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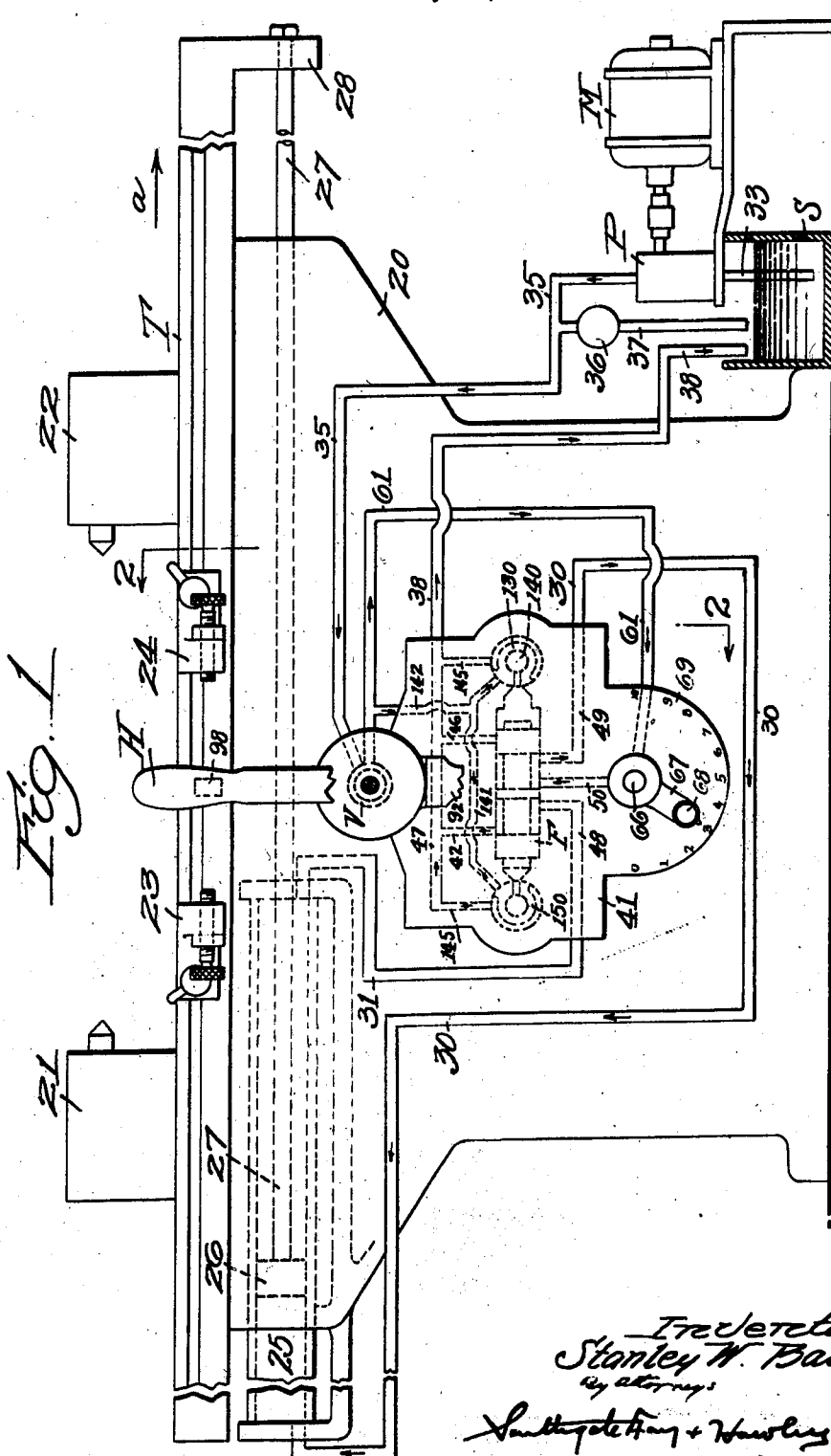
S. W. BATH

1,946,348

HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

Filed May 17, 1932

7 Sheets-Sheet 1



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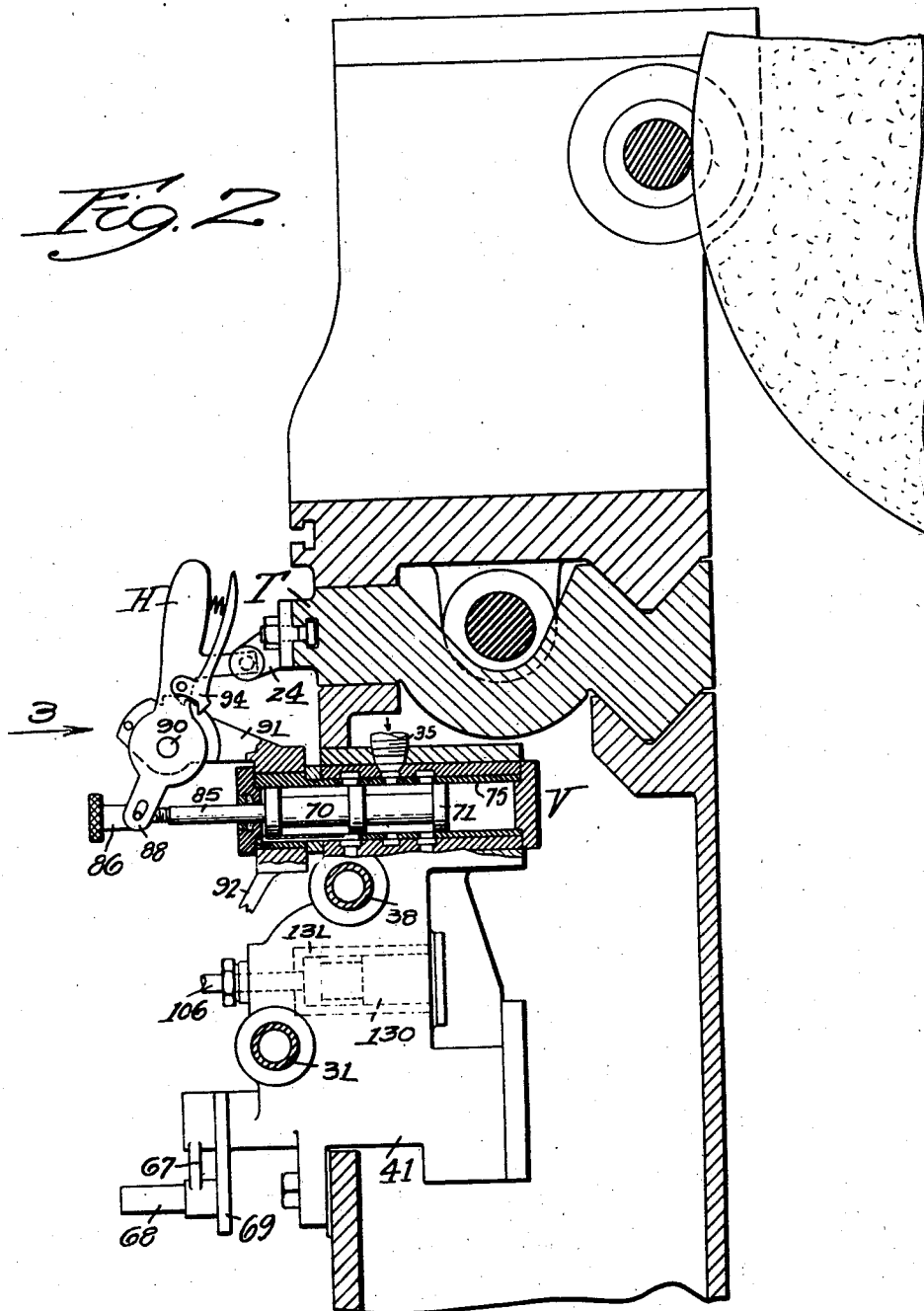
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HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

