May 19, 1936. F. S. HAAS ET AL 2,040,990

HYDRAULIC CONTROL MECHANISM

Original Filed May 31, 1930 3 Sheets-Sheet 1

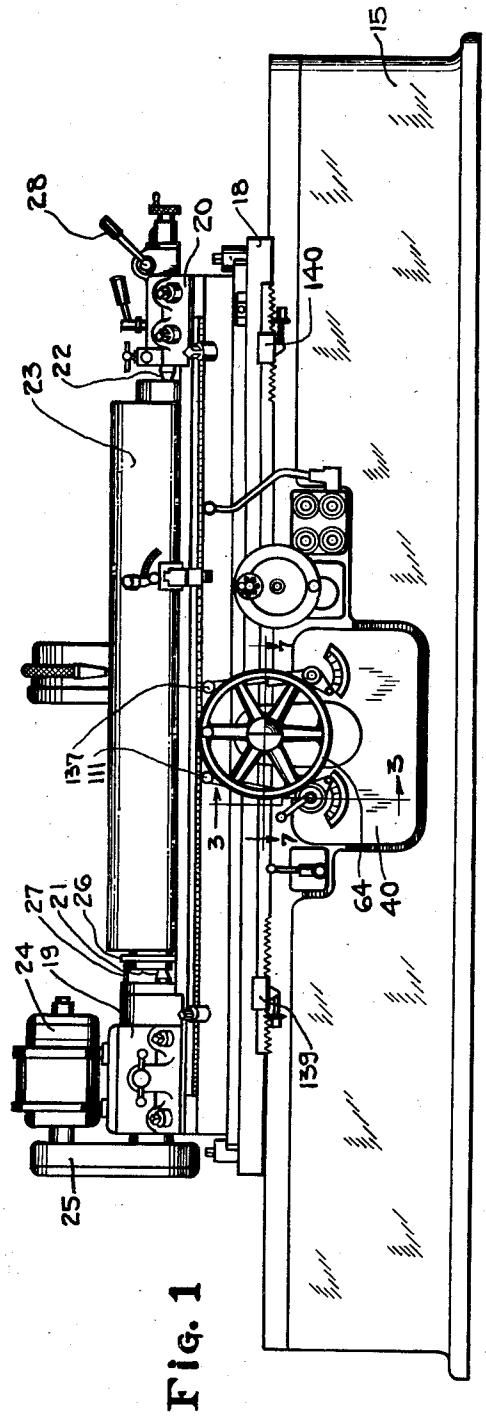


Fig. 1

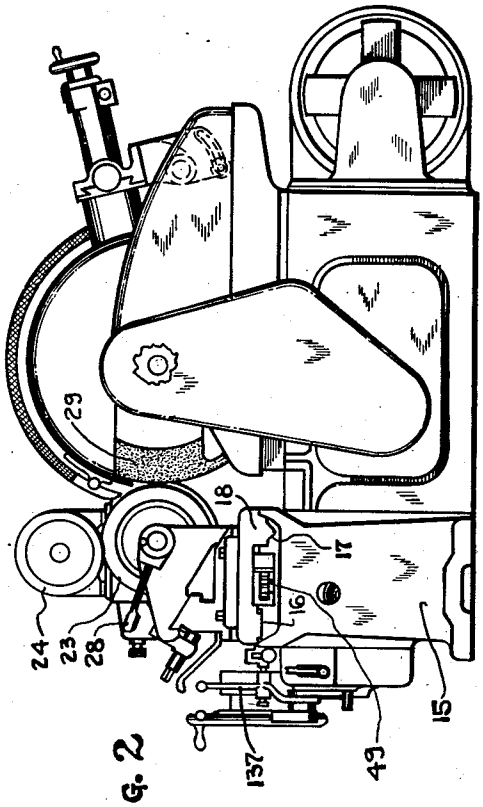


Fig. 2

Inventor

FREDERICK S. HAAS

RALPH L. GOETZEL

By O'K Parsons

Attorney

May 19, 1936. F. S. HAAS ET AL 2,040,990

HYDRAULIC CONTROL MECHANISM

Original Filed May 31, 1930 3 Sheets-Sheet 2

Fig. 3

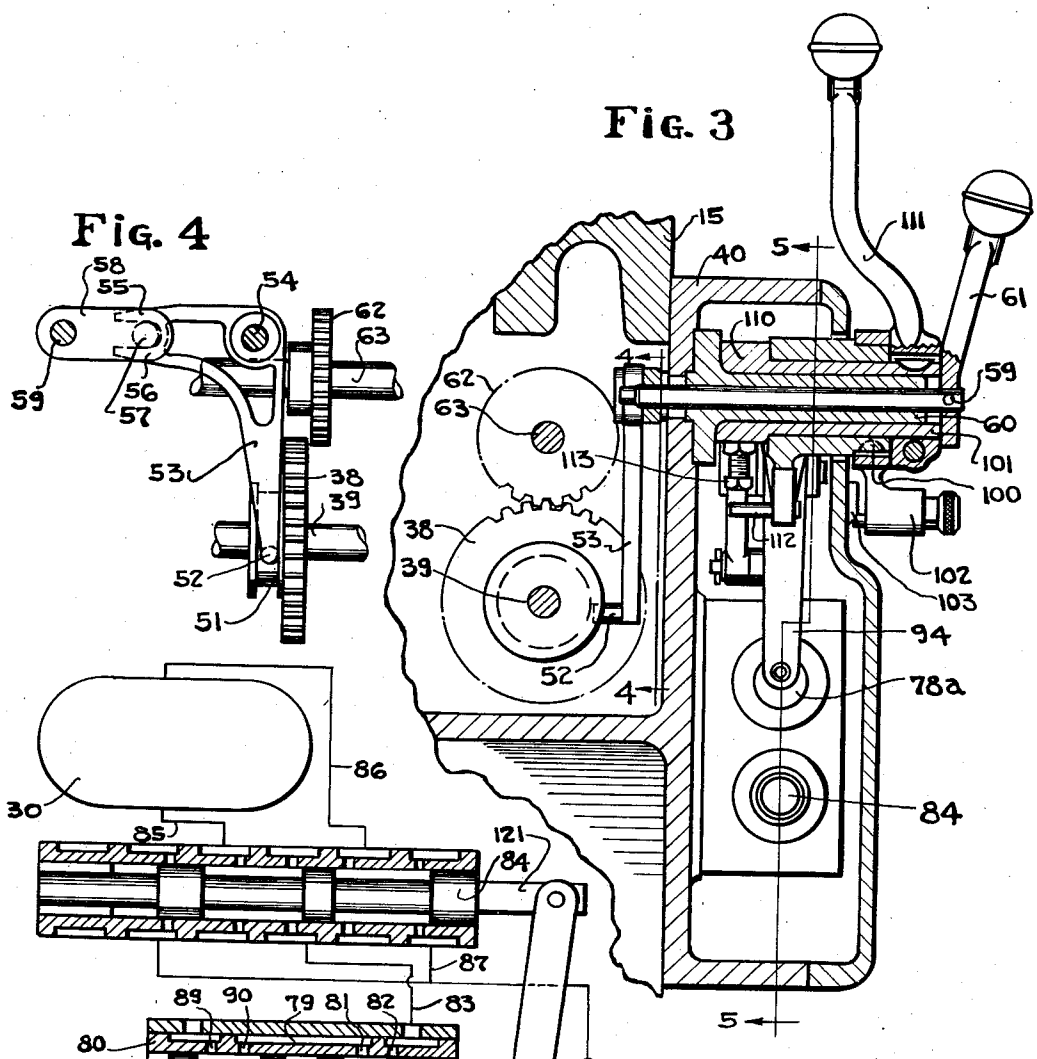


Fig. 4

Fig. 7

Inventor

FREDERICK S. HAAS

RALPH L. GOETZEL

By H. K. Parsons

Attorney

May 19, 1936. F. S. HAAS ET AL 2,040,990

HYDRAULIC CONTROL MECHANISM

Original Filed May 31, 1930 3 Sheets-Sheet 3

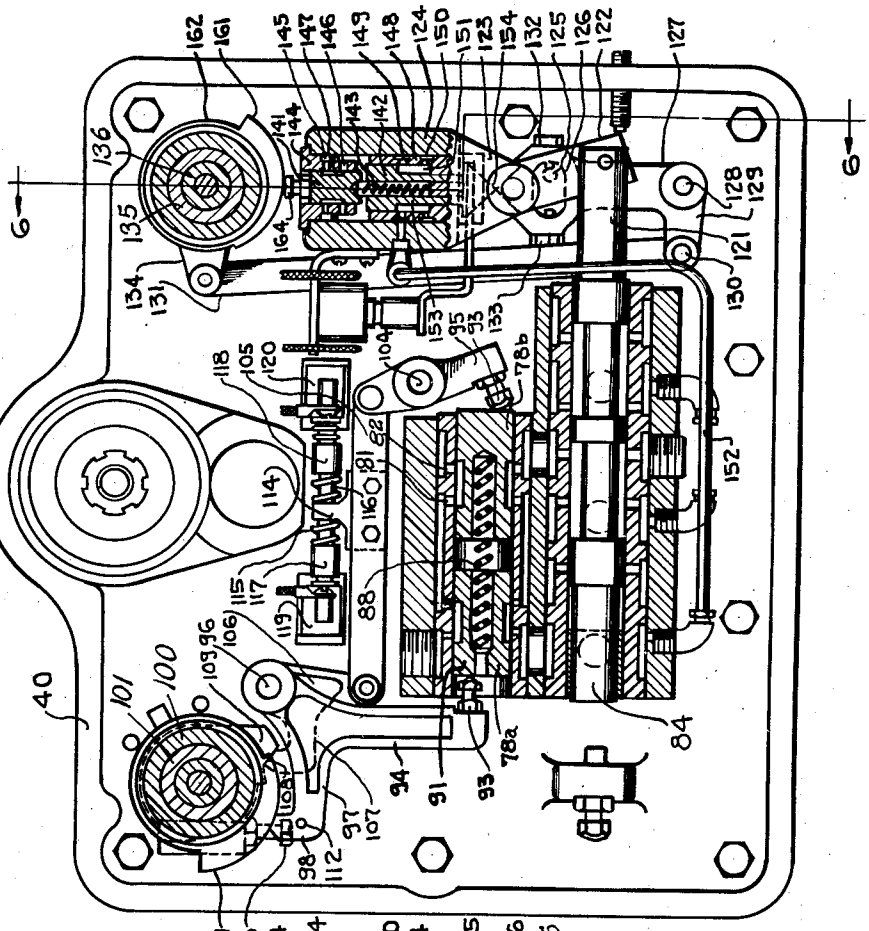


Fig. 5

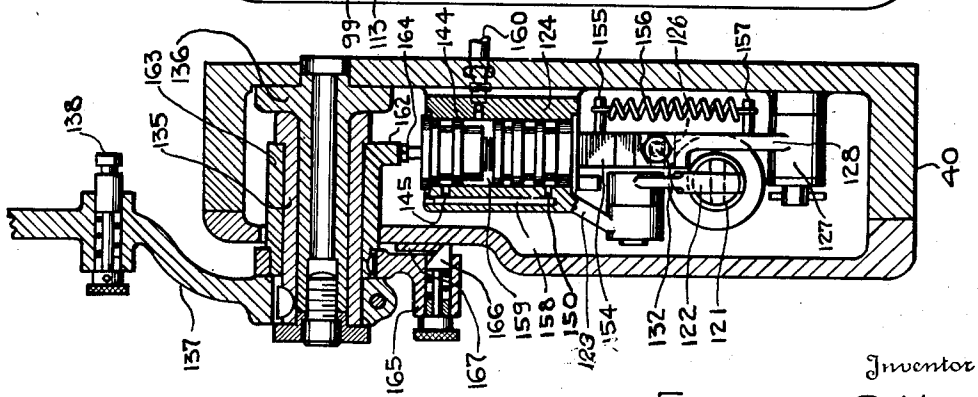


Fig. 6

Inventor

FREDERICK S. HAAS

RALPH L. GOETZEL

By H. K. Parsons

Attorney

Patented May 19, 1936 2,040,990

UNITED STATES PATENT OFFICE

2,040,990

HYDRAULIC CONTROL MECHANISM

Frederick S. Haas, Cincinnati, and Ralph L. Goetzel, Norwood, Ohio, assignors to Cincinnati Grinders Incorporated, Cincinnati, Ohio, a corporation of Ohio

Original application May 31, 1930, Serial No. 458,558. Divided and this application February 29, 1932, Serial No. 595,746

8 Claims. (Cl. 277—42)

