

June 21, 1927.

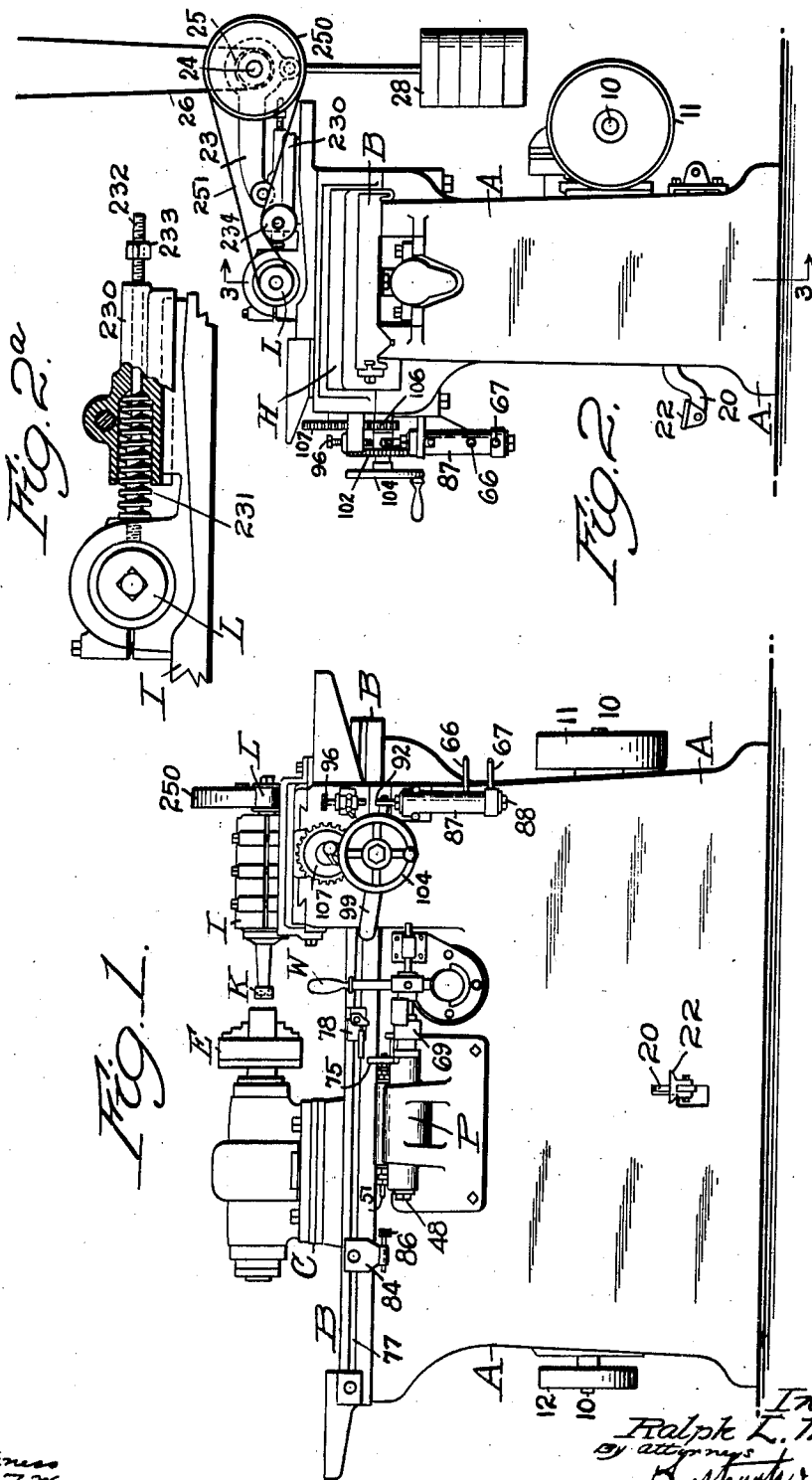
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1,633,557