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Fig. 2.



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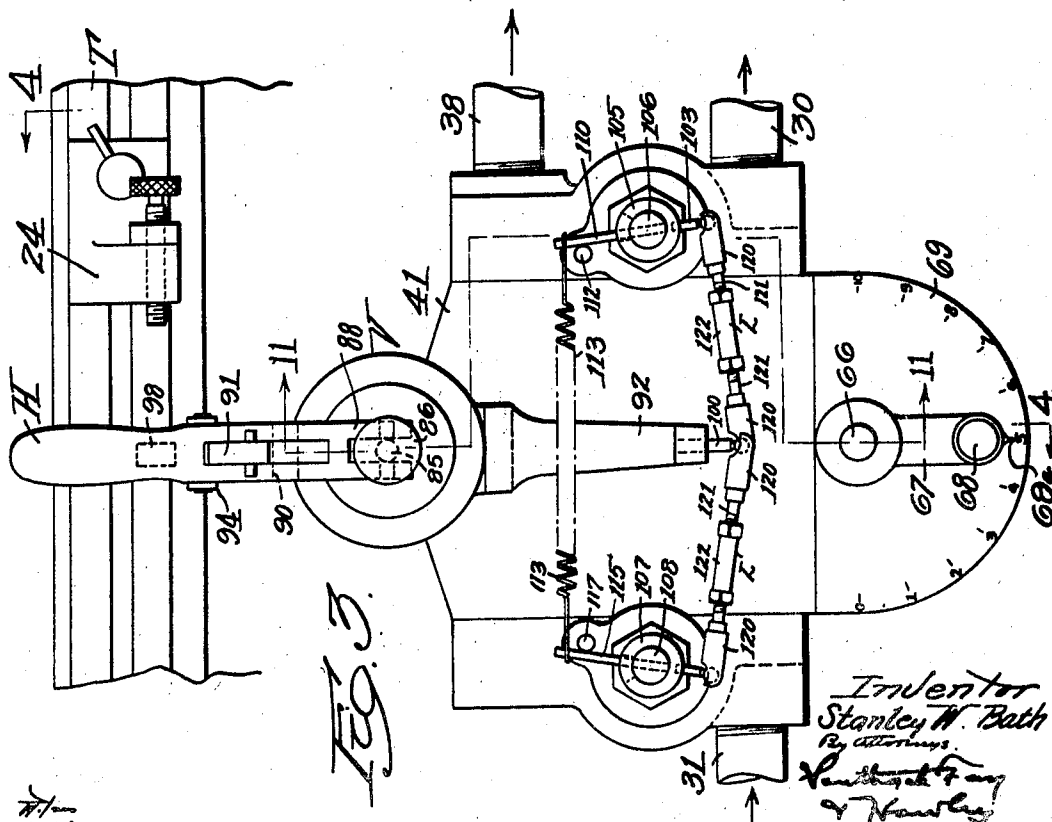
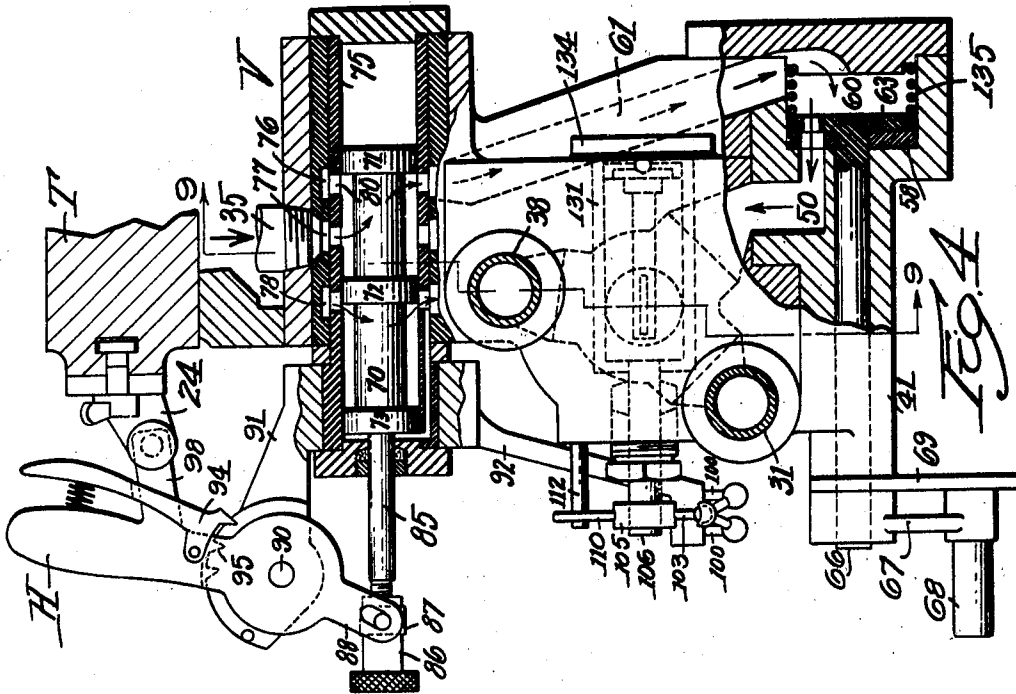
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HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