This invention relates to improvements in grinding machines of the center type or that type in which the work is held between opposed centers for rotation about a predetermined axis and especially to improvements in the mechanism for effecting the table operation and control, being a division of a copending application which eventuated in Patent 2,012,065.

In the performance of grinding operations on work pieces held between centers, there are two methods generally employed. In the first method the work piece is held between the centers on a table or a supporting member which is then traversed across the face of a grinding wheel to reduce the work piece throughout its length to the same size, while in the second method the supporting centers and work piece carried thereby are held stationary as respects this traversing movement and the grinding wheel is fed directly into the work and thereby effecting the stock removal. This invention pertains particularly to the former method of grinding and especially to improved hydraulic and mechanical control means for effecting the proper traverse of the work supporting table. It is further to be noted that the grinding wheel is fed into the work at each end of the traverse of the table either by actuating the table and work toward the wheel or actuating the wheel toward the work.

It is, therefore, one of the principal objects of the present invention to provide improved hydraulic control mechanism determining the operation of the means for actuating the table.

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 exact 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 a front elevational view of a grinding machine embodying the improvements of this invention.

Figure 2 is an elevational view of the machine as seen from the right hand side thereof in Figure 1.

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

Figure 4 is a view of several of the parts shown in Figure 3 as seen particularly from line 4—4 thereon.

Figure 5 is a sectional view taken on line 5—5 of Figure 3.

Figure 6 is a sectional view taken on line 6—6 of Figure 5.

Figure 7 is a diagrammatic view illustrating the hydraulic circuits involved in this application.

Throughout the several views of the drawings similar reference characters are employed to denote the same or similar parts.

A machine embodying this invention may comprise a bed or support 15 having formed longitudinally thereof at its forward end ways 16 and 17 for guiding during its reciprocating movement a work supporting table 18. Adjustably carried by the table at opposite ends thereof is the head stock 19 and tail stock 20 from which centers 21 and 22 respectively project. The centers 21 and 22 support a work piece 23 between them. The head stock 19 has a motor or prime mover 24 connected through suitable transmission means enclosed within guard or casing 25 with the spindle which carries the live center 21. To effect rotation of the work piece 23 from the spindle or center 21 a dog 26 is provided being secured to the work piece and bridged over by driving pin 27 to the said spindle. The work piece 23 is removed from between the centers 21 and 22 by retracting the said center 22 through the medium or handle 28 carried by the tail stock 20.

The table 18 and work 23 are reciprocated longitudinally of the bed while effecting a stock removal from the face of the work throughout its length by a suitable tool or grinding wheel 29 supported by the bed for this purpose. To effect the said movement of the table 18 use is made of an hydraulic motor operated by a hydraulic circuit diagrammatically shown in Figure 7 and described in detail in applicants' Patent 2,012,065.

