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C. L. OTT ET AL
CRANK GRINDING MACHINE

2,220,490

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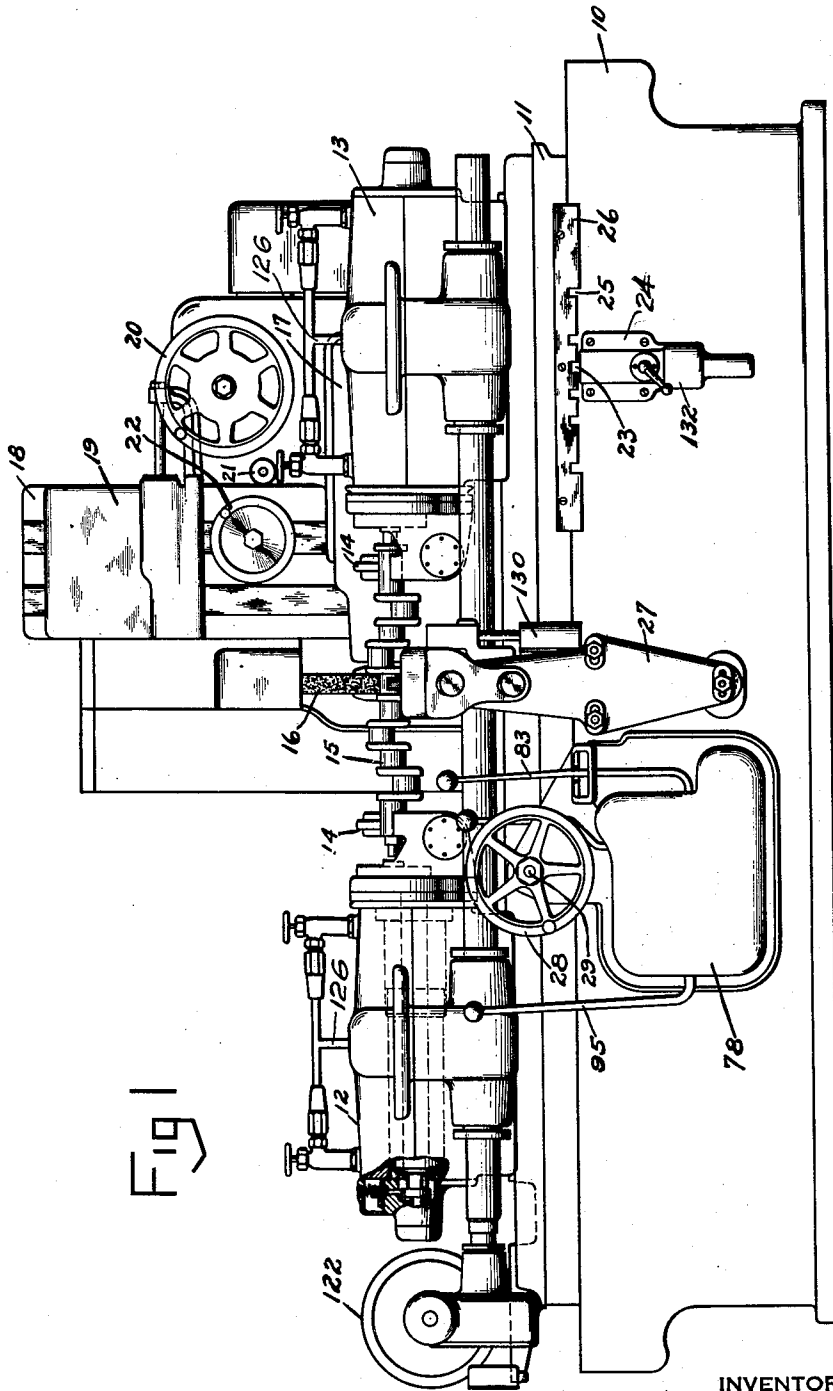