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7 Sheets-Sheet 3



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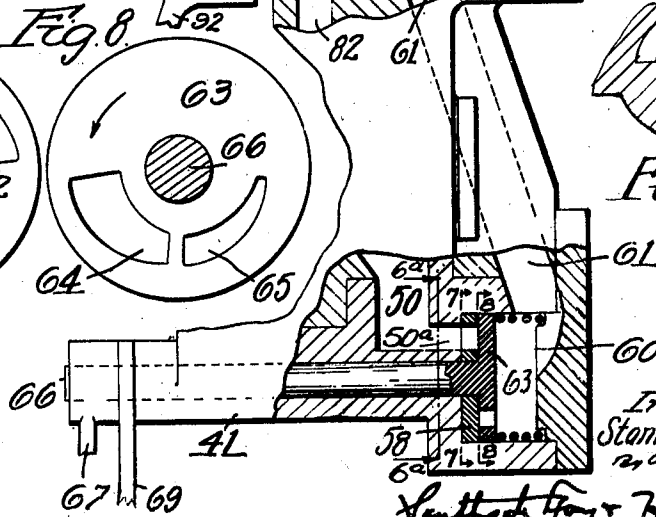
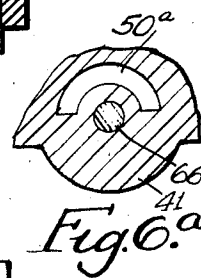
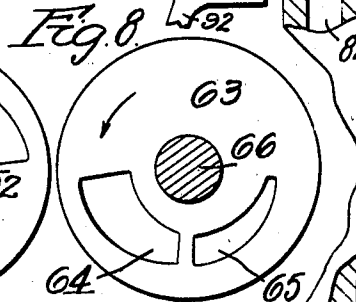
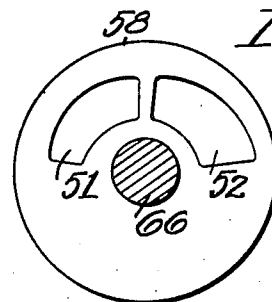
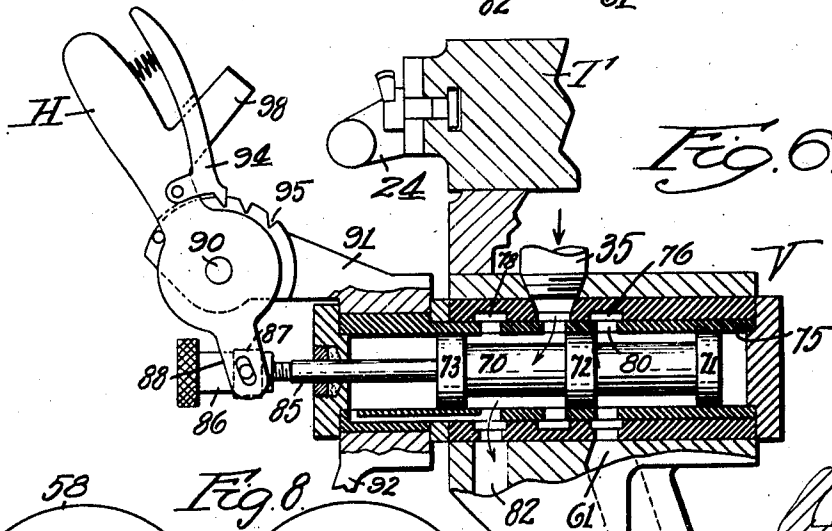
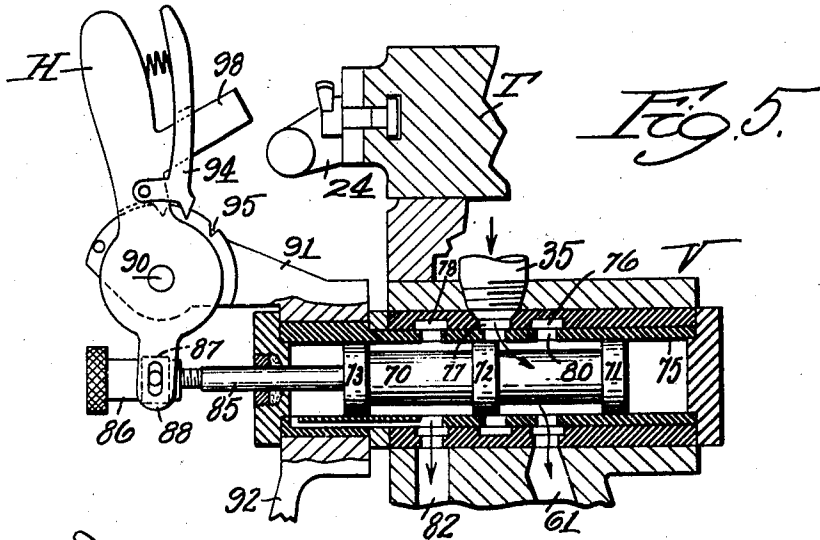
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HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

