

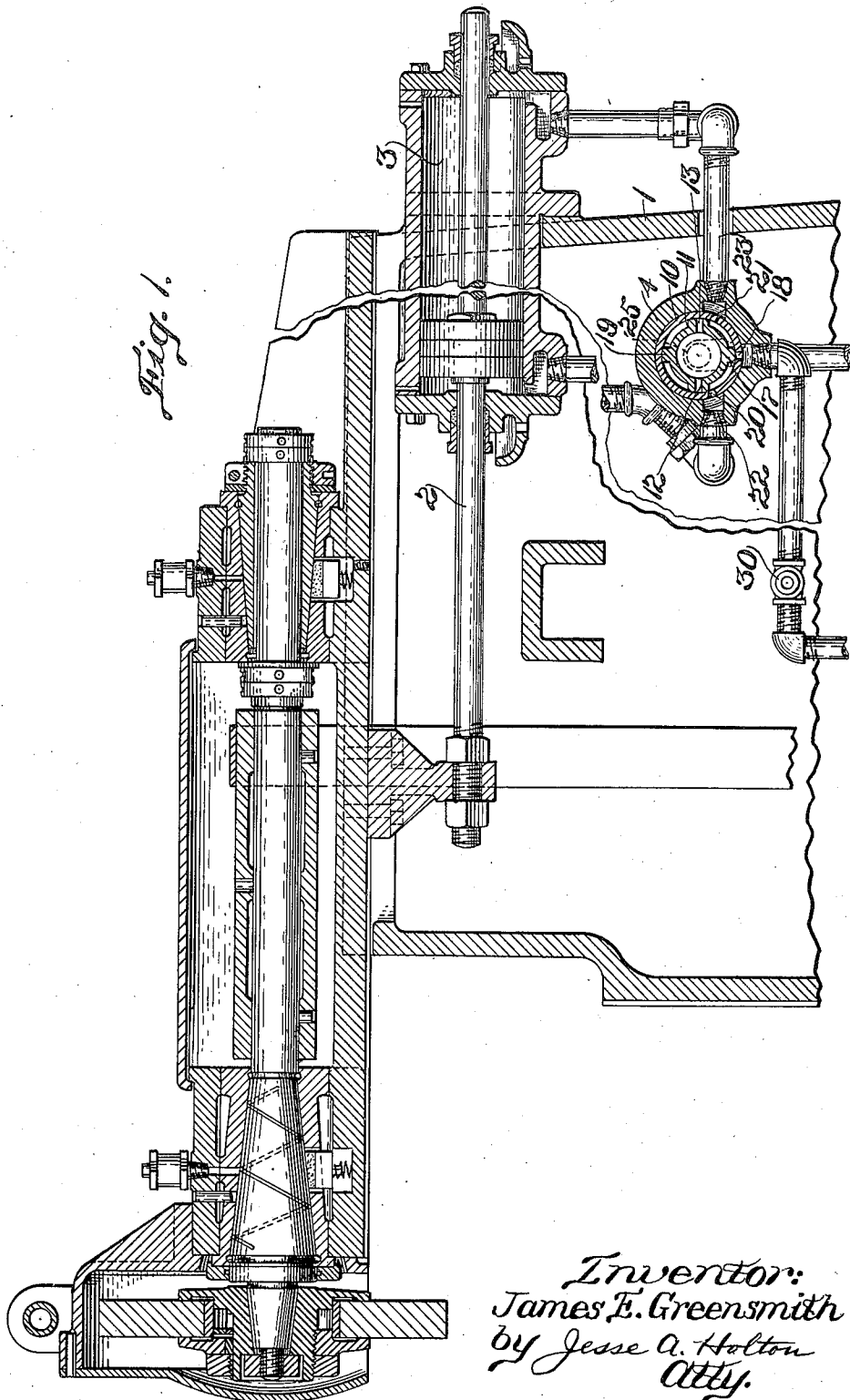
Feb. 12, 1924.