Fig. 1

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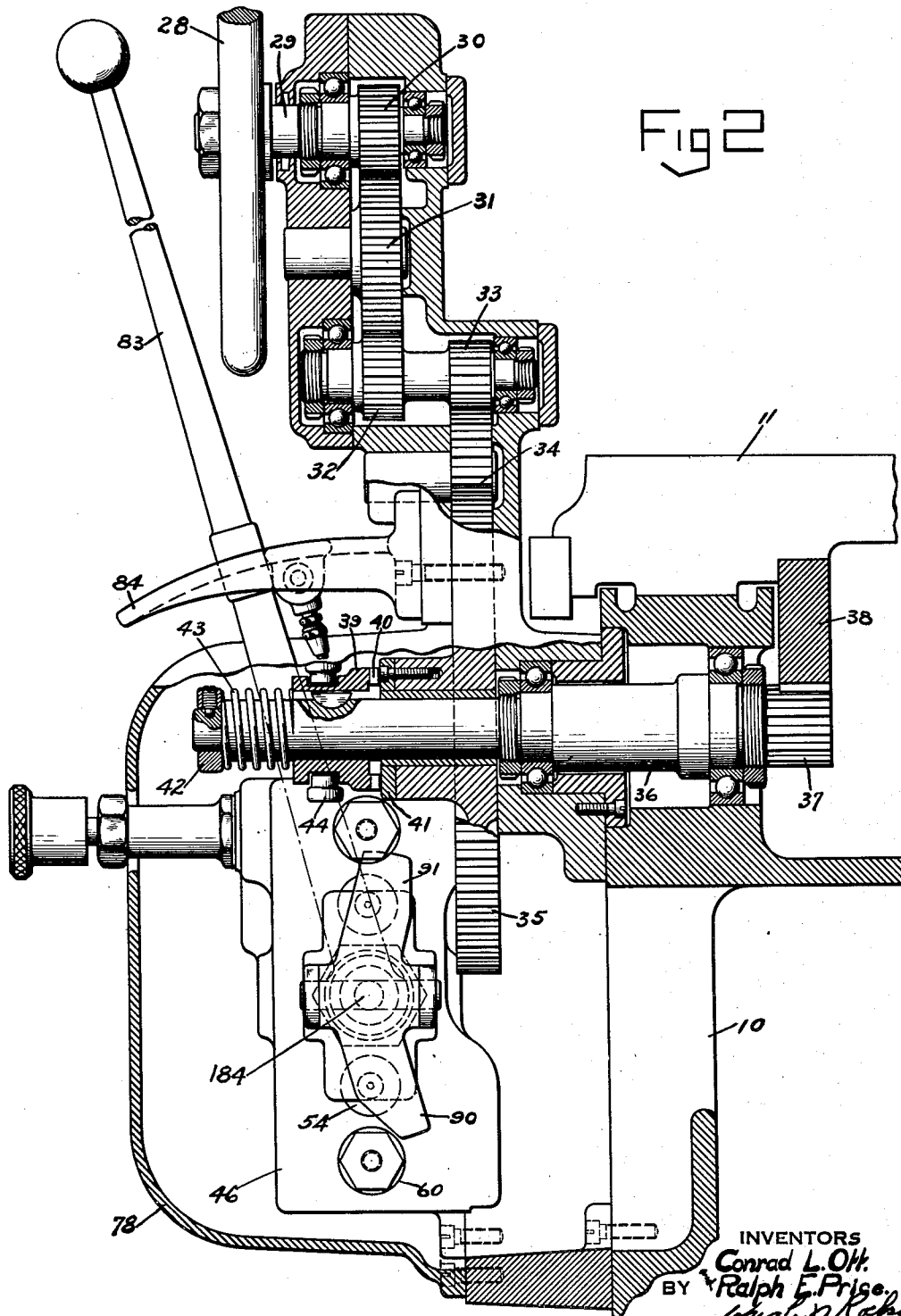
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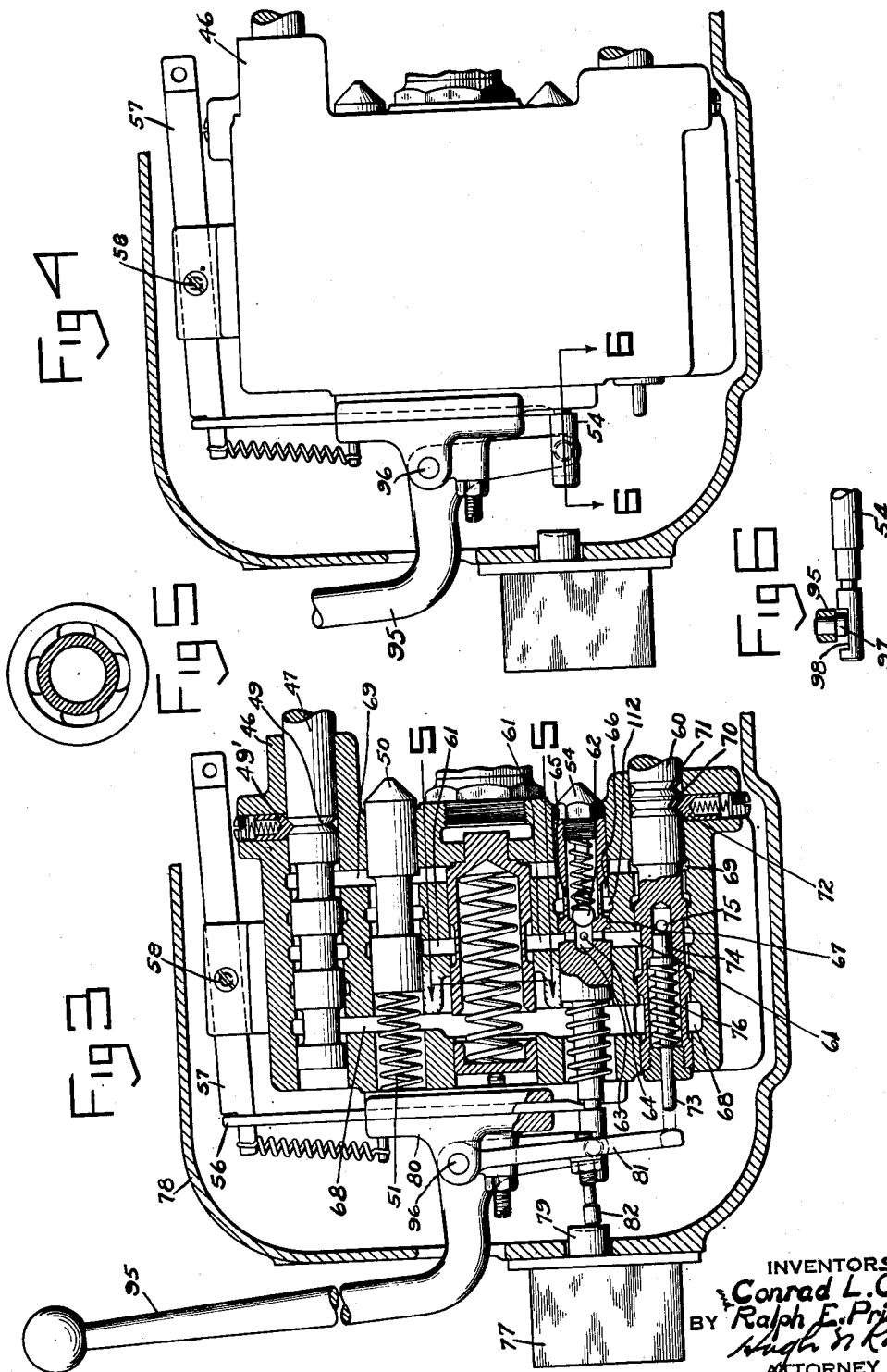
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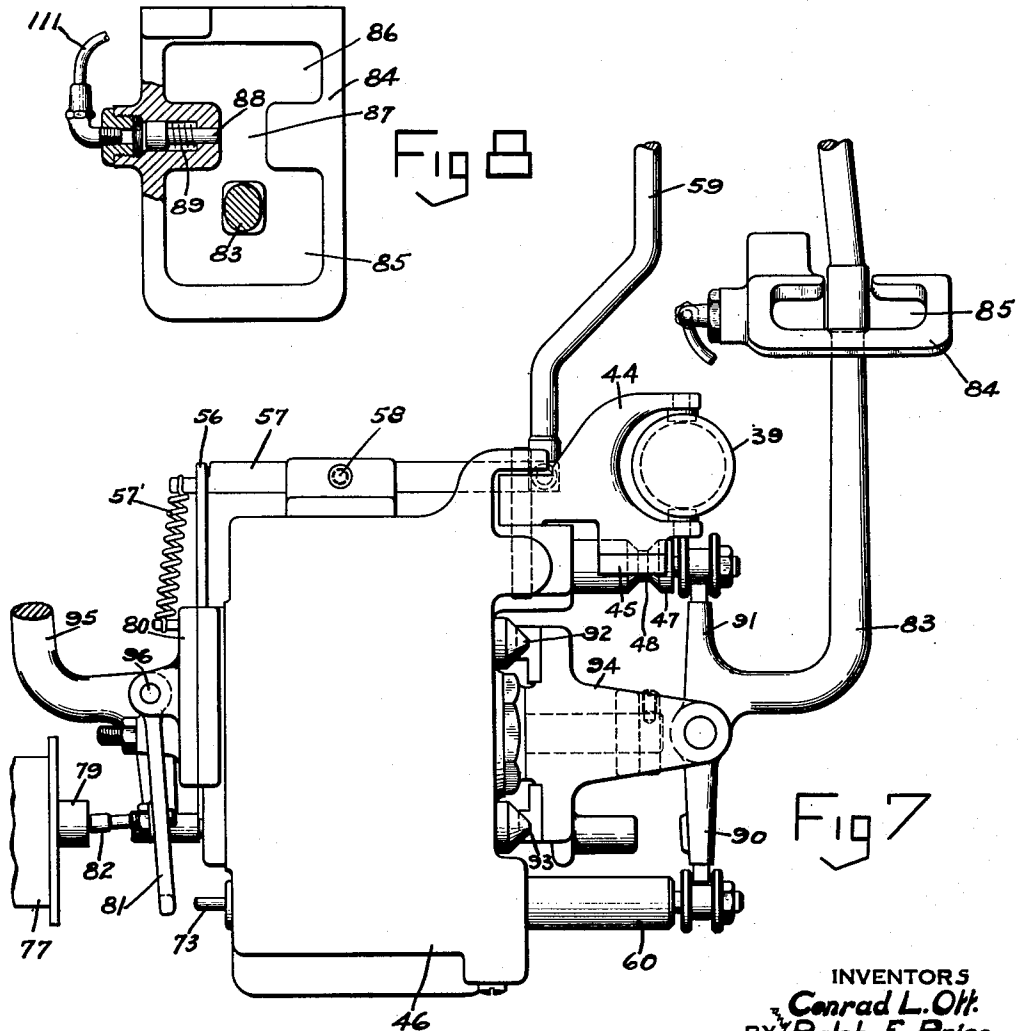
