. The port 76 terminates in a transverse port 80 formed partly in the end block 36 and partly in the intermediate block 37. This port 80 in turn connects with a port 81 formed in the block 36 and being normally closed by a check valve 82, which is cup-shaped to receive a spring 83 which abuts on its upper end with an adjustable plug or stop 84 whereby the tension of the spring is

varied to vary the tension of the check valve 82. Connected with the port 81 is a port 85 which empties into the left hand end of the cylinder 34, as seen in Figures 4 and 5. The other end of the cylinder 34 is in communication with a port or duct 86 formed in the end block 33 and terminates at one end of a port 87. The other end of the port 87 communicates with one end of a port 88 formed partially in the end block 33 and partially in intermediate block 37 and which port 88 in turn terminates in the duct 78.

In Figure 4 the spool valve 65a is shown in its neutral position at which time the piston 35 and parts controlled thereby are held stationary with the piston near its innermost position for reducing the work to the final desired size. In Figure 5 the spool valve 65a is shown unbalanced or in its extreme right hand position with the pressure connected to the right end of the cylinder for actuating the piston to the left hand limit of its movement.

The flow of the hydraulic medium for shifting the piston to the left is as follows. The pressure passes from the pipe or conduit 77 through the port 72, cannellure 67 to the port 78. The flow from the port 78 is through the port or duct 88, port or duct 87 and port or duct 86 to the right hand end of the cylinder. The hydraulic medium ahead of the piston is discharged through port 89 formed in a valve cage 90 which carries a cut off valve 91. This valve is normally held open by means of a spring 92 which abuts the one end of the valve on one end and a pin 93 carried by the cage on the other end. The cage 90 is provided with an opening or port 94 in which the spring is mounted and through which the hydraulic medium flows from the port 89. The port 94 terminates in the port 81 which empties the hydraulic medium passing therefrom into the port 80 to the port 76 which terminates at the port 71 in the valve sleeve 69. The cannellure 66 then connects the medium with the port 70 of the sleeve 69 which is in registry with the discharge conduit 75 for conveying the medium to a suitable sump or tank. The piston 35 is limited in its movement through the cylinder 34 by abutting on one end with the adjacent face or shoulder 95 formed on the block 33 and on the other end by engaging the extreme end of the screw 30 with a stop or abutment 96. This stop or abutment is in the nature of a screw having a knurled operating knob 97 on one end and threaded through a suitable aperture formed in the end block 36. A lock nut 98 is threaded on the screw 96 for locking the same in various adjusted positions.

As was above noted, the cut off valve 91 is provided for stopping the flow of the medium from the cylinder and serves the additional function of cushioning the abutment between the end of the screw 30 and the stop screw 97. This cut off valve is actuated by engagement with the piston 35 during its travel and is actuated against the yielding resistance of spring 92. The valve cage is adapted to be axially shifted upon axial movement or adjustment of the stop screw 96 so that the valve is always in position to cushion the limit of movement of the piston to the left. For this purpose the valve cage 90 has formed therein a slot 99 receiving a flange 100 secured to or formed integral with the stop screw 96 so that as the stop screw is adjusted, the valve cage 90 is also adjusted.

When it is desired to actuate the carriage 12 in the other direction the valve spool 65a is

shifted through the axial shifting of rack bar 60 to the extreme position opposite to that shown in Figure 5, at which time the pressure in the pipe or conduit 77 is connected through the cannellure 67 with the port 71 in the sleeve 69 so that the hydraulic medium under pressure flows through port or conduit 76 to the port or conduit 80, to the port or conduit 81 for raising the valve 82 through the conduit 85 to the left hand end of the piston 35 for actuating same to the right as seen in the drawings. At this time the hydraulic medium ahead of the piston is discharged opposite to the direction in which the pressure flow above described is moving, namely, through port or conduit 86, port or conduit 87, port or conduit 88 and port of conduit 78 to the valve sleeve 69 where the cannellure 68 connects it with the port 74 and conduit 79.