This hydraulic medium is normally contained within a tank 73, see Figure 7, from which it is drawn through a conduit 74 by a pump 75 and discharged from the pump under pressure through a conduit 76. The medium then passes through a conduit 77 to starting and stopping valve 78 from which it passes through port 79 formed along the exterior of valve sleeve 80 to a port 81 for direction to the interior of the sleeve 80 passing then through port 82 to conduit 83 for conveyance to the directional control or reverse valve 84, which directs the medium to one side or the other of hydraulic motor 30. As shown in Figure 7, the medium passes through the conduit 85 from the valve 84 to the lower side of motor 30. The spent medium discharged on the other side of the motor is directed through the conduit 86 back to the

valve 84 for discharge through a conduit 87 to the sump or tank 13. The valve 78 in addition to being used as a starting and stopping valve controls the velocity or rate at which the table 18 is being reciprocated and is of a unique, novel construction. This valve comprises a pair of spools 78a and 78b, each having a bore therein in axial alignment to receive a spring 88 which tends to actuate the spools in opposite directions. The cannelure formed in spool 78b is utilized for connecting ports 81 and 82 formed in the sleeve 80, while the cannelure of spool 78a connects a pair of similar ports 89 and 90 formed in the said sleeve 80. The velocity or rate of movement of the table by the hydraulic motor is controlled more or less by closing off the port 89 by the shoulder 91 formed by the cannelure in the valve spool 78a.

As was noted above, the spring 88 tends to actuate the spools 78a and 78b in opposite directions away from one another and thereby holds the said spools in engagement with adjustable stops 92 and 93 respectively carried by a pivotally mounted bell crank 94 and an arm 95. The bell crank 94 is pivotally mounted at 96 to the bracket or housing 40 and has a second arm 97 extending therefrom. The arm 97 of the bell crank 94 is provided with a nose 98 contacting at all times with cam face 99 formed on a flange of sleeve 100 journaled for rotation about a sleeve 101. Secured to the outer end of sleeve 100 is a handle 102 having a spring pressed locking pawl co-operating with a serrated or toothed plate 103 secured to the cover of the bracket or housing 40 positioned on the forward face of the bed 15 within convenient reach of the operator. Adjustment of the handle 102 rotates the sleeve 100 for adjusting the position of the cam 99 to thereby shift the spool 78a and vary the opening of port 90 to control the flow of the hydraulic medium therethrough. As shown in Figure 5, the port 90 is partly open to permit a normal shifting of the table so that the removal of stock from the work piece 23 takes place at the desired rate.

While the flow of the medium through the port 90 is restricted during actual operation of the machine, the flow from the port 79 formed longitudinally of the sleeve 80 is shut off by the spool valve 78b to stop the reciprocation of the table but an unrestricted flow is permitted during actual operation. As shown in Figure 5, ports 81 and 82 are connected permitting, as noted above an unrestricted flow of the medium therethrough. This spool 78b is shifted by the arm 95 pivoted about pivot 104 carried by the rear wall of the bracket or housing 40. The upper end of arm 95 is pivotally connected to the longitudinally shiftable link 105 which has its opposite end pivotally connected to similar crank arm 106 pivotally carried by pivot 96. The other arm 107 of bell crank 106 is provided with a cam follower 108 at all times held in engagement with the stepped cam 109 formed on a flange 110 carried by the sleeve 101. Pivotally secured to the outer end of the sleeve 101 is the main starting and stopping lever 117 which may be rocked in a clockwise direction to shift the spool valve 78b and open port 81 to permit the table 18 to be actuated at a normal work feeding rate.