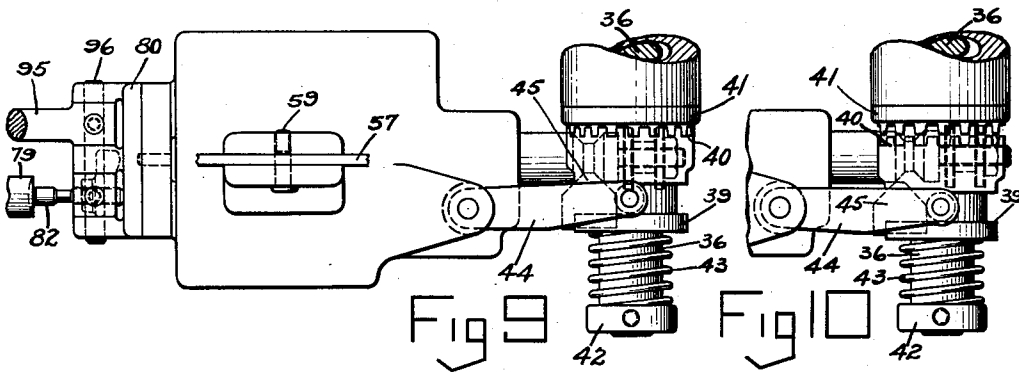
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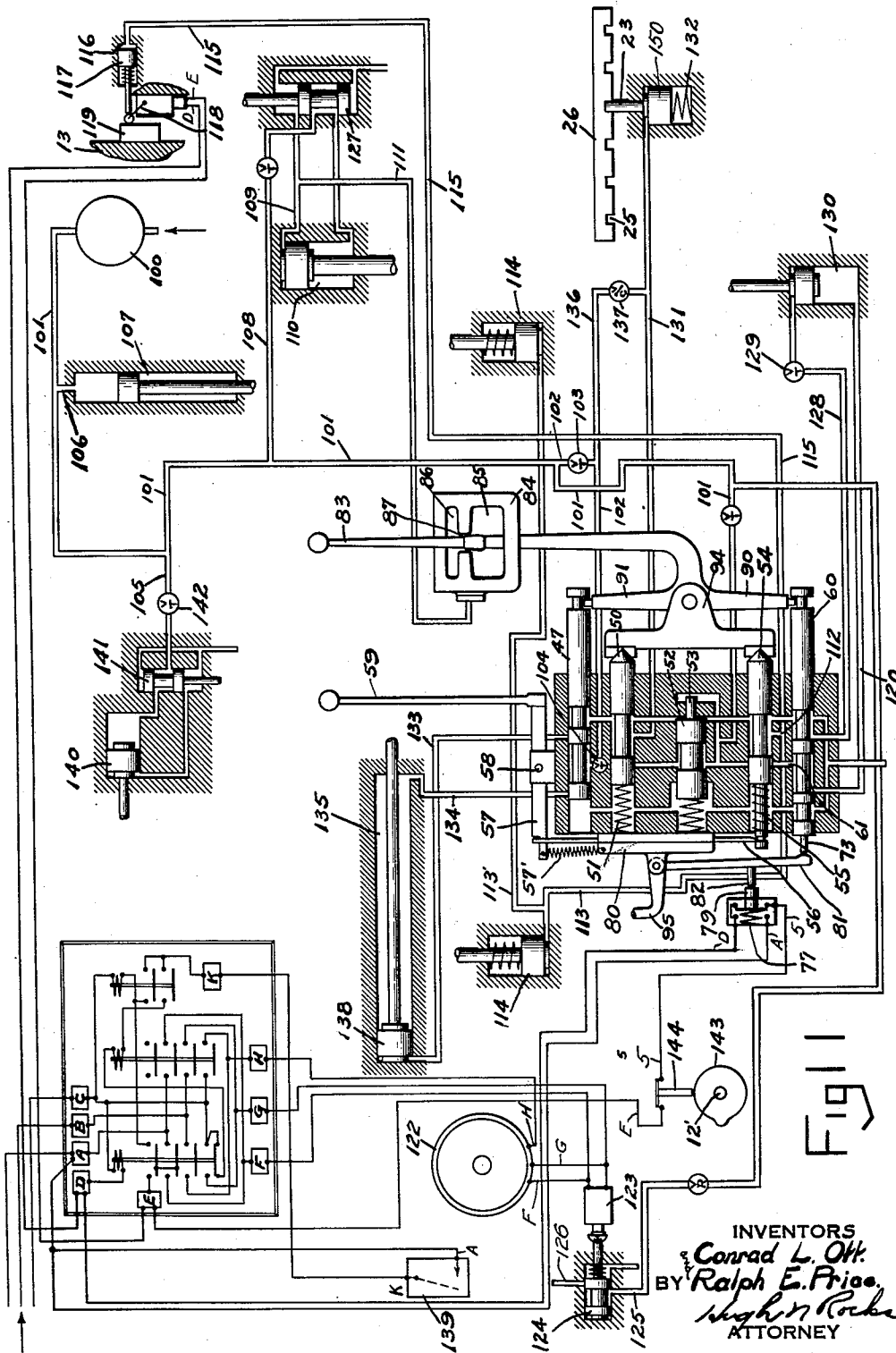
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UNITED STATES PATENT OFFICE