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7 Sheets-Sheet 4



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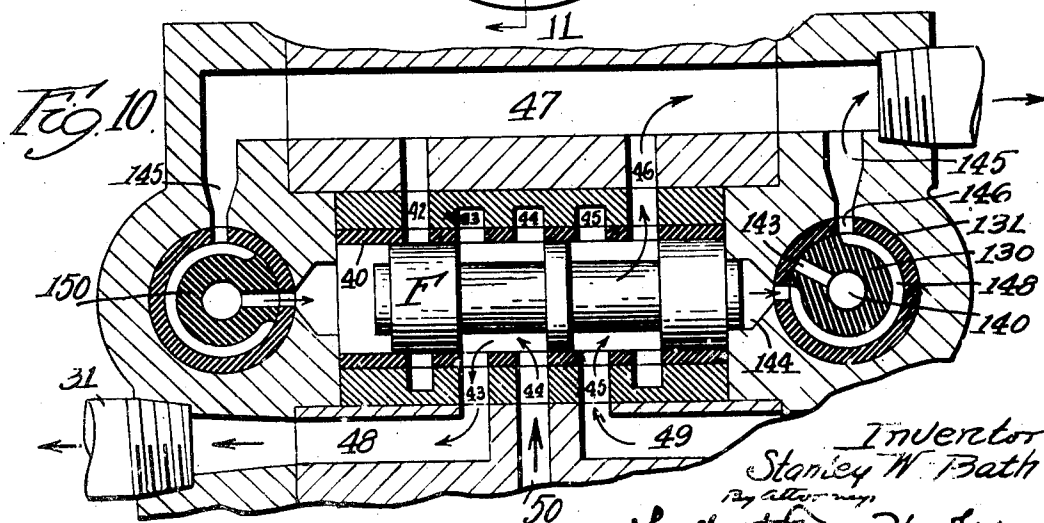
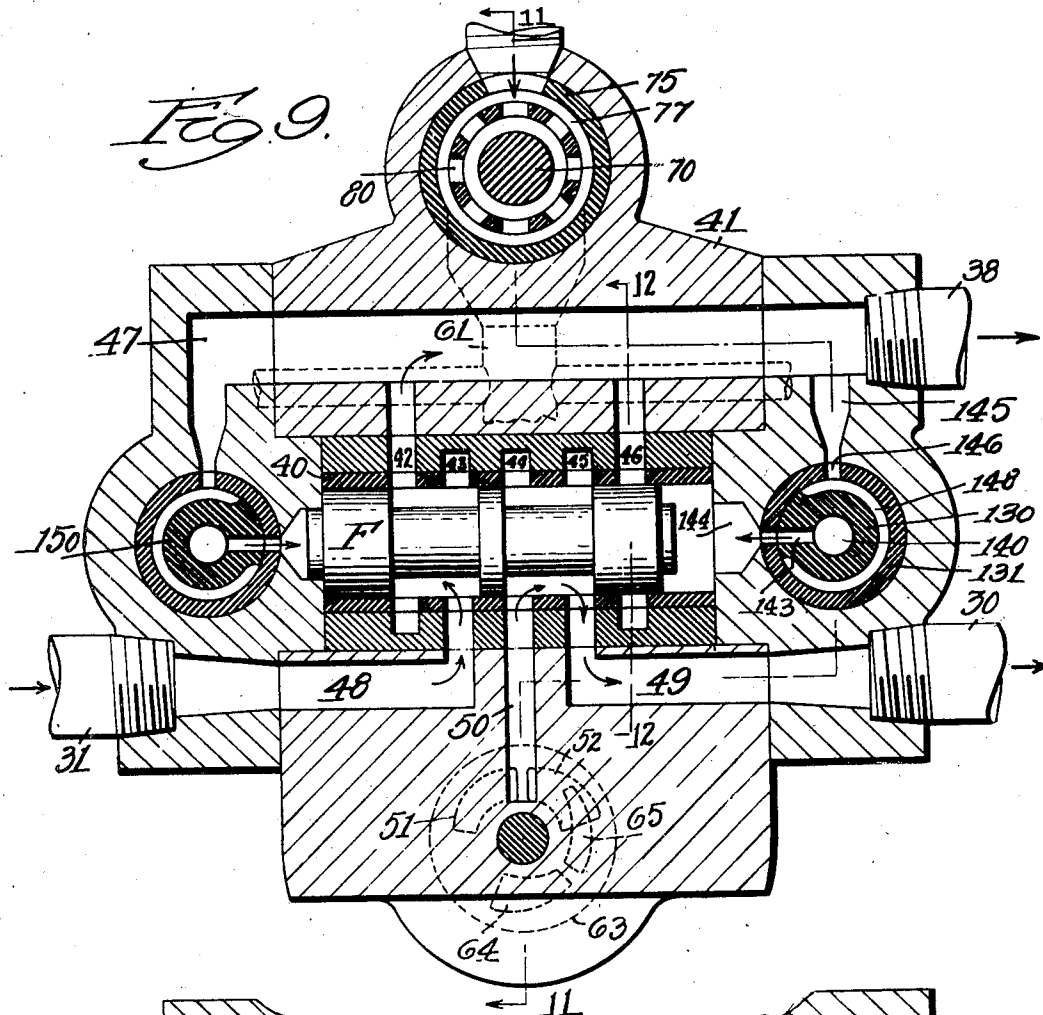
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HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