FLUID PRESSURE OPERATING MECHANISM FOR RECIPROCATING MEMBERS

Filed Nov. 20, 1920

6 Sheets-Sheet 1



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FLUID PRESSURE OPERATING MECHANISM FOR RECIPROCATING MEMBERS

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6 Sheets-Sheet 2

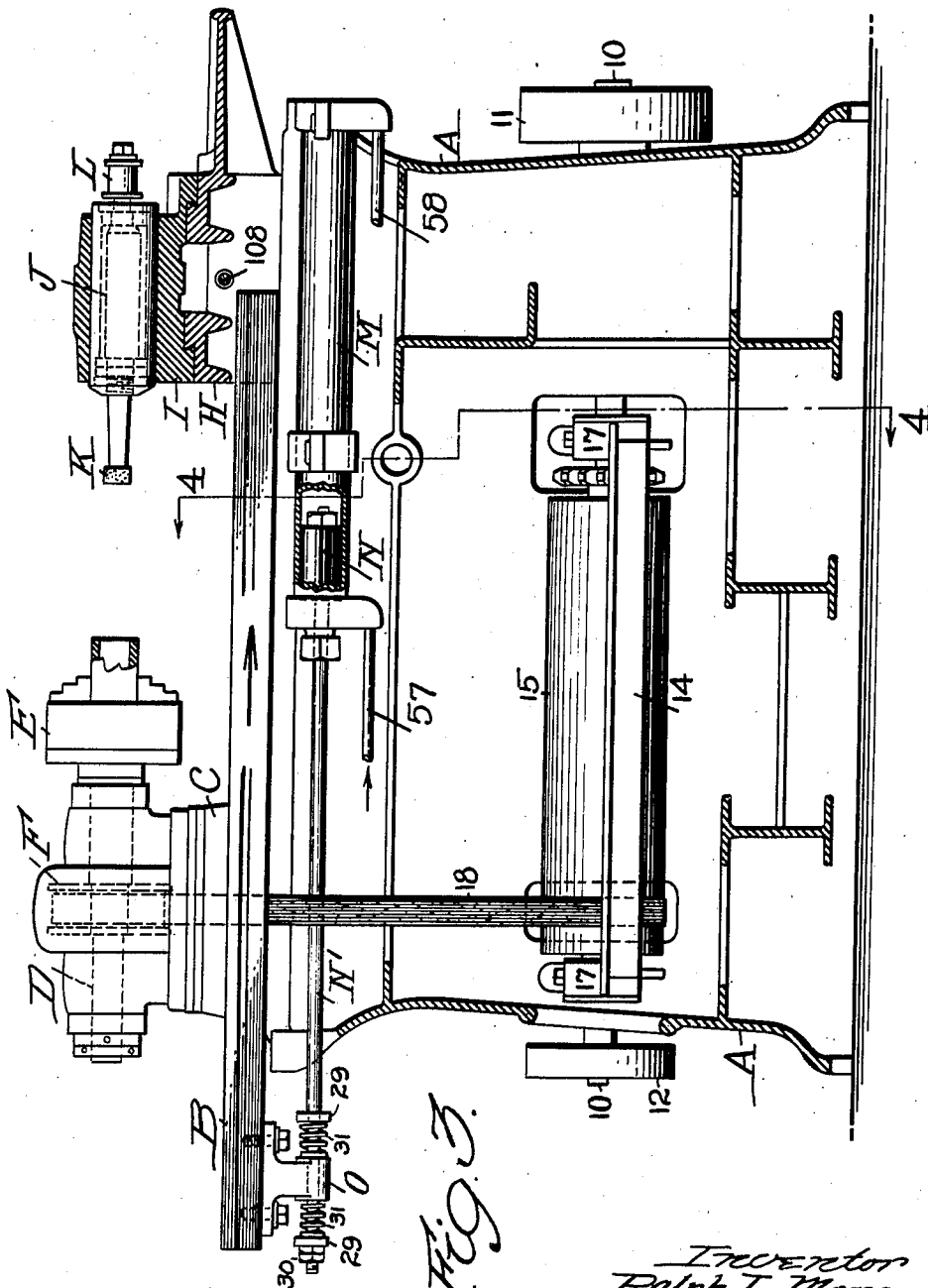


Fig. 3.

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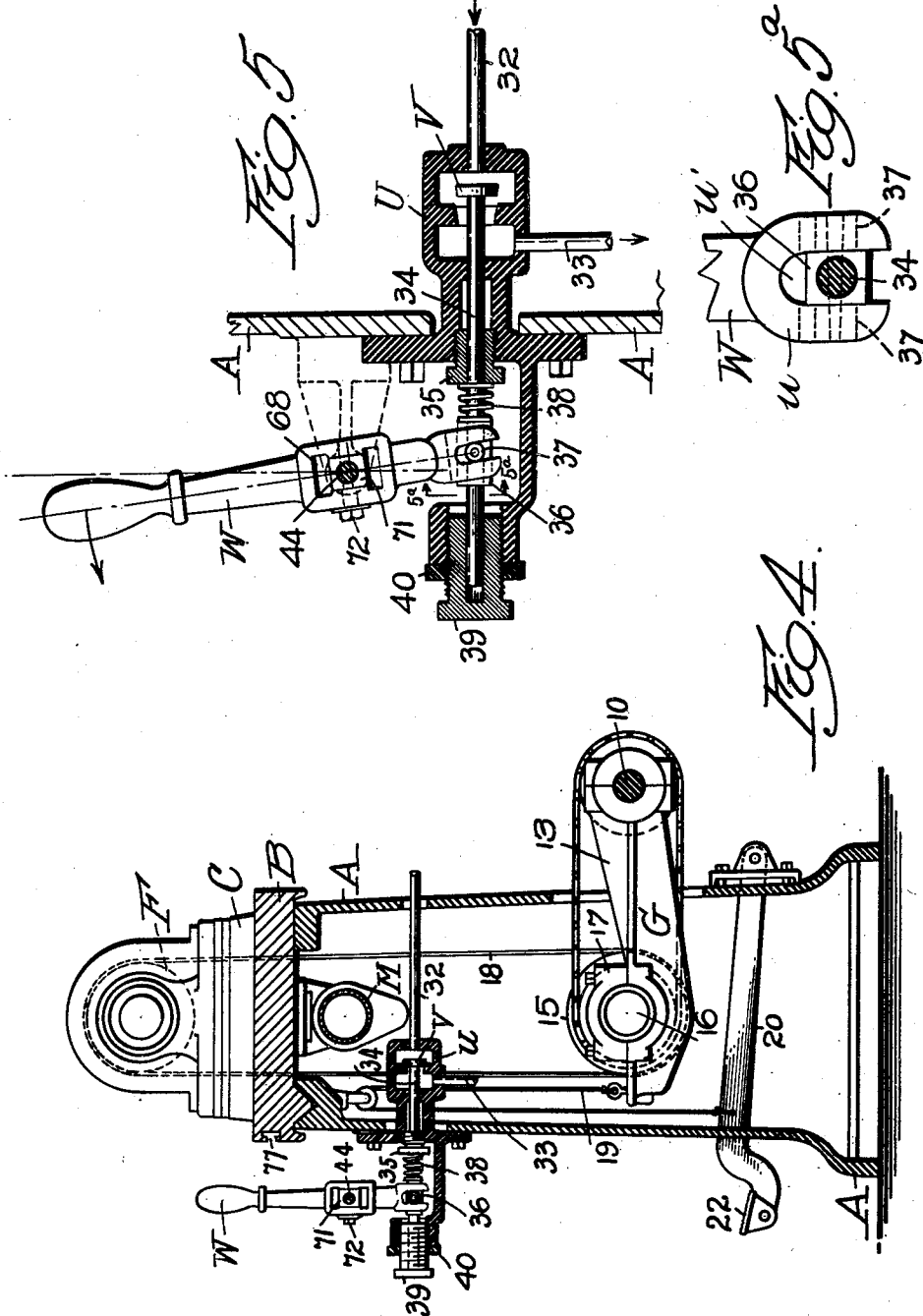
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6 Sheets-Sheet 3