2,220,490

CRANK GRINDING MACHINE

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30 Claims. (Cl. 51—72)

Our invention relates to a machine for grinding crank shafts.

The principal object of our invention is to provide a simplified central control mechanism for several of the functions of the machine.

A further object is to control these functions from a single lever.

A further object is to provide safety devices whereby movements which would interfere with one another are prevented from occurring simultaneously.

In the drawings:

Figure 1 is a front elevation of the machine.

Figure 2 is an end elevation partly in section of the control mechanism and the manual traverse mechanism.

Figure 3 is a sectional front elevation of the control valve showing the arrangement of the various valves, ports and passages.

Figure 4 is a front elevation of the valve assembly showing an auxiliary operating lever for one of the clamping fixture valves.

Figure 5 is a section on the line 5—5 in Figure 3.

Figure 6 is a sectional detail on line 6—6 in Figure 4.

Figure 7 is a front elevation of the control mechanism including the operating mechanism.

Figure 8 is a plan view partly in section of the guide plate for the control lever.

Figure 9 is a plan view of the mechanism for connecting the hand traverse mechanism.

Figure 10 is a plan view showing the structure of Figure 9 in open position.

Figure 11 is a sketch of the hydraulic and electrical systems on the machine.

The feature of our invention lies in a multiple control valve operated by a single lever. Said lever operates four valves, one for the work carriage traverse, one for the spacing bar plunger, one for the hydraulic clamps, and one for the steady rest. The valve for the steady rest has a projecting portion for operating a switch for the headstock motor. The positions of the lever are indicated on a guide plate having a pair of parallel slots connected by a short transverse slot. Movement of the lever in one of the parallel slots actuates the steady rest and the work drive motor and on entering said slot actuates the clamping device. In this slot are initiated functions which should occur during the grinding operation. Movement of the lever into the other slot first withdraws the plunger from the spacing bar after which movement of the lever to right or left causes movement of the work car-

riage one way or the other. The functions initiated with the lever in this slot are those which occur between grinding operations. When the grinding wheel is in working position it is impossible to move the control lever from one slot to the other.

The headstock spindle is lubricated by a supply of fluid under pressure which is controlled by starting and stopping the headstock motor. In the drawings Figure 1, numeral 10, indicates the bed of a machine on which is mounted a work carriage 11. A pair of work heads 12 and 13 are mounted on said carriage and each head carries a clamping fixture 14 in which is supported a work piece 15. A grinding wheel 16 is mounted in a wheel support 17 which is movable transversely toward and from the work either by mechanical means operated by hand wheel 20 or by hydraulic means operated by knob 21. A column 18 mounted on said wheel support carries a vertically slidable support 19. A dressing tool is mounted in another support slidable in a horizontal direction on support 19. Said support 19 may be adjusted vertically by hand wheel 22 thru any suitable mechanism. A plunger 23 slidably mounted in bracket 24 on bed 10 is adapted to engage notches 25 in spacing bar 26 on carriage 11 to locate said carriage in position to permit grinding selected portions of a work piece. A hydraulically operated steady rest 27 is mounted on the bed in line with the grinding wheel. Hand wheel 28 may be used for manually traversing carriage 11.

In Figure 2 is shown the manual traverse mechanism consisting of hand wheel 28, shaft 29, gear 30 on said shaft meshing with gear 31, and driving thru gears 32, 33, 34, 35, shaft 36 and pinion 37 to rack 38 on carriage 11.