In the event that the stop screw 96 is retracted to a position where it will not engage with the adjusting screw to stop further movement of the grinding wheel before a wreck occurs either through engagement of the lug 27 with the block 33 or some other part of the machine, a safety stop mechanism will be brought into play which includes the adjustable abutment screw 101 carried by the carriage lug 27 and in line with the valve rod 102 slidably journaled in the block 33. This rod 102 is normally held to the right as seen in Figure 5 for which purpose it has secured to it a collar 103 forming one abutment for a spring 104 which abuts on its other end with the adjacent surface of a block 33. The rod 102 has formed on its inner end a valve 105 adapted when actuated to the left, as seen in Figure 5, to close the port 76 and prevent further flow through this port. It will be noted that when the piston is traveling to the left the port 76 is an exhaust port and when the stop screw 101 engages with the rod 102 for shifting the same it will through the valve 105 prevent further flow of the exhaust medium through the conduit 76. Now upon reverse actuation of the valve to actuate the grinding wheel toward the work, the port 76 is normally employed as a pressure duct, but with the valve 105 closing off the flow therethrough, additional means of communication to the cylinder must be provided. Therefore, the duct 76 communicates with a transverse duct 106 and a second supplementary duct 107 which terminates in the duct 80. Communication between these two ducts is normally prevented by a plug valve 108 carried by the intermediate block 37 and normally held in its closed position by a spring 109 which bears thereagainst. Therefore upon introduction of pressure into the port 76, which when closed will open the plug valve 108 and flow through the ports 106 and 107 into their normal channels whereupon the piston 35 will be actuated to the right. As soon as the pressure has been removed from the rod 102 the spring 104 will withdraw the plug valve 105 so that communication may be had through the port 76 whereupon the supplementary plug valve 108 is closed. From the foregoing it will be noted that it will be impossible to have a wreck due to the actuation of the parts and at the same time proper actuation thereof can be resumed.

The foregoing operation of the valve 65a is primarily used for effecting the rapid traverse movement of the grinding wheel carriage 12 relative to the bed 10 which is automatically shut off by the following mechanism. The end block 75

or cylinder head 33 has secured to it a yoke-like member 110 having arms 111 and 112 projecting therefrom, see Figure 6. A forked arm 113 is provided having extending through the upper ends of its fingers 114 and 115 pivot pins 116 and 117 respectively carried by the arms 111 and 112 of the yoke 110. The arm 113 therefore is adapted to oscillate about the axis of the pins 116 and 117 of the yoke 110. As shown in Figures 4 and 5, the arm 113 is of a considerable length and carries respectively by the fingers 114 and 115 thereof rollers 118 and 119 spaced beneath and to one side of the axis of oscillation of the arm as determined by the pivot pins 116 and 117. The adjusting screw 30 is formed intermediate the pivot pins 116 and 117 and the adjacent face of the head 33 with a shoulder 120 adapted to engage with the rollers 118 and 119 for oscillating the arm 113 for a purpose that will later appear. The arm 113 has secured to it at 121 one end of a spring 122 which tends to oscillate the same in a clockwise direction for thereby holding the rollers 118 and 119 in contact with the shoulder 120 of the screw 30. However, the rollers are in engagement with the shoulder 120 for only a short period of time or until the lower end of the arm engages the stop 123 projecting from the block 33. The lower end of the arm 113 is further formed with a ball or rounded end 124 which is received in a socket 125 formed in the forward end of a short rack bar 126.

As was noted above, the grinding wheel carriage is shifted at a rapid rate when the spool valve 65a is at one or the other of its extreme positions. By shifting the valve to its extreme left hand position, as seen in Figure 5, the carriage 12 is rapidly moved to the right as seen in Figure 4, which movement continues until the shoulder 120 on the screw picks up the rollers 118 and 119 for oscillating the arm 113 in a counterclockwise direction, as seen in Figure 5. This causes the rack bar 126 to be shifted to the right for correspondingly shifting the spool valve and thereby gradually cutting off the flow of the hydraulic medium and gradually slowing down the movement of the piston and carriage until the work is reduced to the desired final size. In practice the spool valve is not shifted to the right its extreme amount, but only a distance to obtain a relatively rapid movement of the carriage until the grinding wheel contacts with the work whereupon the valve is neutralized through engagement of the shoulder 120 with the arm for shifting the valve to its neutral position.

The complete operation of this mechanism is as follows: It is assumed that the parts have been adjusted to provide the desired distance between the operative points of the grinding and regulating wheels when the piston 35 is in engagement with the positive stop provided by the face 95 of the block 33. In order to place a work piece within the grinding throat, the handle 54 is oscillated to its uppermost position in a clockwise direction as seen in Figure 1, for shifting the valve 65a and elements controlled thereby to the position shown in Figure 5. A work piece is now mounted on the work rest blade 23 in engagement with the angle top 24 thereof and the operative face of the regulating wheel 21. The lever 54 is now oscillated in a counterclockwise direction which rotates the pinion 58 in a corresponding direction for shifting the rack bar to the left as seen in Figures 4 and 5. This shifts