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FLUID PRESSURE OPERATING MECHANISM FOR RECIPROCATING MEMBERS

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6 Sheets-Sheet 5

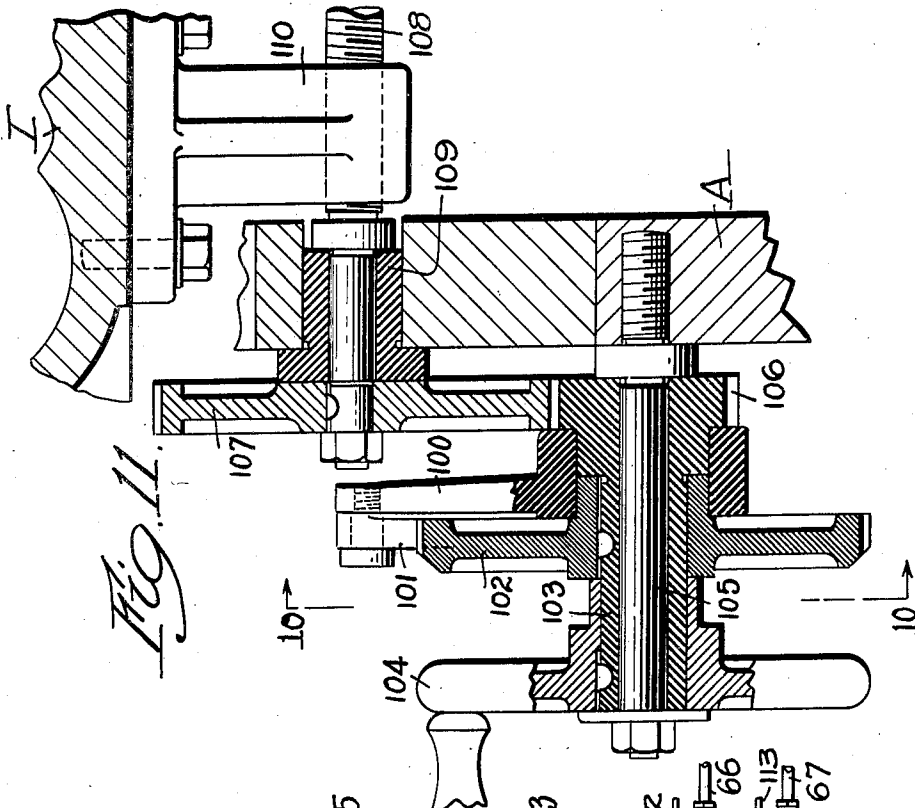


Fig. 11.

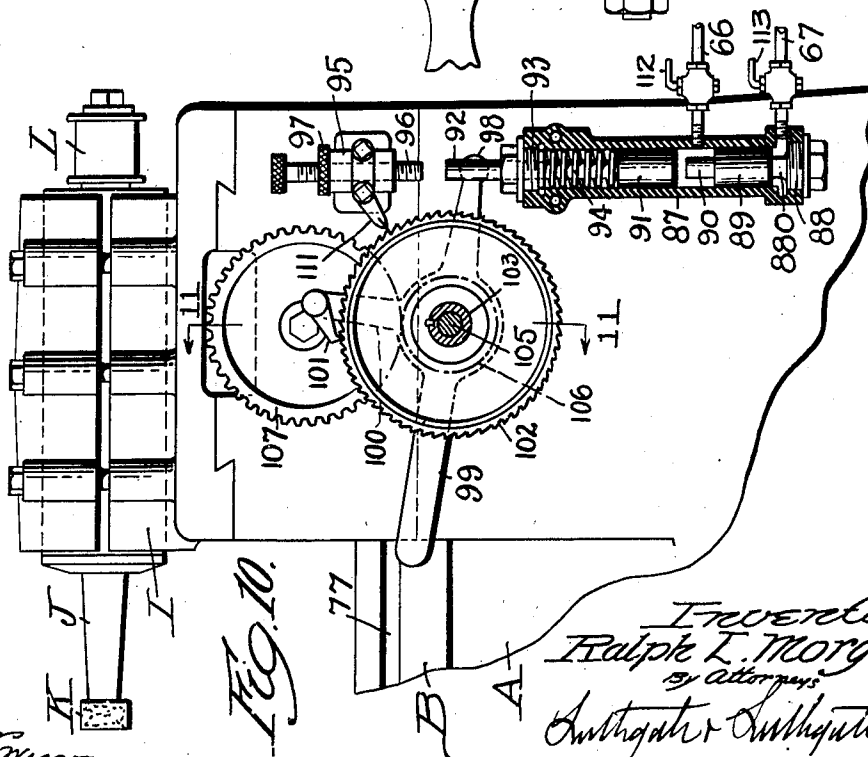


Fig. 10.

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FLUID PRESSURE OPERATING MECHANISM FOR RECIPROCATING MEMBERS

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6 Sheets-Sheet 6

Fig. 10.