On a portion of shaft 36 extending outside the bed is slidably mounted a spool 39 keyed to said shaft and having clutch teeth 40 adapted to engage clutch portion 41 on the hub of gear 35. Said gear 35 is mounted to rotate freely on said shaft. A collar 42 is mounted on the outer end of said shaft. A spring 43 mounted on said shaft between said collar and said clutch acts to keep said clutch normally in engaged position. The means for engaging and disengaging said clutch is shown in Figs. 7, 9 and 10 and consists of a yoke 44 in operative engagement with spool 39. Said yoke is pivotally attached to the valve body 45 so that it may have a swinging movement substantially axially of said shaft. A wedge shaped cam 45 is secured to said yoke and held by spring 43 in engagement with a portion of the reversing

valve 47 which contains a groove 48. Axial movement of said valve either to right or left serves to eject said cam from the groove and thus to swing the yoke 44 to disengage the clutch.

5 The control mechanism consists of a valve body 46 in which are mounted a plurality of valves. Valve 47 is the reversing valve for the traverse motor. This valve is located in central position by a spring pressed wedge 49 which
10 drops into a groove 49 in said valve. Valve 50 controls the supply of fluid to the indexing plunger. This valve is urged to the right by a spring 51 and to the left by a lever to be described later.

15 Relief valve 52 has a reduced portion 53 exposed to pressure. This permits the use of a lighter spring in said valve.

Valve 54 is urged to the right by spring 55 and controls the supply of fluid to the clamping fixtures 14. This valve has a portion extending beyond the valve body with a groove cut therein. A vertical rod 56 at the side of the valve body is adapted to drop into said groove when the valve is moved to the left. The other end of said rod is attached to one end of a lever 57 pivoted at
25 58 on the top of the valve body. Said lever is held in position to permit the rod to drop into said groove by a spring 57'. A handle 59 may be used to lift said rod from said groove. The right hand end of this valve is hollow to accommodate a ball check valve 62 which seats at the mouth of a smaller bore 63 which is concentric with the larger one. From this smaller bore
30 radial passages 64 extend to an annular groove in the surface of the valve. Radial passages 65 also connect the large bore with a wide annular groove 66. The said grooves are separated by a narrow land 67. Fluid must always pass thru the check valve to reach the clamping fixtures.

40 Valve 54 may be operated independently of lever 53. A lever 95 is pivotally attached at 96 to a bracket 90 secured to the left side of the valve body. A vertical slot thru said bracket serves as a guide for latch rod 56. The other end of said lever carries a pin 97 which is inserted in a slot 98 in a protruding portion of valve 54.

Fluid under pressure is supplied to valves 50, 54 and 60 thru a common passage 61. Two exhaust passages 68 and 69 connect all the valves.

Valve 60 controls the supply of fluid to the steady rest. Two positions of said valve are determined by two adjacent grooves 70 and 71 into which a spring pressed plunger 72 may drop to locate the valve. The left hand end of said valve is bored out to two diameters to receive a plunger 73. Said plunger has a piston portion 74 adapted to be inserted in the smaller of the two bores. A radial passage 75 connects said bore with supply passage 61. However fluid does not reach valve 60 until valve 54 has been shifted to open passage 61 to direct fluid under pressure to the clamp cylinder 114. A spring 76 holds said plunger in the right hand position. A switch 77 for starting the workdrive motor 122 is attached to cover plate 78 with a button 79 extending thru to the inside of said cover plate. In normal position as shown this switch connects lines 5 and
60 D thru which current passes to motor 122 thru tappet switch 144. A bracket 80 secured to the left side of the valve body has pivoted thereon an arm 81 from which extends a pin 82 in the direction of said switch button. Another portion
65 of said arm is in the path of plunger 73 so that

when fluid under pressure acts on piston 74, the said plunger is caused to protrude from valve 60 and when said valve is shifted to the left, said plunger will engage arm 81 to close switch 77.

The means to operate the several valves comprises a lever 83 pivoted at 184 for movement in transverse directions. The movements of said lever are indicated by a guide plate 84. Said guide plate has two parallel slots 85 and 86 with a transverse connecting slot 87. The normal position of the control lever is in slot 87. Movement of the lever in slot 86 controls functions which occur during the grinding operation such as work rotation, work clamping and movement
10 of the steady rest into operative position. In one of the projecting portions which form the parallel slots is a plunger 88 held in retracted position by a spring 89. Fluid under pressure may be introduced at the head of said plunger to move the same to block the connecting slot 87. The fluid for actuating said plunger comes from the line thru which fluid passes to move the grinding wheel toward the work. Thus when the wheel is in forward position the lever 83 cannot
15 be moved thru slot 87.

Movement of the lever in slots 85 controls functions which occur between grinding operations such as operating the index plunger and the traverse mechanism. The movements of the lever may be described as backward and forward, and left and right. At the lower end of said lever is an offset portion having a pair of arms 90 and 91 extending in substantially opposite directions in a plane parallel to said lever. Each of said arms is inclined slightly backward. The ends of said arms are adapted when in operative position to fit spools on the ends of valves 47 and 60. When lever 83 is forward, arm 91 is in position to operate valve 47. When said lever is back arm 90 is in position to operate valve 60. Said valves are operated by a left and right movement of said lever.

Valves 50 and 54 are actuated by cam surfaces 92 and 93 on a bracket 94. Said bracket is actuated when lever 83 is moved forward and back. Because said bracket is pivotally attached to lever 83 it is not affected by movements of said lever to right and left. Said cam surfaces are located so that a forward movement of lever 83 actuates valve 50 while a backward movement actuates valve 54. A backward movement within the limits of the slot 85 will permit valve 50 to return to normal position which will in turn
50 relieve the pressure on the plunger piston 150.

A supply of lubricant to the crank heads 12 and 13 is controlled automatically by solenoid operated valve 124 actuated by solenoid 123 which in turn is energized when the head stock motor is started. Fluid under pressure from the pump 100 enters the valve through passage 125 and passes on to the crank heads thru line 126. This machine is also provided with a mechanism for stopping the crank heads in a position where the work can be inserted or removed with the least difficulty. This mechanism consists of a cam 143 mounted on the headstock spindles and disposed in operative relation to a switch 144 which supplies current to the head stock motor thru a line parallel to that in which switch 77 is mounted. Closing either switch will start the headstock motor, but to stop it both must be open. The cam 143 is arranged to open switch 144 when
75

the clamping fixtures are in a position for unloading.