1,483,430

J. E. GREENSMITH

REVERSING VALVE

Original Filed April 19, 1920 3 Sheets-Sheet 1



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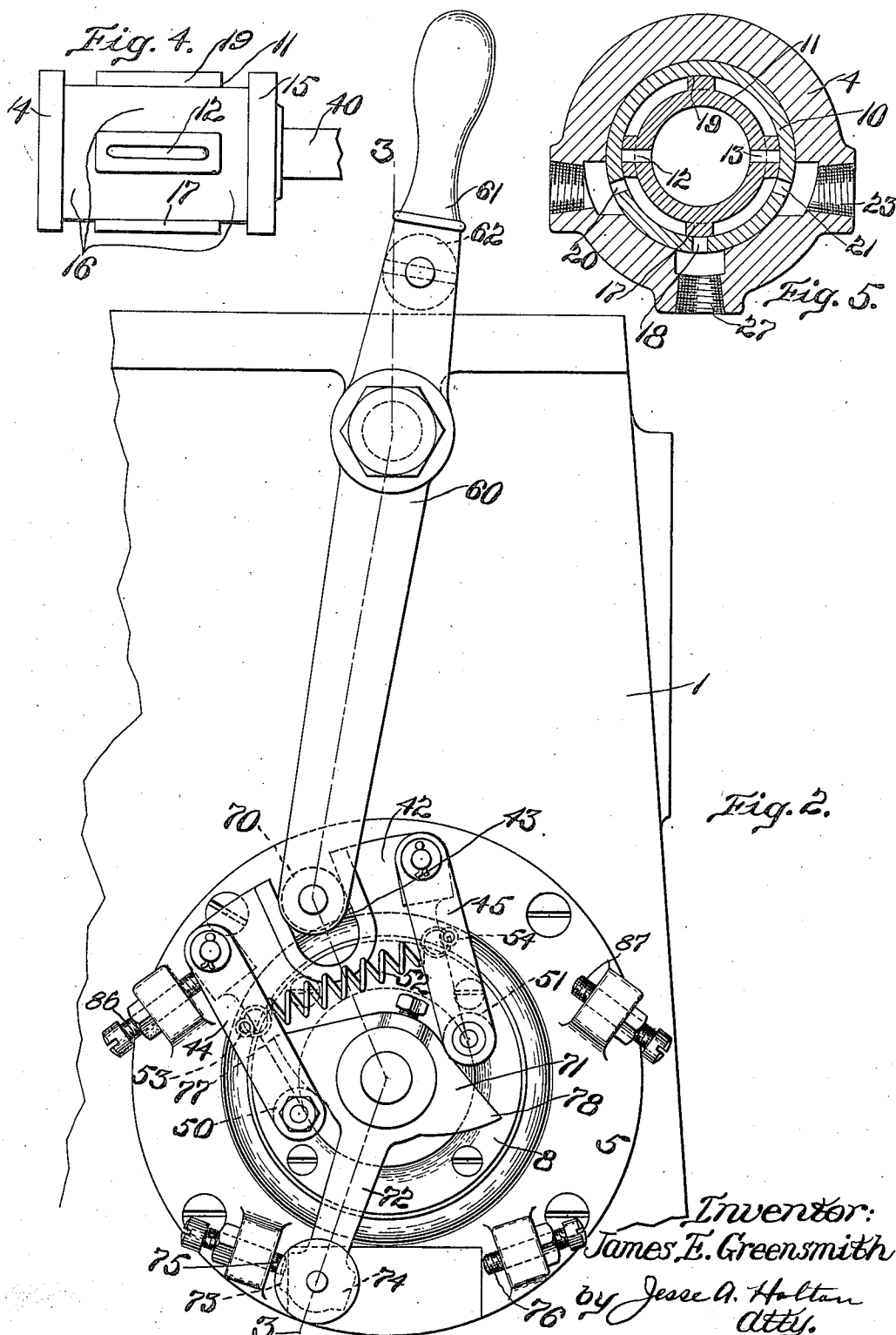
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Original Filed April 19, 1920