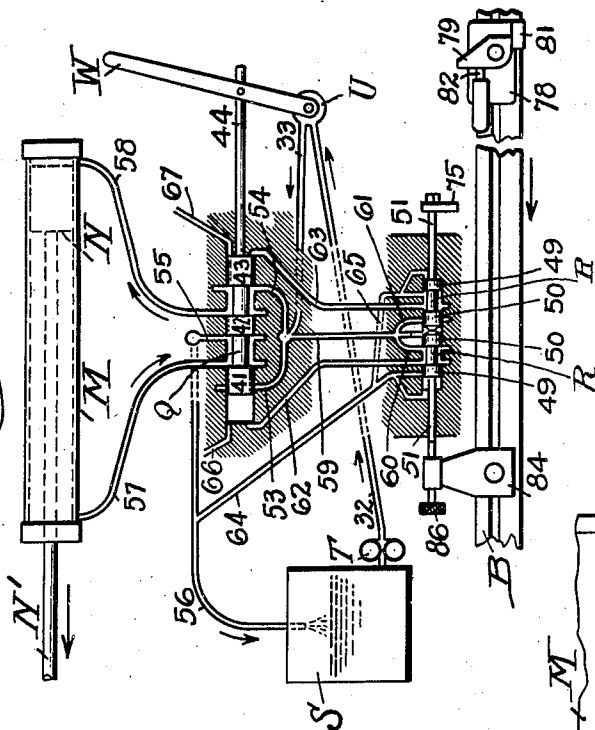


Fig. 12.

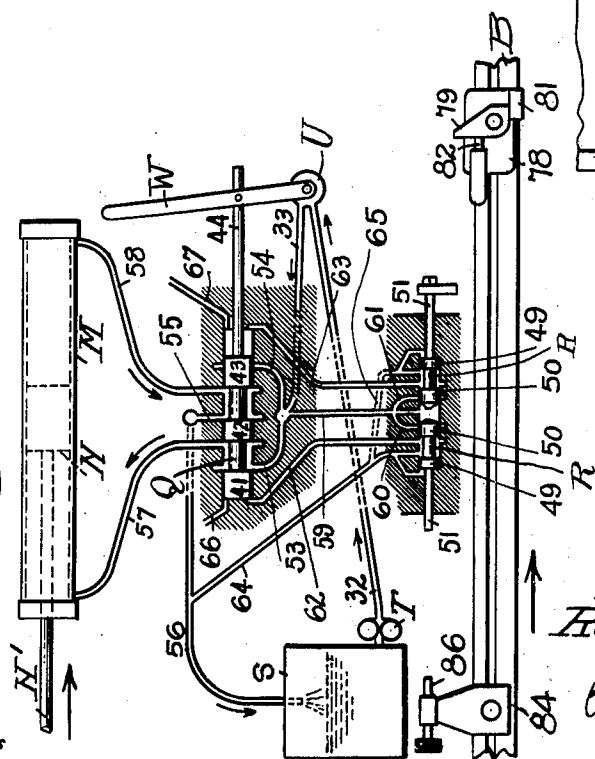
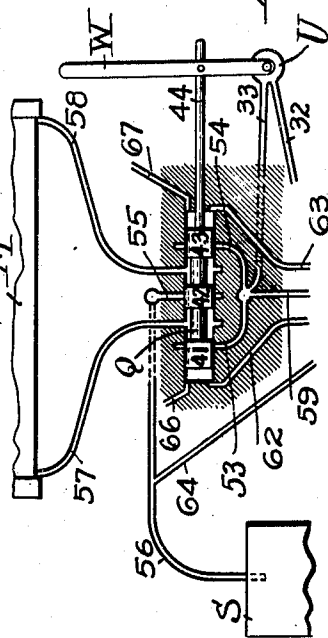


Fig. 14.



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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE-OPERATING MECHANISM FOR RECIPROCATING MEMBERS.

Application filed November 20, 1920. Serial No. 425,475.

The object of this invention is to provide a new and improved valve mechanism for controlling the flow of a fluid to a cylinder and piston connected to reciprocate a moving member.

The invention consists of a main valve for controlling the flow to the cylinder and an auxiliary valve mechanism connected to control the movements of the main valve, and dogs on the moving member for operating the auxiliary valve mechanism. The auxiliary valve mechanism preferably consists of two separate auxiliary valves, pressure being admitted between the same so as normally to force the same to outermost position. The valve connections are arranged so that when the auxiliary valves are in normal position the operating faces of the main valve will be connected to the exhaust. An operating handle is connected to the main valve so that by the arrangement of auxiliary valve mechanism previously described, the main valve can be operated by hand as well as by the auxiliary valve mechanism. An adjustable throttle valve is arranged in the connection between the source of pressure and the main valve and the operating handle for the main valve is connected so that it can also be used to open the throttle valve which throttle valve is normally forced to its adjusted position. By these connections the operating handle can be employed to control not only the movements of the moving member but also can be operated to control the speed of said movements.

I also employ the mechanism previously described to operate some mechanism around the machine to which the valve mechanism previously described is applied. This additional mechanism consists of a cylinder having a piston therein connected to the mechanism to be operated and also a floating piston therein. Connections are arranged between this cylinder and the valve mechanism so that the piston therein can be operated periodically, preferably at either or both reversing movements of the moving member.

While the invention is capable of general application, it has been especially designed for use in connection with the reciprocating

work table of a grinding machine and the auxiliary mechanism has been designed for use in connection with the traverse feed of the grinding wheel of such a machine. The invention will be best understood by describing the application of the same to a grinding machine of this character.