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7 Sheets-Sheet 5



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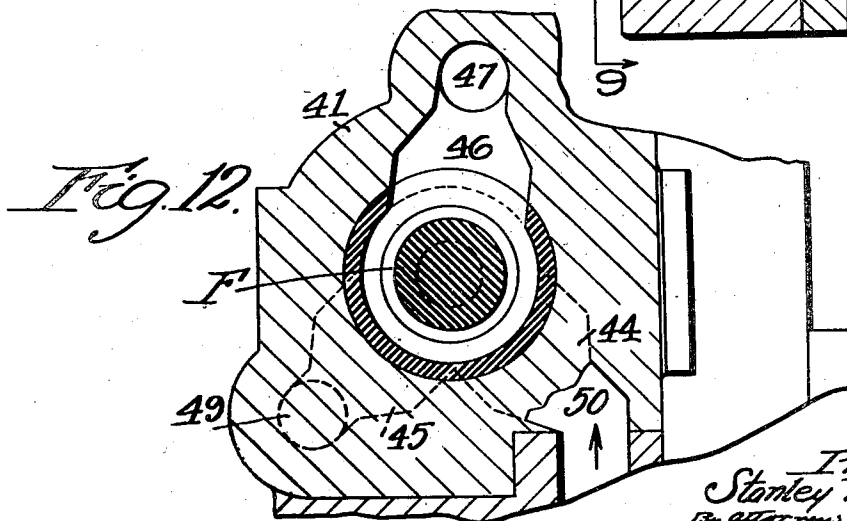
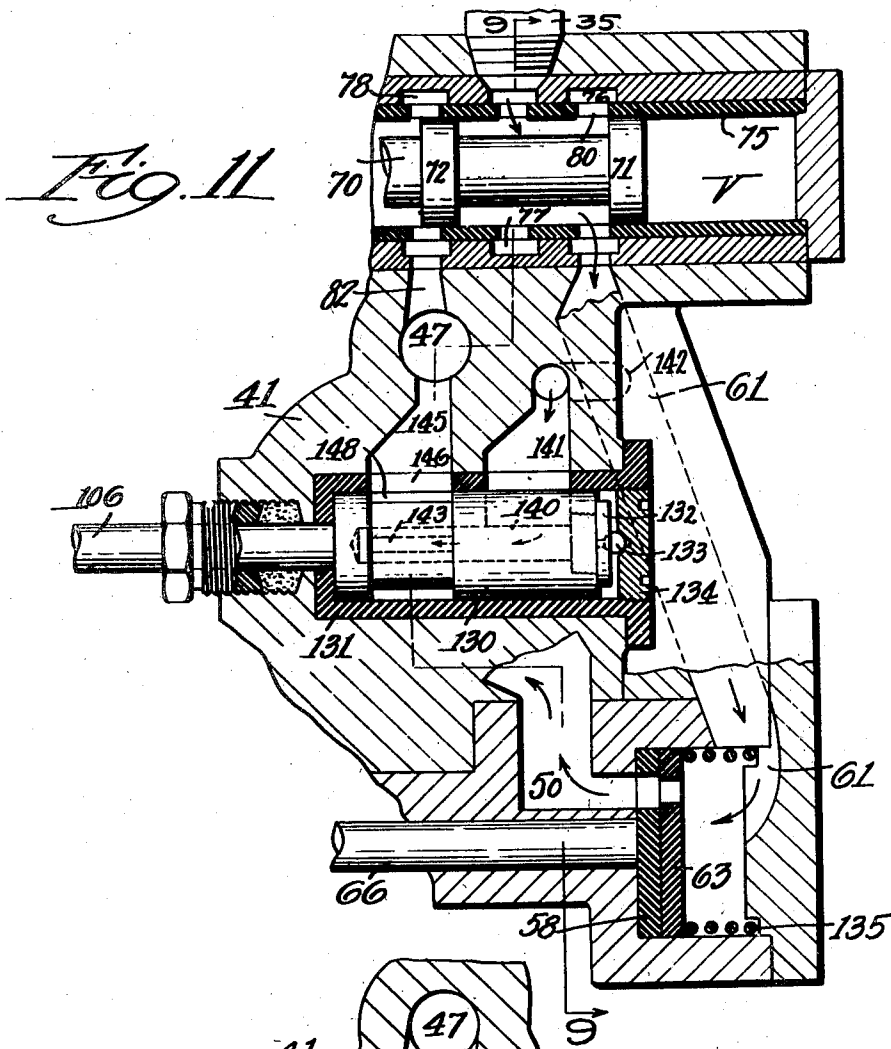
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HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

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7 Sheets-Sheet 6



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HYDRAULIC DRIVING AND CONTROL MECHANISM FOR A RECIPROCATED MEMBER

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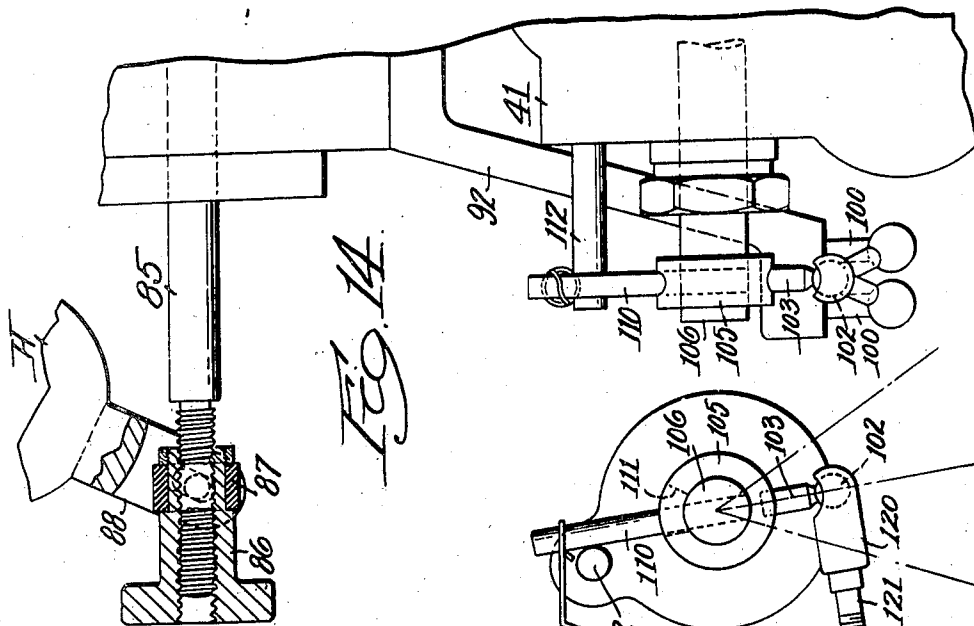


Fig. 14.