the spool valve 65a for connecting the hydraulic pressure through the cannellure 67 with the port 76 to thereby actuate the piston 35 to the right, as seen in Figures 4 and 5. This movement in the beginning will be at a rate corresponding to the uncovering of the port 71 in the valve sleeve 69 until the shoulder 120 is advanced to the position for engagement with the rollers 118 and 119 and starts to shift the rack 126. The movement of this rack 126 will cause the rack pinion 62 to roll on the rack teeth 61 of the bar 60 for gradually closing off the opening through the port 71 until the carriage or grinding wheel is brought to a stop. However, if the lever 54 is continued to be moved in a counterclockwise direction the rack bar 60 through its teeth 61 will continue to balance the movement of the rack 126 through the screw 30 and will thereby keep the valve open until the piston 35 engages the stop or shoulder 95. Furthermore, the carriage 12 will be actuated at the rate of the movement of the handle 54 so that if the said handle is actuated at a rapid rate the grinding wheel carriage will continue at a rapid rate during the actual grinding operation. It is to be understood that the movement of the grinding wheel carriage is controlled during the actual grinding operation and during the actual stock removal from the work piece, which is left entirely to the discretion of the operator and the nature of the grinding wheel and material of the work piece being operated upon.

As soon as the grinding operation is completed the lever or handle 54 is oscillated in a clockwise direction or to the position shown in Figure 1, which then shifts the valve spool to the position shown in Figure 5 so that the hydraulic pressure is actuated through the ports above described to the right hand side of the cylinder for actuating the piston 35 therein. This movement of the piston is at a comparatively rapid rate and the valve remains open because the arm 113 which tends to balance the hydraulic pressure or center the valve strikes the stop 123 thereby limiting its further movement.

If it is found due to wear or truing of the grinding wheel that the work pieces are being produced above the desired size, the spring plunger 50 is withdrawn from the plate 48 and advanced a hole or two for rotating the worm 40 and through the worm wheel 39 the adjusting screw 30, thereby minutely advancing the position of the grinding wheel carriage as respects the said screw without in any wise interfering with the hydraulic actuation of the parts as above described.

What is claimed is:

1. In a machine tool organization the combination of a bed, a tool carriage carried thereby and movable relative thereto, a piston carried by the bed, a piston rod connecting the piston and tool carriage whereby movement of the piston effects movement of the tool carriage, means defining the limits of movement of the piston and the zone of movement of the tool carriage, an hydraulic medium for actuating the piston, a valve controlling the flow of the medium to the piston, means for actuating said valve at a rate to determine the rate of actuation of the piston and tool carriage, said means comprising a floating connection associated with the valve, positive means for actuating said valve through the floating connection in one direction, and additional means under influence of the piston for

actuating the valve in the other direction, said means being the complement of one another for determining the rate of actuation of the piston and tool carriage.

5 2. In a machine tool organization the combination of a bed, a tool carriage carried thereby and movable relative thereto, a piston carried by the bed, a piston rod connecting the piston and tool carriage whereby movement of the piston effects movement of the tool carriage, means defining the limits of movement of the piston and the zone of movement of the tool carriage, an hydraulic medium for actuating the piston, a valve controlling the flow of the medium to the piston, means for actuating said valve at a rate to determine the rate of actuation of the piston and tool carriage, said means comprising a floating connection associated with the valve, positive means for actuating said valve through the floating connection in one direction, and additional means under influence of the piston for actuating the valve in the other direction, said means being the complement of one another for determining the rate of actuation of the piston and tool carriage, and means for varying the connection between the piston rod and tool carriage to vary the zone of movement of the said tool carriage.

3. In a machine tool organization the combination of a bed, a tool carriage carried thereby and movable relative thereto, a piston carried by the bed, a piston rod connecting the piston and tool carriage whereby movement of the piston effects movement of the tool carriage, means defining the limits of movement of the piston and the zone of movement of the tool carriage, an hydraulic medium for actuating the piston, a valve controlling the flow of the medium to the piston, means for actuating said valve at a rate to determine the rate of actuation of the piston and tool carriage, said means comprising a floating connection associated with the valve, positive means for actuating said valve through the floating connection in one direction, and additional means under influence of the piston for actuating the valve in the other direction, said means being the complement of one another for determining the rate of actuation of the piston and tool carriage, and means for varying the connection between the piston rod and tool carriage to vary the zone of movement of the said tool carriage, comprising a screw on the piston rod and a nut on the tool carriage.

4. In a centerless grinder the combination of a bed, a pair of opposed grinding and regulating wheels carried thereby and forming a grinding throat therebetween, a carriage supporting one of said wheels for movement toward and from the other to vary the width of the grinding throat, a reciprocating hydraulic motor for effecting said movement of the carriage and wheel, a valve controlling the rate and direction of flow of the medium to determine the rate and direction of actuation of the motor, means for unbalancing said valve an amount equal to the rate and amount of desired movement of the carriage, and means tending to immediately balance said valve to stop further movement of the carriage whereby the rate and amount of movement of the carriage depends on the rate and amount of continuous unbalancing of the valve, said unbalancing means comprising a rack bar, a rack pinion carried by the valve for movement by the bar, and a manually actuable lever for operating the rack bar, said balancing means

comprising a second rack bar operatively connected with the valve rack pinion, and means for connecting said second rack bar with the reciprocating motor whereby the motor tends to balance the valve.