This application is illustrated in the accompanying six sheets of drawings referring to which and in detail

Fig. 1 is a front elevation of the machine;

Fig. 2 is an end elevation;

Fig. 2^a is a detail of the grinding wheel belt tightener;

Fig. 3 is a sectional elevation on an enlarged scale of Fig. 1;

Fig. 4 is a cross-section on line 4—4 of Fig. 3;

Fig. 5 is a sectional elevation on an enlarged scale of the throttle valve and operating handle;

Fig. 5^a is a detail front elevation of the lower end of the operating handle;

Fig. 6 is a sectional elevation on an enlarged scale of the main valve;

Fig. 7 is a cross-section on the line 7—7 of Fig. 6;

Fig. 8 is a cross-section on the line 8—8 of Fig. 6 on a still further enlarged scale;

Fig. 9 is a front elevation of the parts shown in Fig. 8;

Fig. 10 is a front elevation partly in section of the automatic cross feeding mechanism for the grinding wheel, the section being taken along the line 10—10 in Fig. 11.

Fig. 11 is a cross-section on the line 11—11 of Fig. 10 on an enlarged scale; and

Figs. 12, 13 and 14 are diagrams illustrating the operation of the valve mechanisms which control the operation of the work table.

The invention will be best understood by a detailed description of the parts and connections.

Referring to the drawings and in detail, A designates the frame or base. This base has a lengthwise extending V groove and a flat way and a work table B is fitted to slide back and forth thereon. Bolted to this work table is a bearing block C, in which is journaled a shaft D on the end of which is screwed the chuck E which holds

the piece of work or blank which is to be ground. A pulley F is secured on the shaft D and the block is made hollow so that the shaft can be driven from below and the pulley covered up so as to be out of the way of the operator.

A driving shaft 10 is journaled in bearings or brackets secured to the rear of the base A and the same is driven by a pulley 11 secured on the same to which a belt may be led from a suitable countershaft. A pulley 12 is also secured on the shaft 10 and is employed to drive the oil pump hereinafter referred to. A cradle G is carried by the shaft 10 and extends inside of the base A. This cradle consists of two arms 13 pivoted on the shaft 10, said arms being connected together by a tying member 14. A drum 15 is mounted on a shaft 16 which is journaled in bearings 17—17 formed or carried on the arms 13—13 as illustrated in Fig. 4. A belt 18 is led around said drum 15 and around the pulley F. The pulley F is flanged as shown in Fig. 3 so that as the work table is reciprocated back and forth on the base, the chuck E will be rotated, the belt moving along the drum 15. The weight of the cradle and the parts which are carried thereby is relied upon to keep the belt 18 under tension. A wire rope 19 is connected to the cradle and is led up over a small pulley or wheel secured inside of the frame and the end of the rope is attached to a lever 20 pivoted to the back of the frame and extending out through an inverted L-shaped slot in the front of the frame. A foot piece or treadle 22 is attached to the front end of the lever. By pressing down on the treadle and moving the same to the left as shown in Fig. 1, the front end of the cradle will be raised and locked in raised position so that tension will be taken off of the belt 18 whereby the rotation of the work holding chuck E will be stopped.

An arch shaped support H is secured to the base A as illustrated in Fig. 2. This support is made in this shape so that the work table B can pass under the same. This support H is provided with a transversely extending dove-tail, fitted to slide on which is a bearing block I secured in which is a bearing quill, journaled in which, preferably by ball bearings, is a shaft J which carries a grinding wheel K on one end and a driving pulley L on the other end. An arm 23 is pivoted to a slide 230 fitted on ways formed on the bearing block I as illustrated in Fig. 2. This slide is normally forced to the rear by a spring 231 housed in the same and fitted on a threaded shaft 232, one end of which is threaded into the bearing block. A nut 233 is screwed on the shaft 232 to limit the rearward movement of the slide 230 in case the grinding wheel driving belt should

break. A shaft 24 is journaled in the arm 23 and carries on one end a pulley 25 which is driven by a belt 26 extending from a suitable countershaft. Secured on the other end of the shaft 24 is a pulley 250, and the grinding wheel driving belt 251 is led around the same and around idler pulley 234 journaled on a stud secured in the slide 230, and around driving pulley L. A weight 28 is hung on the pivoted arm 23. By these connections the grinding wheel K will be rotated at high speed and the same can be moved transversely of the machine without effecting this rotation.

A cylinder M is secured inside of the base A near the top thereof. Fitting in the same is a piston N, secured to which is a piston rod N' which extends out through a stuffing box attached at the left of the cylinder M as shown in Fig. 3. The piston rod N' is connected at its left hand end to a block O secured to the left end of the work table B. This connection is preferably made yielding by placing collars 29—29 on the piston rod which is reduced or turned down at its left hand end. Nuts 30—30 are threaded in the end of the piston rod and springs 31—31 are placed between said collars and the block O. By these connections as the piston N is forced to the right or left in the cylinder (Fig. 3) the work table will be correspondingly moved back and forth in the ways. A valve casing P is secured to the front of the frame or base A and working in this valve casing is a main valve Q and two auxiliary valves R—R, these valves being employed to control the flow of liquid to and from the ends of the cylinder M and thereby to control the movements or reciprocation of the work table.

The liquid preferably a light oil which is employed to move the piston and thus to reciprocate the work table, is kept in a tank S and is taken therefrom by a gear pump T and forced through a pipe 32 to a casing U which contains a throttle valve V operated by an operating handle W. The liquid passes from the valve casing U to the main valve through a pipe 33.