Operation

Fluid under pressure is supplied to the various mechanisms by pump 100 which discharges thru line 101 to supply fluid to all parts of valve 46 except the reversing valve 47. A branch line 102 cuts off from line 101 and the fluid in said line passes thru throttle valves 103 and 104 before reaching valve 47. Additional branch lines supply other mechanisms such as line 105 leading to the wheel dressing device and 106 leading to a backlash cylinder 107. Branch line 108 supplies fluid to the rapid wheel feed mechanism. From the line 109 leading to the head of the wheel feed cylinder 110 a line 111 connects with the bore in guide plate 84 in which is mounted the piston which forms the head of pin 88.

When the operator has placed a piece of work in the machine he shifts lever 83 forwardly thru or from slot 87 into slot 86. This movement of lever 83 places element 90 thereof in position to operate valve 60. This movement also rotates bracket 94 so as to cause cam 93 on said bracket to depress valve 54. Rod 56 drops into the groove in the extension of said valve and prevents return of the valve by spring 55. This causes passage 61 to be connected with port 112 from which fluid passes thru line 113 and lines 113' to the clamping cylinder 114. Fluid from port 112 also passes thru line 115 to cylinder 116 in which is mounted a piston 117, which actuated by the fluid under pressure, holds a switch arm 118 in operative relation to a lug 119 on the wheel base of the machine. Said lug prevents the piston 117 from closing the switch. The lever is then moved to the right in slot 86. This movement shifts valve 60 to the left. Fluid has acted on piston 74 within said valve so that pin 73 is in position to engage arm 81 and close switch 77 as soon as the valve is shifted. In Figure 11 valve 60 is shown in normal position. In this position passages 61 and 120 are connected and fluid passes to the head end of steady rest cylinder 130 to hold the work supporting elements in retracted position. As soon as said headstock motor is started solenoid 123 is actuated to shift valve 124 to permit fluid from the hydraulic system to enter said valve from passage 125 and pass on thru line 126 to supply lubricators on the crank heads 12 and 13. The operator next pulls knob 21 to shift valve 127 to direct fluid to the head end of cylinder 110 to move the wheel support rapidly to grinding position. Movement of the wheel supports acts thru lug 119 to release switch arm 118 which completes a pickup circuit to the work drive motor 122. When this circuit is closed the one thru switch 77 may be opened without stopping the motor. Said switch 77 is opened when lever 83 is moved to the extreme left hand position in slot 86 to shift valve 60 to the right. In this position of the valve fluid passes from passage 61 thru line 128 and throttle valve 129 to the rod end of cylinder 130 to move the work engaging elements of the steady rest into engagement with a work piece. The grinding operation continues until the work has been ground to size. Then the operator pushes knob 21 to cause the wheel to move to inoperative position and depress the switch arm 118 to stop the heads. Next he moves lever 83 thru slot 87 to slot 85, pin 88 having been withdrawn when the wheel support was backed off. Movement of the lever out of slot 86 first shifts valve 60 to normal position directing fluid to the head end of cylinder

130 and thus moving the steady rest away from the work. The operator next presses lever 59 downwardly to withdraw latch rod 56 and permit spring 55 to return valve 54 to normal position where the lines 113 and 115 are connected to exhaust line 69 thus permitting the clamping fixtures to be opened and the switch 118 to return to inoperative position. With switch 118 open the motor 122 will continue to operate until cam 143 opens switch 144. Upon said switch being opened a brake switch 139 becomes operative to stop the motor instantly. Thus the clamps cannot be opened while work rotates because the backward movement of wheel base first stops the work and then releases latch 88 on guide plate so that lever 83 can be moved to position for opening the clamps. Clamps remain closed and work rotates until wheel moves back because lever cannot move out of clamping position, thus it is impossible to open clamps while heads are rotating. After opening the clamping fixtures the operator rotates the crank shaft to bring another pin on center. Then he shifts lever 83 thru slot 87 into slot 85 and against the side of the slot. This movement of the said lever causes cam 92 to depress valve 50 so that fluid from line 61 may pass thru line 131 to plunger cylinder 132 and withdraw plunger 23 from spacing bar 26. As soon as said plunger has been withdrawn the operator may move lever 83 either to right or to left depending on the direction of traverse desired. The previous movement of said lever into slot 85 placed arm 91 in position to shift valve 47. Fluid is supplied to valve 47 from branch line 102 thru throttle valve 103 and 104. Said valve 47 may direct said fluid thru either of lines 133 or 134 to opposite ends of traverse cylinder 135. A line 136 having a check valve 137 therein connects the supply line 131 which feeds the plunger cylinder 132 with line 102 which supplies the traverse motor. After plunger 23 has been withdrawn, pressure is built up in line 131 and fluid passes thru check valve 137 and line 136 to valve 47 and the traverse motor thus increasing the volume of fluid supplied to said motor and increasing the traverse speed. In effect valve 50 becomes a bypass valve around throttle valve 103. Just before the next notch reaches the plunger the operator pushes lever 83 forward in the traverse position. This releases valve 50 sufficiently to permit the exhaust of fluid from the plunger cylinder 132. The extra fluid which increased the traverse speed is thus cut off and the traverse movement is retarded. Check valve 137 prevents fluid in line 102 from passing out thru the exhaust line. The spacing bar moves across the plunger which is held in contact therewith by a spring until said plunger drops into a notch. The operator then returns the lever 83 to neutral position.

We claim:

1. In a machine of the kind described a work support, a tool support, mechanisms for effecting relative transverse and axial movements between said supports, work clamping fixtures on said work support, means to rotate said clamping fixtures, a steady rest, mechanism for moving said steady rest toward and from work supporting position, a lever for controlling said mechanisms, said lever being operable in either of two positions, actuation thereof in one position being effective to operate the clamping fixtures, work rotating means and steady rest, actuation thereof in the other position being effective to operate

said mechanism for effecting relative axial movement between said supports.