5. In a feeding mechanism for use with machine tools the combination of a slide, a reciprocating hydraulic motor operatively connected with the slide, a cylinder block associated with the hydraulic motor, a plurality of hydraulic circuits formed in the block comprising ports extending from each end of the motor, a source of hydraulic pressure, a valve connecting the source of hydraulic pressure with either circuit of the hydraulic motor and an exhaust conduit connectible with the remaining circuit, means for actuating said valve in the desired direction and at the desired rate that the motor is to be operated, means at each end of the motor stroke for limiting its movement including fixed stops, means at each end of the motor stroke for cushioning the engagement with the stops and comprising a cut off valve, and means by-passing said cut off valve upon reverse actuation of the rate and control valve.

6. A feeding mechanism for use with machine tools comprising a bed, a work support mounted thereon, a tool support carried by the bed, one of said supports including a slide for movement toward and from the other, a reciprocating motor connected with said slide, an hydraulic medium under pressure for actuating said motor, a circuit for the medium extending from each end of the motor, an hydraulic pressure source, an exhaust return conduit, a direction and rate control valve for connecting the pressure source with one of said motor circuits and for connecting the exhaust conduit with the other of said motor circuits, a valve for stopping the flow of the medium through one of said circuits to prevent undesirable extended movement of the slide, a branch hydraulic circuit by-passing the stop valve, and a valve normally closing said by-pass circuit, but operable by the hydraulic pressure when the said motor circuit is closed.

7. In a feeding mechanism for use with machine tools the combination of a bed, a member mounted thereon for movement relative thereto, an hydraulic piston and cylinder mechanism for effecting the movement of the member, stop means for limiting the movement thereof at each end of the stroke, one of said stop means being in the nature of an adjustable abutment, and means associated with said abutment and adjustable therewith for cushioning the engagement with the abutment.

8. In a feeding mechanism for use with machine tools the combination of a bed, a member mounted thereon for movement relative thereto, an hydraulic piston and cylinder mechanism for effecting the movement of the member, stop means for limiting the movement thereof at each end of the stroke, one of said stop means being in the nature of an adjustable abutment, and means associated with said abutment and adjustable therewith for cushioning the engagement with the abutment, said means comprising a valve controlling the outlet port for the piston and cylinder mechanism, a casing for the valve, and an operative connection between the valve casing and the abutment whereby adjustment of the abutment correspondingly adjusts the position of the valve casing.

9. In a feeding mechanism for use with machine tools the combination of a bed, a member

mounted thereon for movement relative thereto, an hydraulic piston and cylinder mechanism for effecting the movement of the member, stop means for limiting the movement thereof at each end of the stroke, one of said stop means being in the nature of an adjustable abutment, and means associated with said abutment and adjustable therewith for cushioning the engagement with the abutment, said means comprising a valve controlling the outlet port for the piston and cylinder mechanism, a casing for the valve, and a flange on the abutment received in a slot in the valve casing whereby adjustment of the abutment through the flange and slot connection effects corresponding adjustment of the valve casing.

10. In a machine tool organization the combination with a bed, and a slide mounted thereon for translation relative thereto, of a piston and cylinder mechanism for effecting the translation of the slide through a definite zone relative to the bed, an hydraulic system including an hydraulic medium, a pair of hydraulic circuits one for each end of the piston and cylinder mechanism, and a valve for connecting the medium with one or the other of the circuits, means for changing the zone of translation of the slide relative to the bed, means operable in one of

said circuits to limit the movement of the slide prior to the said slide reaching the limit of its zone of movement, and a valve controlled by-pass around said movement limiting means to effect reverse movement of the slide relative to its zone.

11. In a machine tool organization the combination with a bed, and a slide mounted thereon for translation relative thereto, of a piston and cylinder mechanism for effecting the translation of the slide through a definite zone relative to the bed, an hydraulic system including an hydraulic medium, a pair of hydraulic circuits one for each end of the piston and cylinder mechanism, and a valve for connecting the medium with one or the other of the circuits, means for changing the zone of translation of the slide relative to the bed, means operable in one of said circuits to limit the movement of the slide prior to the said slide reaching the limit of its zone of movement, a valve controlled by-pass around said movement limiting means to effect reverse movement of the slide relative to its zone, and yielding means for rendering the limiting means inoperative upon reverse actuation of the slide.

FREDERICK S. HAAS.
BERNARD A. KEARNS.