The throttle valve construction is illustrated in detail in Fig. 5. The throttle valve V is preferably made conical in shape and is arranged to co-operate with a tapered valve seat formed in a partition in the casing U. The valve V is formed or mounted on a stem 34 which is carried out through a stuffing box 35. A block 36 having trunnions or studs 37 is secured on the valve stem 34 by a taper pin and a spring 38 is arranged between said block 36 and the stuffing box 35 so as normally to force the throttle valve V to its seat to close the same. The end of the valve stem 34 is fitted in a hole in an adjusting knob 39 threaded into a bracket extending outwardly forming part of the throttle valve

casing U, a check nut 40 being threaded on the adjusting nut. The lower end of the operating handle W is made in the form of a yoke *u* (Fig. 5^a) and each prong thereof is
 5 slotted as at *u'* so as to engage the studs 37. Normally the valve stem 34 is forced outwardly to the bottom or end of the hole in the adjusting nut 39. By turning the adjusting nut and by unlocking and locking the
 10 check nut 40, the amount of normal opening of the throttle valve can be adjusted so that the speed of the normal movement or reciprocation of the work table B can be determined. The normal position of these
 15 parts is illustrated in Fig. 4. By pulling the top of the operating handle outwardly from the front of the machine as illustrated by the arrow in Fig. 5, the throttle valve can be
 20 opened as wide as desired and by this manual actuation of the valve the speed of the work table can be increased to any desired degree within the limits of the design of the machine. This brings in an important point
 25 of control as will be referred to more particularly after the valves have been described.

The main valve Q consists of three pistons 41, 42 and 43 arranged on a rod 44. A head or cylindrical projection 45 is screwed
 30 into the right hand end of the main valve casing and a stuffing box 46 is arranged therein through which the rod 44 passes. The rod 44 is also fitted in a bearing 47 formed on the throttle valve casing U. A
 35 plug 48 is screwed into the other end of the main valve casing.

Each auxiliary valve R consists of a piston 49 and a piston 50 formed on a stem 51 extending out through a stuffing box 52
 40 screwed in the valve casing. The auxiliary valves are oppositely arranged. The innermost pistons 50 are turned down or have beveled ends as shown so that if they butt together there will still be room for some oil
 45 to get between them as illustrated in Fig. 13. The valve casing P is bored or formed with passages which are arranged as follows. The pipe 33 connects to a passage which is divided into two branches 53 and 54 controlled by pistons 41 and 43 of the main
 50 valve. An exhaust passage 55 is controlled by the piston 42 of the main valve and this passage is connected by a pipe 56 to the oil tank S. A passage through the main valve casing to the left of the passage 55 is connected by pipe 57 to the left hand end of the
 55 cylinder M and a passage through the main valve casing to the right of the passage 55 is connected by pipe 58 to the right hand end of the cylinder M, the cylinder being provided at its ends with heads to which these
 60 pipes connect. The pipe or passage 33 also connects by a passage 59 to the part of the casing in which the auxiliary valves operate. This passage has branches 60 and 61. The

part of the valve casing which contains the auxiliary valves is connected to the left of the main valve by a passage 62 and to the right of the main valve by a passage 63. This part of the casing is also connected to
 70 the exhaust pipe 56 by a passage 64 which is branched as at 65, the ends of the passages 64 and 65 also being branched out into two passages, one to cooperate with the side and the other with the end of each piston 49 of
 75 the auxiliary valves. The ends of the main valve casing are connected by pipes 66 and 67 to operate the traverse feed of the grinding wheel as hereinafter described.

The way the liquid flows through these
 80 various passages will be hereinafter detailed after the various other parts have been described.

The intermediate section of the operating handle W is formed into a rectangular loop
 85 or strap 68. A sleeve 69 is fitted on the cylindrical head 45 of the main valve, which sleeve has an extending arm 70 which has at its end a block 71 through which the stem 44 of the main valve passes. The block 71 is
 90 fitted inside the strap 68 and these parts are secured together by a pivot bolt 72 (see Fig. 5). The parts 69, 70 and 71 are preferably made one integral piece and the arm 70 is shaped to clear the stuffing box 46 as shown
 95 in Fig. 6. An arm 73 is also preferably formed with the parts 69, 70 and 71 and a stud 74 is held therein by a suitable nut (see Figs. 8 and 9). A rocker wing 75 is secured on the stem of the right hand auxiliary
 100 valve R and the same has a slot 76 into which the stud 74 fits.

By this arrangement, the operating handle W can be moved to the right or left around
 105 the studs 37 as a pivot and this movement will push the main valve Q to the right or left. Also the top of the operating handle can be pulled outwardly or away from the frame of the machine, in this operation the
 110 stem or rod 44 of the main valve acting as the pivot. This operation will correspondingly open the throttle valve. This operation can take place no matter how the handle stands longitudinally of the machine. When the handle W is pulled outwardly
 115 the rocker wing 75 is partly rotated as indicated in dotted lines in Fig. 8 for a purpose hereinafter described.

The work table B is provided along its front face with a T slot 77. A dog 78 is
 120 fitted into this slot and is provided with a latch 79 hung on a screw 80 by which the dog is clamped in adjusted position. The top of the latch 79 is shaped to engage a projection 81 on the dog 78 and the latch is
 125 kept to the right (Fig. 6) by a plunger 82 and a spring 83. The latch thus forms a pawl, the lower end of which can be moved to the left as shown in Fig. 6 against a spring tension. Another or left hand dog 130

84 is secured in the slot 77 by a locking bolt 85. An engaging screw 86 is preferably threaded into this dog in position to engage the stem 51 of the left hand auxiliary valve R. The right hand dog is placed in position to engage the wing 75 secured on the stem 51 of the right hand auxiliary valve, when the same is in normal position. But when the wing is swung out of operative position by the movement indicated by dotted lines in Fig. 8, the latch 79 will clear the same.