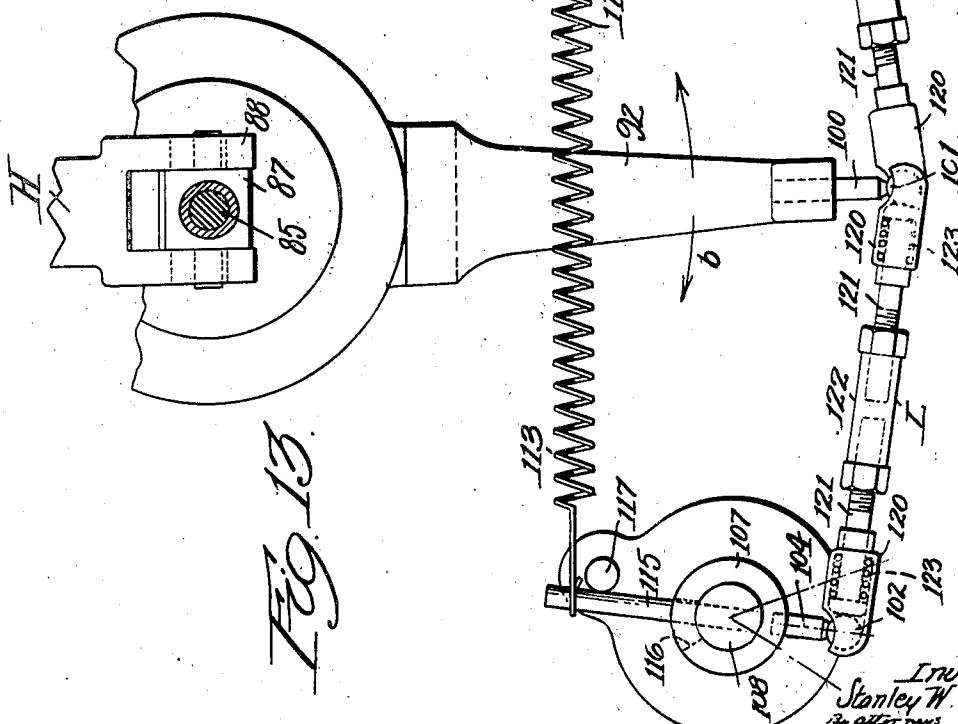


Fig 13.

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UNITED STATES PATENT OFFICE

1,946,348

HYDRAULIC DRIVING AND CONTROL
MECHANISM FOR A RECIPROCATED
MEMBER

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Application May 17, 1932. Serial No. 611,861

7 Claims. (Cl. 121-45)

This invention relates to machine tools having a reciprocated member such as a work table or grinding wheel head.

It is the general object of my invention to provide improved hydraulic driving mechanism for such a reciprocated member, together with improved reversing and speed control mechanism therefor.

A further object is to provide improved mechanism by which a reciprocated member may be smoothly operated and may be stopped, reversed and started without jar or shock. I also provide convenient hand control for slow speed operation and for stopping the machine without disturbing the adjustment of the reversing dogs.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a front elevation of my improved machine;

Fig. 2 is a partial sectional side elevation, taken along the line 2-2 in Fig. 1;

Fig. 3 is an enlarged detail front elevation, looking in the direction of the arrow 3 in Fig. 2;

Fig. 4 is an enlarged sectional side elevation, taken along the line 4-4 in Fig. 3;

Figs. 5 and 6 are views similar to Fig. 4, but showing the parts in different relative positions;

Fig. 6^a is a detail sectional view, taken along the lines 6^a-6^a in Fig. 6;

Figs. 7 and 8 are detail sectional elevations of certain valve mechanism, taken along the lines 7-7 and 8-8 in Fig. 6;

Fig. 9 is an enlarged sectional front elevation, taken substantially along the line 9-9 in Figs. 4 and 11;

Fig. 10 is a view similar to Fig. 9 but showing the parts in reverse position;

Fig. 11 is a sectional side elevation, taken substantially along the line 11-11 in Figs. 3 and 9;

Fig. 12 is a detail side elevation, taken along the line 12-12 in Fig. 9;

Fig. 13 is a detail front elevation showing certain reversing mechanism appearing in Fig. 3 but further enlarged, and

Fig. 14 is a side elevation, partly in section, of the mechanism shown in Fig. 13.

Referring to the drawings, I have shown my invention as embodied in a machine tool, such as a grinding machine, having a bed 20 (Fig. 1) on which a table T is mounted for longitudinal reciprocation. The table T may support work heads

21 and 22 or any other desired parts and is provided with stops or dogs 23 and 24, longitudinally adjustable to desired positions on the side face or edge of the table T. These dogs 23 and 24 alternately engage a reversing and control handle H which will be hereinafter described.

I have shown the bed 20 as provided with a cylinder 25 in which a piston 26 is slidably mounted. The piston 26 is connected by a rod 27 to an arm 28 extending downward from one end of the table T. Pipes 30 and 31 are connected to the opposite ends of the cylinder 25, either of which pipes may be connected to a supply of fluid under pressure, while the other pipe is simultaneously connected to the exhaust, whereby the table T may be moved in a desired direction in the usual manner.

In the drawings, I have shown the pressure fluid as supplied by a pump P (Fig. 1), driven by a motor M and connected to a storage tank S. The oil or other liquid in the tank S is drawn upward through an intake pipe 33 by the pump P and is delivered to the control mechanism through a delivery pipe 35.

A relief valve 36 is mounted in a branch pipe 37, by which surplus liquid may be returned direct to the storage tank S when the pressure in the pipe 35 exceeds a predetermined limit. An exhaust pipe 38 normally returns to the storage tank S the liquid discharged from the cylinder 25.

A freely movable or floating valve F (Fig. 9) is mounted in a cylinder 40 formed in a valve block 41 and provided with annular ports 42, 43, 44, 45 and 46. The ports 42 and 46 are connected through an exhaust passage 47 (Fig. 10) to the return pipe or exhaust connection 38 previously described.

The port 43 is connected through a passage 48 to the pipe 31 which is connected to one end of the cylinder 25. The port 45 is connected through a similar passage 49 to the pipe 30 and thence to the other end of the cylinder 25.

The port 44 is connected through a feed passage 50 (Fig. 6) and a semi-circular port 50^a (Fig. 6^a) to ports or openings 51 and 52 (Fig. 7) in a disc 58 fixed in one end of a chamber or recess 60, which recess is in turn connected through a pipe 61 (Fig. 1) and control valve mechanism V (to be described), to the pressure or delivery pipe 35 of the pump P.

A speed control disc 63 (Figs. 6 and 8) is adjustably mounted in the chamber or recess 60 and is provided with openings 64 and 65 (Fig. 8), and with a rod or shaft 66 (Fig. 6) extend-

ing forward through a bearing in the lower portion of the valve block 41. An arm 67 is secured to the front end of the shaft 66 and is provided with a handle 68 (Figs. 3 and 4) and an index 5 or pointer 68^a, cooperating with graduations on a fixed index plate 69 mounted below the valve block 41.