2. In a machine of the kind described a work support, work holding and clamping mechanism on said support, mechanism for effecting an axial movement of said support, a plunger and spacing bar for locating said work support in predetermined positions, a lever for controlling said mechanisms, said lever having two operative positions in one of which it is effective to initiate functions which are incidental to the machining of a work piece, in the other of which it is effective to initiate functions which occur during the interval between machining operations, movement of said lever into one position being effective to actuate said clamping mechanism to clamp a work piece, movement of said lever into the other position being effective to withdraw said plunger from said spacing bar.

3. In a machine of the kind described, a bed, a work support movably mounted thereon, mechanism for effecting an axial movement of said support, a plunger and spacing bar for locating said support, in predetermined positions, a lever for controlling operation of said moving mechanism and said plunger, means actuated by movement of said lever in one direction for withdrawing said plunger, means actuated by movement of said lever in another direction for actuating said moving mechanism, the means for controlling withdrawal of said plunger being effective to supply additional power to said moving mechanism, reversal of the first movement of said lever being effective to release said plunger and cut off the additional supply of power to said work support moving mechanism.

4. In a machine of the kind described having a bed, a work support, a spacing bar on one of said parts, a plunger on the other, a group of mechanisms for performing certain functions during a grinding operation, another group of mechanisms for performing certain functions during the interval between grinding operations including a work support moving mechanism and a plunger actuating mechanism, a lever operable in one position to control said first mentioned mechanisms and in another position to control said second group of mechanisms said lever being effective to control mechanisms in each group as it moves from one position to the other, means actuated by movement of said lever into said second position for withdrawing said plunger from said spacing bar and means operable thereafter by shifting said lever in said second position for moving said work support to the left or right.

5. In a machine of the kind described, a work support, work holding and rotating mechanisms mounted thereon, a motor for driving said rotating mechanism, means to actuate said work holding mechanism comprising a lever, a tool support, mechanism for moving said tool support toward and from said work support, means to hold said lever in operating position while said tool support is moving toward or is in advanced position, means to stop said motor only when said tool support is being withdrawn from working position, the means to stop said motor being effective only when said work holding means is in a predetermined angular position.

6. In a machine of the kind described, a work support, a mechanism on said work support for holding and for rotating a work piece, a tool support, mechanism for moving said tool support toward and away from said work support, mechanisms for stopping rotation of said work piece and for opening said work holding mechanism

only when said tool support is withdrawn and means to stop said work rotating means with said work holder in a predetermined position.

7. In a machine of the kind described a work support, a head stock mounted thereon, a motor for driving said headstock, a hydraulic system for operating various parts of said machine including a pump which is operated continuously, means to supply lubricant to said headstock, comprising a line from said pump to said headstock, a shut off valve in said line, a solenoid for operating said valve, and connection from said solenoid to said motor whereby to open said valve to direct lubricant to said headstock when said motor is started.

8. In a machine of the kind described a bed, a work support, means to effect a traversing movement of said work support on said bed, means to locate said support in predetermined positions comprising a notched spacing bar and a plunger for entering the notches in said bar, means to withdraw said plunger including a lever to permit traversing movement of said support, means for automatically supplying additional power to speed up said traversing means upon actuation of said lever and means to cut off said additional supply of power for slowing down said traversing means just before said plunger enters the next notch.

9. In a machine of the kind described a work support, fluid mechanism to effect a traversing movement of said support, means to supply a predetermined amount of fluid to said traverse mechanism, a reversing valve for directing said fluid to one side or the other of said traverse mechanism, another fluid operated mechanism, a second valve for directing fluid to said second mechanism, common means for actuating said valves, and connections for automatically conducting fluid from said second valve to both mechanisms after said second mechanism has been actuated, whereby to increase the rate of movement of said work support.

10. In a machine of the kind described, a bed, a work support slidably mounted thereon, a wheel support, fluid means to effect a relative longitudinal movement of said supports including a fluid motor, a valve for directing fluid under pressure to said motor, means to effect said movement intermittently to locate said wheel support and a series of portions of a work piece in operative relation comprising a spacing bar and a plunger, said plunger having a piston attached thereto, said piston being mounted in a cylinder, means to actuate said plunger including a valve for directing fluid under pressure to said cylinder and a common means for actuating both of said valves.

11. In a machine of the kind described a base, a work support slidably mounted thereon, work rotating means mounted on said work support including a motor, a wheel support movable toward and from said work support, a circuit for energizing said motor while said wheel support is in advanced position, a second circuit which is normally open and operable regardless of the position of the wheel support, a lever for opening and closing said circuit, said circuit being closed only while said lever is in closing position.

12. In a machine of the kind described a work support, a wheel support, mechanism for effecting relative transverse and longitudinal movement of said supports, work rotating and clamping mechanisms on said work support, a lever for controlling operation of said work support

and said rotating and clamping mechanisms, said lever being operable in one position for initiating operation of said work rotating and clamping mechanisms and in another position for initiating said longitudinal movement, a latch, and means for positioning same when the wheel support is in an advanced position to prevent shifting said lever from one position to the other.

13. In a machine of the kind described, having a work support, work holding means on said support including a work head, a spindle rotatably mounted therein, an electric motor for driving said spindle, a supply of fluid under pressure for operating various mechanisms on said machine, connections from said supply to said spindle whereby said fluid may be utilized to lubricate said spindle, a valve in said connections and means for opening said valve when said motor starts and for closing same when said motor stops.

14. In a machine of the kind described having a work support, work holding means on said support including a work head, a spindle rotatably mounted therein, an electric motor for driving said spindle, a switch for starting said motor, a lever for actuating said switch, a supply of lubricant under pressure for said spindle, means responsive to the pressure of the lubricant for rendering said lever effective to actuate said switch, a valve in said lubricant supply and means operable upon starting said motor for opening said valve.