The mechanism for operating the traverse feed of the grinding wheel will now be described and reference to follow this operation should be had to Figs. 10 and 11. The pipes 66 and 67 extending from the main valve casing are connected to a cylinder 87 secured to the front of the frame at the right hand end. A plug 88 with an upwardly extending projection 880 is screwed in the bottom of the cylinder 87. A lower or floating piston 89 provided with an upwardly extending hub 90 is fitted in the cylinder 87. This piston 89 is shown in its lowest position and it will be seen that liquid coming in through the pipe 67 always can act on the bottom of the piston 89 by reason of the projection 880 on the plug 88. An upper piston 91 is also fitted in the cylinder 87 and has a piston rod 92 extending out through a stuffing box 93 secured in the top of the cylinder 87. The upper piston 91 will always be subjected to fluid coming in through the pipe 66 by reason of the hub or upwardly extending projection 90 on the lower or floating piston 89. A spring 94 is arranged around the piston rod and acts to force the upper piston 91 normally to its lowest position. A bracket 95 is secured to the frame or casing A and a limiting screw 96 is threaded therein, this screw being set in position so that the upper end of the piston rod 92 will engage the same. This screw 96 is provided with a knurled head and by turning the same, the upward movement of the piston rod 92 can be adjusted. The screw 96 is provided with a nut 97 so that it can be locked in adjusted position.

When fluid under pressure comes in through the pipe 67, the lower or floating piston will be forced upwardly to strike the upper piston, which then will be forced upwardly until the piston rod 92 engages the end of the adjusting screw 96.

If fluid under pressure comes in through pipes 66, the same will keep the lower or floating piston in its lowest position and will force the upper piston upwardly until the piston rod 92 engages the adjusting screw 96. Thus, if pressure is supplied through either pipe 66 or 67 the piston rod will be lifted or raised until it contacts with the adjusting screw.

By the connections hereinafter described and by the use of this simple mechanism the cross or traverse feed of the grinding wheel can be set to operate at either or both the reversing movements of the work table and the feed movements can be adjusted.

The piston rod 92 is connected to one arm 98 of a three armed lever 98, 99 and 100. The arm 99 of this lever is provided so that the feed can be worked by hand. A pawl 101 is pivoted to the arm 100 of this lever and this pawl engages with a ratchet wheel 102 secured on a quill 103. A hand wheel 104 is also secured on the quill. The quill is journaled on a stud 105 secured in the frame. A pinion 106 is cut on the quill. The three armed lever 98, 99 and 100 turns loosely on the quill and on the hub of the ratchet wheel 102. The pinion 106 engages a gear 107 fastened on the end of a feed screw 108 turning in a bearing 109 secured in the frame A. The feed screw 108 is threaded into a nut 110 secured to the bearing block I. An indicator 111 may be secured to the bracket 95 to register with marks on the ratchet wheel 102 for indicating the amount of feed. The pipes 66 and 67 are provided with valves 112 and 113 so that the feed can take place at either or both reverses of the table movement.

The operation will now be described. Normally the two auxiliary valves are forced outwardly in the casing. This normally will connect the two ends of the main valve to the exhaust. The main valve therefore can be moved to any position by the operating handle W. When the main valve and operating handle are moved to the left as shown in Fig. 12, fluid under pressure is let into the left hand end of the cylinder M and the table is moved to the right, the right hand end of the cylinder being connected to the exhaust. When the operating handle W is moved to the right as indicated in Fig. 13, the right hand end of the cylinder M is connected to the pressure and the left hand end to the exhaust and the table is moved to the left. When the handle is set in the vertical position the middle piston 42 of the main valve covers the exhaust passage 55 and the pistons 41 and 43 close the inlet passages 53 and 54 and the movement of the piston N and table B is stopped. Thus, the movements of the table are always within the control of the handle. The speed of the normal movements of the table is regulated by the adjustment of the throttle valve as hereinbefore described. If the handle is pulled outwardly, the throttle valve is opened and the movement takes place at a faster speed.

When a piece of work is to be ground, the same is clamped in the chuck E and the chuck is set in rotation. The grinding wheel is also set in rotation and the same is

adjusted to proper transverse position for initial engagement with the inside of the work. The dogs are adjusted in position on the work table so that the table will have the right movement of reciprocation so that the wheel will grind the required distance on the work. The traverse feed of the grinding wheel is adjusted for the right operation at either or both reverses of the

10 work table. These adjustments are preferably made with the work table at its extreme left hand position or as the machine is started in operation. The machine is thrown into operation by throwing the handle W to the left as indicated in Fig. 12
15 so that the table will start on its movement to the right, the latch 79 of the right hand dog snapping over the rocker wing 75. This movement will continue until the left
20 hand dog engages the stem of the left hand auxiliary valve R. This engagement will move the left hand auxiliary valve inwardly and will let the pressure act on the left hand of the main valve. This will shift
25 the main valve to the right as indicated in Fig. 13 and will reverse the movement of the table and start the same on its movement to the left. As the table starts on its left hand movement, the left hand auxiliary valve will move to the left back to its normal position. When the table reaches the end of its desired movement to the left, the latch 79 of the right hand dog will engage the wing 75 on the stem of the right hand
35 auxiliary valve and will push the same inwardly which will let pressure on the right hand end of the pilot valve causing the same to shift from the position shown in Fig. 13 back to the position shown in Fig. 12 whereby the movement of the table to the left will be reversed and the same will be started on its movement to the right. Thus, the table will reciprocate backward and forward. As the table reverses at the
45 right hand end of its movement, fluid under pressure will be allowed to flow into the pipe 67 and as the table reverses at the left, fluid under pressure will be allowed to flow through the pipe 66. The pipes 66 and 67 are normally connected to exhaust. Thus the traverse feed of the grinding wheel can take place at either or both reversing movements of the table depending upon how the valves 112 and 113 are opened.