By moving the handle 68 and arm 67 to the various positions indicated by the index plate 69, the openings 64 and 65 in the movable disc 63 may be brought into various relations with the openings 51 and 52 in the fixed disc 58, thus providing a carefully graduated port opening between the chamber 60 and the feed passage 15 50 (Fig. 6).

The control valve mechanism V is operated manually to stop the table in any desired position or to operate the table at slow speed for inspection or other purposes. This valve mechanism V, as shown in Figs. 4, 5 and 6, comprises a cylindrical valve 70 having spaced piston portions 71, 72 and 73.

The valve 70 is slidable in a cylinder or valve casing 75 having annular passages 76, 77 and 25 78, each connected through a series of perforations 80 (Fig. 9) with the interior of the casing 75. The annular passage 76 connects through the pipe 61 (Fig. 4) to the speed control chamber or recess 60 previously described. The annular passage 77 is connected to the inlet pipe 30 35, and the annular passage 78 is connected through a passage 82 (Figs. 5 and 11) to the exhaust passage 47 and exhaust pipe 38.

The control valve 70 (Fig. 5) has a valve rod 35 85 extending forward and threaded to receive a nut 86 (Fig. 14). A yoke 87 (Fig. 13) is loosely mounted on the nut 86 and is pivoted in yoke arms 88 (Fig. 13) formed at the lower end of the handle H previously described. The handle 40 H is pivoted at 90 (Fig. 5) on a support 91 formed integral with a reversing lever 92 mounted to swing about the axis of the control valve 70.

A spring latch 94 is pivotally mounted on the handle H and is yieldingly seated in one of a series of notches 95 formed on the support 91. 45 As the handle is moved on its pivot 90, the control valve 70 assumes one of the three positions indicated in Figs. 4, 5 and 6, and will be held in the selected position by the latch 94.

50 The usual or running position is indicated in Fig. 4, with the inlet pipe 35 directly connected through the annular passages 77 and 76 to the pipe 61, and thence through various connections to one end or the other of the cylinder 75.

55 If it is desired to temporarily operate the table T at slow speed for inspection of the work or for other purposes, the handle H is moved to the intermediate position shown in Fig. 5, with the inlet annular passage 77 partially 60 blocked off by the piston portion 72, so that a much reduced flow of liquid to the pipe takes place. The nut 86 may be adjusted to provide whatever rate of slow speed movement is desired.

70 If it is desired to stop the table temporarily, the handle H is moved to the position shown in Fig. 6, in which the inlet pipe 35 is connected direct to the exhaust through the annular passage 78 and exhaust passage 82, and no liquid is delivered to the pipe 61. So long as the handle H remains in the position shown in Fig. 6, the table T will remain without movement in either direction.

75 It will be further noted that the handle H is provided with an arm 98 (Fig. 4) which is

aligned with the dogs 23 and 24 when in the normal operative position shown in Fig. 4, but which is out of alignment when the handle H is in the slow speed position of Fig. 5 or the stopping position of Fig. 6. Consequently the 80 dogs 23 and 24 are operative to automatically reverse the table travel only when the handle H is in normal operating position. The table may be moved at slow speed to any desired position and may be stopped in any position without 85 disturbing the setting of the automatic reversing dogs, which will again become operative when the handle H is restored to normal operative position.

The reversing lever 92 (Fig. 13) is extended 90 downward and provided with studs 100 having ball-shaped end portions 101 connected by links L to the ball-shaped lower end portions 102 of studs 103 and 104. The stud 103 is fixed in a collar 105, loosely mounted on a valve rod 106, 35 and the stud 104 is similarly mounted in a collar 107 loosely mounted on the valve rod 108.

A cross pin 110 (Fig. 13) is fixed in the valve rod 106 and extends upward through an elongated slot 111 in the collar 105. At its upper 130 end, the cross pin 110 engages a fixed stop pin 112 and is also connected to one end of a tension spring 113. A similar cross pin 115 is fixed in the valve rod 108 and extends upward through a slot 116 in the collar 107. At its upper end 105 it engages a fixed stop pin 117 and is also connected to the other end of the spring 113.

Each link L (Fig. 13) is formed with cup-shaped ball-engaging end sleeve members 120, 100 loosely mounted on headed rods 121, which in turn are threaded into a connecting sleeve 122. Springs 123 are interposed between the end members 120 and the heads of the rods 121 and tend to move the end members 120 inward against the ball-shaped lower ends of the studs 100, 103 115 and 104. The studs are thus held firmly against the ends of the headed rods 121 and lost motion is eliminated.

The valve rod 106 (Fig. 11) actuates a cylindrical trip valve 130, mounted to rotate in a sleeve or casing 131 seated in the valve block 41. The valve 130 is firmly seated against the 120 outer end of the casing 131 by an anti-friction bearing comprising a plate 132 on the inner end of the valve 130, a ball 133 and an outer plate 125 134 threaded into the sleeve 131. The speed control valve disc 63 is similarly seated by a spring 135 (Fig. 6).

The valve 130 (Fig. 11) is provided with an axial passage 140 continuously connected through 130 branch passages 141 and 142 to the pipe 61 in which fluid under pressure is always present when the machine is operating. The valve 130 has a radial passage or port 143, which may be aligned as shown in Fig. 9, with a port or 135 opening 144 in one end of the floating valve cylinder or casing 40 previously described.

The exhaust passage 47 (Fig. 11) is connected by a branch passage 145 to a port 146 in the trip valve casing 131, which port communicates 140 with an annular recess 148 (Figs. 9 and 10) extending around substantially three-quarters of the periphery of the valve 130. When the valve is in the position shown in Fig. 10, the annular 145 recess 148 forms a connecting exhaust passage between the port or opening 144 in the end of the cylinder 40 and the port 146 of the branch exhaust passage 145.

An exactly similar valve 150 is mounted on 150

the valve rod 108 and constitutes a trip valve for the opposite end of the floating valve cylinder 40.