15. In a machine of the kind described a work support, work rotating means mounted thereon, means for driving said work rotating means including a motor and a switch therefor, a source of fluid under pressure, a lever, connections between said lever and said switch including a valve, a plunger movably mounted therein which is normally in an inoperative position and which is held in operative position so long as this fluid under pressure is available.

16. In a machine of the kind described a work support, means for providing a longitudinal movement of said support, means for successively locating said support in a series of working positions, a lever for controlling said locating means and said moving means, means actuated upon movement of said lever in one plane for causing said longitudinal movement and means actuated upon movement of said lever in another plane for operating said locating means and for varying the speed of said longitudinal movement.

17. In a machine of the kind described a work support, mechanism for providing a traversing movement of said support, mechanism for effecting said traversing movement either manually or by power, work rotating and clamping mechanisms on said support, a single lever for controlling the operation of said mechanisms and automatically operated means for rendering said manual traversing mechanism operable while said lever is in position for operating said work clamping and work rotating mechanisms.

18. In a machine of the kind described a work support, fluid mechanism for effecting a longitudinal movement of said support, a supply of fluid therefor, a throttle valve in said supply, means for effecting said movement intermittently for presenting successive portions of a work piece in position for machining including a spacing bar having portions corresponding to this position, means for engaging said portions for locating said support in said position, a

lever for controlling said fluid mechanisms and said locating means and a valve operable by said lever for bypassing fluid under pressure around said throttle valve.

19. In a machine of the kind described a work support, work rotating means including an electric motor, a switch for said motor, a cam rotatable with said work for intermittently opening said switch, a second switch having two poles one of which is between said first mentioned switch and a source of electric current, the other of which supplies current to said motor direct, and a third switch operated independently of said second switch connected to said motor in parallel with said other switches.

20. In a machine of the kind described a work support, work rotating means including an electric motor, a switch for said motor, a cam rotatable with said work for intermittently operating said switch, a second switch between said first switch and a source of current, said second switch having two sets of contacts, one of which is normally open but effective when closed to start said motor, the other of which is normally closed but ineffective to start said motor, said normally closed contact being in series with said cam operated switch, a third switch operable independently of said second switch for supplying current to said motor, said third switch being connected to said motor in parallel with said cam operated switch.

21. In a machine of the kind described a work support, work rotating means including an electric motor, a plurality of circuits for supplying current to said motor including a circuit for starting said motor, a circuit operated independently of said starting circuit for supplying current to said motor after the starting circuit is opened and a third circuit in parallel with said second circuit, which is opened and closed intermittently in synchronism with the rotation of the work.

22. In a machine of the kind described a work support, work rotating means including an electric motor, mechanism movable relative to said work support, a plurality of circuits for supplying current to said motor one of which is normally closed at one point and at another point is opened and closed in time with the rotation of the work, another of which is connected in parallel with said first circuit and which is opened and closed by movement of said mechanism, a third circuit which is effective only to start said motor and means for closing said first and third circuits alternately.

23. In a machine of the kind described, a work support, work rotating means including an electric motor, mechanism movable relative to said work support, a plurality of circuits for supplying current to said motor, one of which includes at one point a normally closed switch, and at another point a switch opened and closed in timed relation with the rotation of the work, a second circuit which is connected in parallel with said first circuit, and which comprises a switch which is opened and closed by movement of said mechanism, a third circuit which includes a switch which is effective only to start said motor, and means whereby said starting switch and said normally closed switch are opened and closed alternately.

24. In a machine of the kind described, a work support, a tool support and means for causing a relative transverse movement between said supports, work rotating means including an electric

motor, a plurality of circuits for supplying current to said motor including a circuit for starting said motor, a circuit operated independently of said starting circuit and in response to said transverse movement for supplying current to said motor after the starting circuit is opened and a third circuit in parallel with said second circuit, which is opened and closed intermittently in synchronism with the rotation of the work.

25. In a machine of the kind described, a work support, a tool support, power means for effecting relative movement of said supports, a manually operated mechanism for effecting said movement including a handwheel, a gear assembly, a clutch connecting said parts, means including a lever movable in opposite directions for determining the direction of movement of said power means, and mechanisms actuated by shifting said lever in either direction for disengaging said clutch and initiating movement of said power means.

26. In a machine tool, a work support, mechanism for providing a traversing movement of said support either manually or by power, a reversing lever which is shiftable in opposite directions to determine the direction of movement of said carriage and for initiating said movement, and connections between said reversing lever and said manual traverse mechanism operable upon shifting of said lever in either direction for rendering said manual traverse mechanism inoperative.

27. In a machine tool, a work support, work clamping means rotatably mounted on said support, a single lever for controlling operation of a plurality of mechanisms on said machine, means actuated by said lever for operating said clamps to grip a work piece, and means to prevent opening of said clamps when said lever is moved to another position including a latch for

holding said clamp operating means in position to effect clamping of the work.

28. In a machine of the kind described, a work support, mechanism for effecting a traversing movement of said support, work clamping mechanism mounted on said support, mechanism for rotating said clamping mechanism, means for actuating said mechanisms comprising a main control lever and an auxiliary lever for actuating said clamping mechanism when said main control lever is being used to control another mechanism.

29. In a machine of the kind described, a work support, mechanism for effecting a traversing movement of said support including a supply of fluid under pressure, a throttle valve in said supply, a second fluid operated mechanism for locating the work table, an unrestricted passage connecting said supply and said locating mechanism, a start and stop valve for said traversing mechanism, and a connection controlled by said start and stop valve for supplying additional fluid under pressure to said traversing mechanism at the same time that said second mechanism is actuated.

30. In a machine of the kind described, a work carriage, means for effecting intermittent longitudinal movement of said carriage including a hydraulic motor, a spacing bar on said carriage having a series of spaced portions, a plunger for cooperating with said spaced portions for controlling said intermittent carriage movement, a lever for initiating said carriage movement and for determining the direction of said movement, said lever being operable also to direct fluid under pressure for withdrawing said plunger, and means for utilizing said plunger operating fluid to increase the speed of said carriage movement.

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