55 When it is desired to get a quick movement of the table to its extreme left hand position, as for example for examination or calipering of the work or after the piece under operation is ground, the operating handle is pulled way out and is thrown to the right. As the operating handle is pulled way out, by the connections previously described the rocker wing 75 will be moved so that as the table moves rapidly
65 on its movement to the left, the latch 79

will not engage the same. Thus, the table will move quickly to its extreme left hand position, where it may be stopped by moving the handle lever W to mid position, either manually or by a special stop dog on the table as shown and described in the patent to Myles Morgan, No. 1,535,331, issued April 28, 1925. This permits the operator to remove the piece in the chuck that has been ground and to insert a fresh piece. After this is done, the operating handle W can be thrown to the left and the table started on its movement to the right. This can take place at the normal speed as previously described, or if desired, this movement can take place at a high speed until the work engages the grinding wheel by pulling outwardly on the handle W when it is thrown over to the left.

Thus a machine is provided in which the operations can be rapidly and accurately controlled to obtain an enlarged output and there is no danger of any mistake or maladjustment by the operator. The specific application of my improvements to a grinding machine is not claimed herein but forms the subject matter of a co-pending divisional application, Serial No. 624,358, filed March 12, 1923.

The details and arrangements herein shown and described may be greatly varied by a skilled mechanic without departing from the scope of my invention as expressed in the claims.

Having fully described my invention what I claim and desire to secure by Letters Patent is:—

1. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, an operating handle effective for manual movement of said main valve, auxiliary valve mechanism connected to control the movements of said main valve, and means to automatically actuate said auxiliary valve mechanism, said auxiliary valve mechanism automatically returning to normal position after such actuation and as the direction of movement of said moving member is reversed, and being connected to relieve said main valve of unbalanced pressure, when in normal position, whereby said main valve may be thereafter freely moved manually by said handle while connected for automatic control.

2. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, an operating handle effective for manual movement of said main valve, two auxiliary valves connected to control the movements of said main valve, and dogs on the moving member for automati-

cally operating said auxiliary valves, said auxiliary valves after displacement by said dogs moving automatically as the direction of movement of said moving member is reversed to positions in which they equalize the opposed pressures on said main valve, whereby said main valve may be thereafter freely moved manually by said handle while connected for automatic control.

3. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, an operating handle effective for manual movement of said main valve, an auxiliary valve mechanism for admitting fluid under pressure to operate said main valve, and automatic means to actuate said auxiliary valve mechanism, said auxiliary valve mechanism returning automatically to normal position after such automatic actuation and as the direction of movement of said moving member is reversed, and thereby connecting the two end portions of said main valve to the exhaust, whereby said main valve may be thereafter freely moved manually by said handle while connected for automatic control.

4. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, an operating handle effective for manual movement of said main valve, two auxiliary valves connected to control the movement of said main valve, and dogs on the moving member for automatically operating the auxiliary valves, said auxiliary valves being automatically positioned to balance the opposed pressures on said main valve except when said auxiliary valves are positively displaced by said dogs.

5. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the direction of flow of actuating fluid under pressure to the cylinder, a throttle valve for controlling the rate of flow of actuating fluid under pressure to the main valve, a single operating handle connected to control both the main valve and the throttle valve, auxiliary valve mechanism connected to control the movements of the main valve, and dogs on the moving member for operating the auxiliary valve mechanism.

6. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the direction of flow of actuating fluid under pressure to the cylinder, an additional adjustable throttle valve for controlling the rate of flow of actuating fluid under pres-

sure to the main valve, and an operating handle pivoted on both the stem of the main valve and the stem of the throttle valve.

7. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the direction of flow of actuating fluid under pressure to the cylinder, an additional adjustable throttle valve for controlling the rate of flow of actuating fluid under pressure to the main valve, a spring normally acting to move said throttle valve toward one of its extreme positions, and an operating handle pivoted on the stem of the main valve and pivotally connected to the stem of the throttle valve for actuation of said valves by movements in different paths.

8. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, a throttle valve for controlling the flow to the main valve, an operating handle connected to control both the main valve and the throttle valve, auxiliary valve mechanism connected to control the movements of the main valve, and dogs on the moving member for operating the auxiliary valve mechanism, said operating handle being also connected to render one of said dogs inoperative when the handle is moved to open the throttle valve.

9. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, a throttle valve for controlling the flow to the main valve, an operating handle connected to control both the main valve and the throttle valve, two auxiliary valves connected to control the movements of the main valve, dogs on the moving member for operating the auxiliary valves, a rocker wing on one of the auxiliary valves and connections thereto from the operating handle arranged so that as the operating handle is moved to open the throttle valve, the rocker wing will be moved so that the co-operating dog on the moving member will clear the same.

10. The combination of a frame or base, a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, two auxiliary valves connected to control the movements of the main valve, fluid under pressure being admitted between the two auxiliary valves to keep them normally in outermost position to connect the main valve with the exhaust, and dogs on the moving member for cooperating with the auxiliary valves.

11. The combination of a frame or base,

a moving member fitted to slide thereon, a cylinder and piston for reciprocating the member, a main valve for controlling the flow to the cylinder, an operating handle connected to the main valve, two auxiliary valves connected to control the movements of the main valve, fluid under pressure being admitted between the two auxiliary valves to keep the same normally in their outermost positions to connect the main valve with the exhaust, and dogs on the moving member for operating the auxiliary valves, whereby the main valve can be operated automatically or by hand.

In testimony whereof I have hereunto affixed my signature.

RALPH L. MORGAN.