From the foregoing, it will be noted that handle 102 may be adjusted for positioning the valve spool 78a to determine the rate of speed at which the work supporting table will be reciprocated. It will also be noted that with starting and stopping lever in its neutral or central position, the flow of hydraulic medium is restricted to stop the movement of the table, while the shifting thereof to the right or in a clockwise direction will open port 81 and permit the flow of the medium therethrough determined by the setting of the valve spool 78a.

There are times when it is desired to reciprocate the work table 18 at a high or rapid traverse rate, such as when grinding bearing portions at opposite ends of a shaft, for example, to thereby materially reduce the time involved in completing a given grinding operation. To this end the arm 97 of bell crank 94 is provided with a pin 112 in the path of movement of an abutment 113, shown in Figure 3, as an adjustable screw carried by a projection on flange 110 of sleeve 101. Rotation of main starting and stopping lever 111 in a counterclockwise direction will cause the abutment 113 to engage the pin 112 and actuate the bell crank 94 about its pivot 96 to shift valve spool 78a to the right, as seen in Figure 5, thereby completely uncovering port 90 and permitting an unrestricted flow of the hydraulic medium therethrough. This unrestricted flow of the medium through port 90 effects a corresponding speeding up of rotation of the power gears to correspondingly rapidly rotate the pinion shaft 48 and reciprocate the table at a rapid rate.

The longitudinally shiftable bar 105 has secured thereto a projection 114 abutting on opposite sides with adjacent ends of springs 115 and 116 through which depressible plungers 117 and 118 of starting and stopping switches 119 and 120 are actuated to start and stop the head stock rotating motor 24 with which the said switches are electrically connected. From this it will be noted that actuation of the lever 111 to effect reciprocation of the table 18 simultaneously effects the rotation of the motor 24 and work piece 23 rotated thereby.

The directional control or reversing valve 84 is shifted at each end of the stroke of the table 18 to thereby reverse the movement of the table. To this end the valve 84 is provided with a shifter rod 121 having a forked end and receiving between its arms a pivotally mounted lever 122. The lever 122 is pivoted to a projection 123 depending from a casing 124 carried by the housing or bracket 40. The pin 125 projects from the lever 122 into an elongated perforation 126 formed in the upper end of one arm of bell crank 127. This bell crank 127 is pivoted at 128 and has its other arm 129 pivoted at 130 with one end of a link 131. Carried by the bell crank 127 and projecting into the perforation 126 therein and from opposite sides thereof is a pair of set screws 132 and 133 adapted to engage with the pin 125 of lever 122. The upper end of the link 131 is pivotally connected to a crank arm 134 integral with the sleeve 135 journaled about a hollow shaft 136 supported by the bracket or housing 40. Keyed or otherwise secured to the outer end of the sleeve 135 is a reversing lever 137 extending upwardly above the bed 15 and having a projection 138 extending therefrom toward the said bed 15. The table 18 has secured to its forward edge at opposite ends thereof dogs 139 and 140 adapted to engage with the projection 138 for oscillating same about its axial center or hollow shaft 136.

At each end of the stroke of the table a slight pause is effected followed by a gradual increase in speed of movement of the table in the opposite direction. This pause is effected by an hydrau-

lic tarry valve enclosed within the casing 124. Vertically shiftable through the casing 124 is a pair of spool valves 141 and 142 having co-axial bores therein for a spring 143. The spool 141 is enclosed within a sleeve 144 through which ports 145 and 146 are formed. A cannelure 147 formed in the spool valve 141 connects the ports 145 and 146. The spool valve 142 is likewise enclosed in a sleeve 148 having ports 149 and 150 connected together by the passage 151 formed on the spool 142. The hydraulic medium under pressure is conveyed to the the casing 124 through a conduit 152 coupled into the casing containing the reversing valve 84 and is in direct communication with the main pressure line 77. The spool valve 142 is provided with a reduced portion 153 having formed at the end thereof a wedge-shaped head 154 having cam faces on opposite sides thereof. These cam faces co-operate with similar cam faces formed on the end of valve shifter lever 122. A pin 155 projects from the valve spool head 154 to which is attached one end of a spring 156. The other end of said spring is secured to a pin 157 projecting from the rear face of the bell crank 127. Referring to Figure 6, it will be noted that the port 145 of sleeve 144 is connected with a port 150 of sleeve 148 by a longitudinal port 158. The chamber 159 formed between valve spools 141 and 142 and their containing sleeves 144 and 148 is drained through a port 160 formed in the valve casing 124.