3 Sheets-Sheet 2



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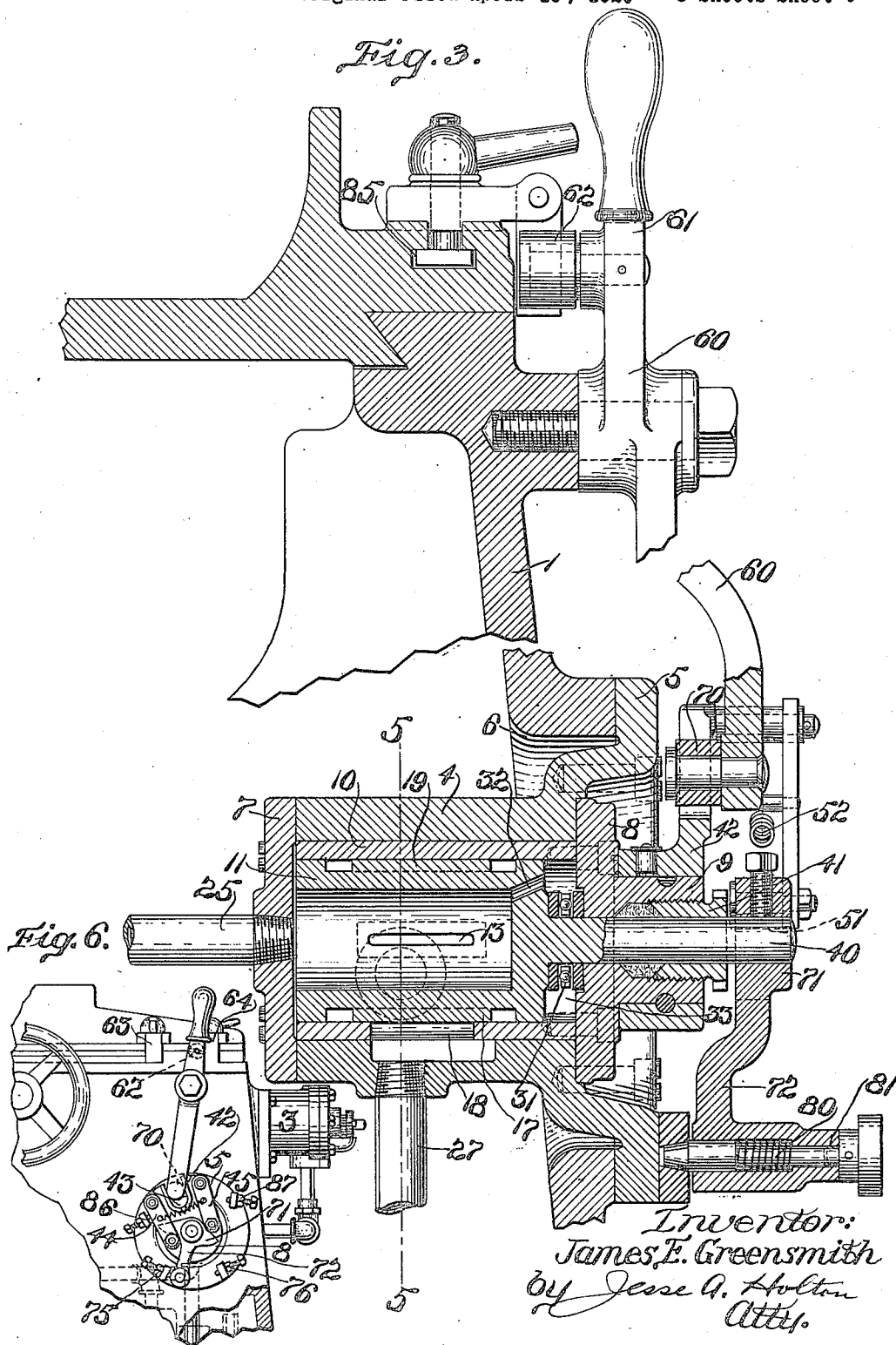
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Fig. 3.



UNITED STATES PATENT OFFICE.

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REVERSING VALVE.

Original application filed April 19, 1920, Serial No. 374,815. Divided and this application filed January 13, 1921. Serial No. 437,068.

To all whom it may concern:

Be it known that I, JAMES E. GREENSMITH, a citizen of the United States, residing at Brookline, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Reversing Valves, of which the following is a clear, full, and exact description.

This invention relates to reversing valves and with regard to certain more specific features thereof to reversing valves adapted for use with fluid pressure operated machines.

The invention has for one of its objects to provide a highly balanced mechanism with a minimum amount of friction between co-operating valve parts.

Another object of the invention is in the provision of simple and reliably operative means for effecting accurate registration of the different valve ports.

Still another object of the invention is to provide a simple and inexpensive device for effecting reversal of fluid flow, which means are actuated primarily by moving parts of the fluid pressure operated machine, but the final actuation of which means is independent of the action of said moving parts.

Other objects will be in part obvious and in part pointed out particularly hereinafter.