Having described the details of construction of my improved reversing and control mechanism, the method of operation thereof is as follows:—

The operator first sets the speed control arm 67 (Fig. 3) and pointer 69 to a desired speed, as indicated on the graduated plate 70. Such movement of the arm 67 adjusts the openings in the speed control discs 58 and 63 (Figs. 7 and 8) in the desired relative position, such for instance as appears in dotted lines in Fig. 9, where the opening 65 partially overlaps the opening 52 for relatively low speed operation.

The handle H is then moved from the stopping position shown in Fig. 6, to the slow speed or starting position shown in Fig. 5. This causes liquid under pressure to be delivered at a reduced rate through the pipe 61 and the openings in the discs 63 and 58 to the passage 50 and thence to the middle annular port 44 (Figs. 9 and 10) for the floating valve F.

The trip valves 130 and 150 are normally in the position shown in Fig. 9, with liquid under pressure being applied to both ends of the valve F. The valve is thereby balanced and is maintained in whatever position it may occupy.

Assuming that the valve F is in the position shown in Fig. 9, liquid is being delivered from the passage 50 through the passage 49 and pipe 30 to the left-hand end of the cylinder 25, and the table T is moving to the right, as indicated by the arrow a.

As the table approaches the end of its desired travel, the dog 23 will engage the handle H, rocking the reverse lever 92 to the left, as indicated by the arrow b in Fig. 13. This movement causes the collar 107 for the left-hand trip valve 150 to move idly relative to the cross pin 115, but causes the collar 105 for the trip valve 130 to engage the cross pin 110 and rock the valve 130 to the position shown in Fig. 10, and thus connects the right-hand end of the cylinder 40 through the annular recess 148 and passage 145 to the exhaust.

As full pressure remains at the left-hand end of the cylinder 40, the floating valve F immediately moves to its extreme right-hand position, as indicated in Fig. 10, thus reversing the connections to the cylinder 25 and causing the table to begin its travel to the left.

When the right-hand dog 24 engages the handle H, a similar procedure moves the trip valve 150 to connect the left-hand end of the cylinder 40 to the exhaust, causing the valve F to return to the position shown in Fig. 9.

By the use of the floating valve F, I entirely avoid any wire-drawing effect in the reversing mechanism, as the valve F moves substantially instantaneously from one end to the other of its cylinder 40 and as soon as either end of the cylinder is opened to the exhaust.

This automatic operation will continue as long as desired, but may be interrupted at any time by moving the handle H to the slow speed position shown in Fig. 5 or to the stopping position shown in Fig. 6, and without interfering with the adjustment of the dogs 23 and 24.

Obviously the setting of the speed control disc 63 may be changed as desired at any time during the operation of the machine.

Having thus described my invention and the advantages thereof, I do not wish to be limited to

the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:—

1. Hydraulic actuating and control mechanism for a machine tool having a reciprocating member, comprising a cylinder and piston, one of which is connected to move said member, means to supply fluid under pressure for said cylinder, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a floating-valve reversing device in said connections, trip valves for said floating-valve, and means operated by said reciprocating member to selectively move said trip valves, said trip valves normally admitting fluid under pressure to both ends of said floating-valve device and said latter means moving a selected trip valve to relieve the pressure on one end of said floating-valve as said reciprocating member approaches its limit of travel, whereby said floating-valve is reversed, and said valve-moving means comprising a single actuator effective when moved in one direction to shift one trip valve and effective when moved in the other direction to shift the other trip valve, and lost motion mechanical connections between said actuator and said two trip valves.

2. Hydraulic actuating and control mechanism for a machine tool having a reciprocating member, comprising a cylinder and piston, one of which is connected to move said member, means to supply fluid under pressure for said cylinder, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a floating-valve reversing device in said connections, rotatably movable trip valves for said floating-valve, and means operated by said reciprocating member to selectively move said trip valves, said means including a reverse lever actuated from said reciprocating member and lost-motion connections between said lever and each trip valve effective to move one trip valve only when said lever is shifted in one direction and the other trip valve only when said lever is shifted in the opposite direction, said lever being also operable manually to independently control the movements of said trip valves.

3. Hydraulic actuating and control mechanism for a machine tool having a reciprocating member, comprising a cylinder and piston, one of which is connected to move said member, means to supply liquid under pressure for said cylinder, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a floating-valve reversing device in said connections, trip valves for said floating-valve, means operated by said reciprocating member to selectively move said trip valves to pressure-relieving positions, and a single spring effective to restore both of said valves to normal position.

4. Hydraulic actuating and control mechanism for a machine tool having a reciprocating member, comprising a cylinder and piston, one of which is connected to move said member, means to supply fluid under pressure for said cylinder, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a manually-operated speed control and stopping device in said connections, a reversing valve, and means operated by said reciprocating member for effecting movement of said reversing valve, said speed control and stopping device when in position for normal speed operation of said machine tool forming a part of the connections between said operating means and said reversing valve.

5. Hydraulic actuating and control mechanism for a machine tool having a reciprocating mem-

ber, comprising a cylinder and piston, one of which is connected to move said member, means to supply fluid under pressure for said cylinder, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a manually-operated speed control and stopping device in said connections, a reversing valve, and means operated by said reciprocating member for effecting movement of said reversing valve, said speed control and stopping device when in position for normal speed operation of said machine tool forming a part of the means for effecting operation of the reversing valve, but disabling said valve-operating means when moved to slow speed or stopping positions.

6. Hydraulic actuating and control mechanism for a machine tool having a reciprocating member comprising a cylinder and piston, one of which is connected to move said member, means to supply liquid under pressure to said hydraulic mechanism, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a manually-operated speed control and stopping

device in said connections, a reversing valve, and dogs on said reciprocating member for moving said reversing valve, said speed control and stopping device having a portion positioned in the path of said dogs when said device is in position for normal speed operation of said machine tool.

7. Hydraulic actuating and control mechanism for a machine tool having a reciprocating member comprising a cylinder and piston, one of which is connected to move said member, means to supply liquid under pressure to said hydraulic mechanism, connections from the opposite ends of said cylinder to said supply means and to the exhaust, a manually-operated speed control and stopping device in said connections, a reversing valve, dogs on said reciprocating member for moving said reversing valve, said speed control and stopping device having a portion positioned in the path of said dogs when said device is in position for normal speed operation of said machine tool, and a spring latch to hold said device in a selected position.

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