Assuming the table to be traveling to the left, as seen in Figure 1, the dog 140 upon engagement with the projection 138 would rotate lever 137 and sleeve 135 which through the crank 134 would depress link 131. This depression of link 131 actuates the bell crank 127 in a counter-clockwise direction to take up the lost motion between the pin 125 and abutment set screw 132 and then shift the valve 84 to its neutral or stop position to stop further movement of the table. At the same time through the inter-engagement of the contacting cam faces on the upper end of the bell crank and the cam faces on the head 154 the depression of link 131 forces upwardly the said head 154 and spool valve 142 permitting the hydraulic medium flowing through the conduit 152 to fill the passage 151. By oscillating the bell crank 127 until the lost motion between the ends of set screws 132 and 133 is taken up and the valve 84 shifted to its neutral position the apex of the cam faces on the bell crank 127 is beyond the point of the head 154. At this time the spring 156 which was tensioned by the raising of the head 154 tends to actuate the said head downwardly, thereby bringing into engagement the opposite cam faces. This downward movement of the head and valve spool while freely moved upward is now restricted in its descent since it must force outwardly from the passage 151 the hydraulic medium therein. The medium is discharged through port 150 to port 158 to the upper port 145 in sleeve 144. The flow of the medium through the port 145 is restricted by the shoulder on the valve 141 so that the descent of the head 154 and valve spool 142 is restricted and the shifting of the valve 84 takes place only at the rate of movement of the head. This movement gradually uncovers the port through which the hydraulic medium is passing and the hydraulic motor thereby slowly picks up speed to correspondingly slowly accelerate the speed of movement of the table 18.

The adjustment of the spool valve 141 is obtained through cam face 161 formed on flange 162 of a sleeve 163 mounted for rotary movement about the sleeve 135. A cam follower 164 projects from the spool valve 141 into engagement with the cam 161 being held in this engagement by a spring 143. The sleeve 163 is adjusted by a handle 165 keyed or otherwise secured thereto and locked in position by the inter-engagement of a spring pressed pawl 166 co-operating with a serrated or toothed plate 167. From this it will be seen that the amount of tarry and rate of acceleration of the movement of the table 18 after reversal may be adjusted to any desired limit.

From the foregoing it will be noted that there has been provided a grinding machine employing improved table actuation and control means adjustable to very fine limits for accurately controlling and actuating the table and work carried thereby.

What is claimed is:

1. In a mechanism of the class described the combination of a conduit through which an hydraulic medium flows, a starting, stopping and velocity control valve mechanism in the conduit comprising a pair of spool valves, ports connecting the said valves, common means for actuating said spool valves to stop the flow through the ports, means for actuating one of the valves against said last mentioned means for initiating the flow of the hydraulic medium through the port, and additional means for adjusting the position of the other valve against the actuation of the common means to control the rate of flow of the medium through the port and therefore through the conduit.

2. In a mechanism of the class described the combination of a conduit through which an hydraulic medium flows, a starting, stopping and velocity control valve mechanism in the conduit comprising a pair of spool valves, ports connecting the said valves, common means for actuating said spool valves to stop the flow through the ports, means for actuating one of the valves against said last mentioned means for initiating the flow of the hydraulic medium through the port, additional means for adjusting the position of the other valve against the actuation of the common means to control the rate of flow of the medium through the port and therefore through the conduit, and additional means for further shifting the last mentioned spool valve against said common valve shifting means to effect a rapid flow of the fluid through the ports and therefore through the conduit.

3. An hydraulic control including a valve mechanism interposed in the conduit between a source of impelling fluid and the member to be impelled thereby, said valve mechanism including a casing, a pair of co-axially disposed valve members slideable within the casing, fluid passages in the valve members and casing providing a sinuous conduit serially embodying the valves successively, a spring interposed between said valves outwardly urging same in an axial direction, abutments terminally engaging the respective valves to individually limit their respective outward movements, a control lever, and connections between the control lever and the abutments effective to transmit power from the lever to the abutments whereby the effective position of the individual valves may be adjusted by movement of the lever.

4. Means for determining the effective action of an hydraulic circuit including a pair of op-

posed valve members serially arranged in the circuit, means for yieldingly outwardly urging said valve members, independent adjustable abutments for limiting the movement of the valve members as so urged, oscillatable levers supporting said abutments, an oscillatable control lever, and power transmitting connections between the control lever and the abutment supporting levers for varying the position of the individual valves in accordance with predetermined movements of the control lever.

5. A control valve mechanism for a fluid circuit including a ported casing and a pair of independent valve members slideable within the casing for effecting connection or blocking off of the several ports of the casing, said valves being arranged serially as respects the hydraulic flow porting of the casing, means resiliently urging the valves into port blocking positions, a first abutment adjustable to effect a predetermined throttle setting of one of the valves whereby the rate of flow of the hydraulic medium through the conduit is determined, a second abutment adjustable to limit the movement of the other valve member to a fully open position, a single control lever, and power connections between the control lever and the valve member effective to shift the throttle valve to a wide open position for rapid flow or alternatively to shift the other valve to a closed position, stopping flow of the fluid when the throttle valve is in its rate determining position.

6. An hydraulic control unit including a casing having valve receiving chambers formed therein and adapted to receive rate controlling and flow controlling valves, conduits in the casing interconnectible in serial relation by the valves for determining the effective hydraulic flow of an actuating medium through the casing, a combination valve unit contained in one of the chambers and comprising a pair of axially disposed individual valve units floating within the chamber, a compression spring interposed between said units for urging them into separated position, adjustable abutments terminally engaging the floating unit for determining the position thereof as an entirety with respect to the ports of the casing, and means for individually temporarily varying the position of an individual abutment and its associate valve member while the position of the unit as an entirety is maintained by the opposed abutment, substantially as and for the purpose described.

7. An hydraulic control unit including a casing having valve receiving chambers formed therein and adapted to receive rate controlling and flow controlling valves, conduits in the casing interconnectible in serial relation by the valves for determining the effective hydraulic flow of an actuating medium through the casing, a combination valve unit contained in one of the chambers and comprising a pair of axially disposed individual valve units floating within the chamber, a compression spring interposed between said units for urging them into separated position, adjustable abutments terminally engaging the floating unit for determining the position thereof as an entirety with respect to the ports of the casing, and means for individually temporarily varying the position of an individual abutment and its associate valve member while the position of the unit as an entirety is maintained by the opposed abutment, substantially as and for the purpose described, said means including a control lever having a fixed cam associated therewith for imparting the prescribed movement to one of the abutments and its associate valve and having an adjustable member for cooperation with the other abutment for variably shifting the other of said valve members for prescribed movement of the lever.

8. Means for determining the effective action of a fluid circuit including a pair of opposed valve members serially arranged in the circuit, means for urging said valve members into circuit interrupting position, independent adjustable abutments for limiting the movement of the valve members as so urged, oscillatable levers supporting said abutments, an oscillatable control lever, power transmitting connections between the control lever and the abutment supporting levers for varying the position of the individual valves in accordance with predetermined movements of the control lever, and operative connections between said power transmitting connections and the power device for the other part whereby the actuation of said second power device is determined by the oscillatable control lever in predetermined relation to the abutment determined effect of the valves.

FREDERICK S. HAAS.
RALPH L. GOETZEL.