The invention, accordingly, consists in the various features of construction, combination of elements and arrangements of parts, which will be exemplified by the construction hereinafter set forth and the scope of the application of which will be indicated by the appended claims:

This application is a division of one filed by me April 19, 1920, the serial number of which is 374,815.

In the drawings, wherein is represented one of various possible embodiments of the invention:

Fig. 1 is a vertical longitudinal sectional view of a hydraulic grinding machine showing the improved reversing valve mechanism.

Fig. 2 is a view in front elevation of the exterior of the valve mechanism shown in Fig. 1.

Fig. 3 is a view in cross section taken substantially along the line 3—3 of Fig. 2.

Fig. 4 is a view in elevation of the valve body or core, and

Fig. 5 is a cross sectional view taken along the line 5—5 of Fig. 3.

Fig. 6 is a view in front elevation of the valve showing the reversing device.

Referring now more particularly to the drawings, wherein similar reference characters refer to similar parts throughout the several views, there is indicated at 1 a portion of the frame of a grinding machine wherein the tool carrying head or ram is hydraulically reciprocated by means of a piston 2 which is moved back and forth in a cylinder 3 under the influence of fluid introduced under pressure at one or the other of the cylinder ends.

The valve mechanism comprises a housing in the form of a short cylindrical tube 4 having a flange or annular lip 5 by which the tube is secured to the frame 1 through an opening 6 provided in the front of the frame. A closure plate 7 is attached to the rear of the tube and there is a front closure plate 8 formed with an extended sleeve 9 which is secured against the forward part of the tube in the bell shaped opening provided by the junction of the flange and body of the housing.

The body of the housing contains a cylindrical cage 10 and within this cage there is rotatively fitted a valve or core 11. The body of this valve or core is in the form of a shell having two substantially diametrically opposed ports 12 and 13 of long and narrow configuration. The exterior of the core is cleared away intermediate two narrow end bands 14 and 15 as shown clearly in Fig. 4 at 16, except for small areas bordering the ports 12 and 13, an area 17 which co-operates with an exhaust port 18 and an area 19 substantially at the top of the valve which is left for the purpose of assisting in securing a high degree of valve balance.

The valve cage 10 has two ports 20 and 21 corresponding in size and shape with ports 12 and 13 of the valve or core, and the said valve ports are adapted respectively and alternately to register with the ports 20 and 21 of the cage. The valve as shown in Figs. 1 and 5 is in neutral position, shutting off the fluid from forward and rearward supply pipes 22 and 23 of the cylinder and closing an exhaust pipe 24. Should the valve be turned to cause registration of the ports

12 and 20, the fluid will pass from a supply pipe 25 through the interior of the hollow shell of the valve core, through port 12 of the valve core, port 20 of the valve cage, forward cylinder supply pipe 22, to the forward end of cylinder 3, whereupon piston 2 will be urged rearwardly and the tool carrier in the same direction. It will be noted that when these two ports are in communication the port 13 of the valve core is moved out of registration with the port 21 of the valve cage which latter is in communication with the rearward cylinder supply pipe 23. The raised area surrounding the port 13 of the core is moved beyond port 21 of the cage so that fluid in the cylinder to the rear of the piston is permitted to exhaust through the rearward cylinder pipe 23, port 21, around the exterior of the valve core, passing by the raised area at the ends thereof, and discharging through the port 18 of the valve cage into an exhaust pipe 27.

To reverse the direction of flow of the liquid the valve core is rotated to cause registration of the ports 13 and 21 which will cause the raised area of port 12 of the core to move beyond the port 20 in the valve cage. This will permit the flow of fluid through the rearward cylinder supply pipe and exhaust of the fluid through the forward pipe around the valve core through the port 18 of the cage to the exhaust pipe 27.

This improved valve construction provides a nicety of balance of the valve parts. The fluid pressure is distributed evenly inside and outside of the valve. As the fluid used has a lubricating characteristic and flows about between the valve core and its cage, constant lubrication is effected. The routing of the exterior of the valve leaving only the few raised areas necessary to close, open or partition the ports, reduces friction to a minimum. The valve may be set in its different operative positions by a movement through a very slight angular range. The balance and consequent ease of operation obtained by this valve structure contributes to the smooth and flexible operation of the machine under the influence of the hydraulic motor. Inasmuch as the tool carrier is intended to be automatic in its reciprocatory feeding movement, and the reversal of its movement at each extremity is under its own control through the medium of the valve, it is highly advantageous to reduce the burden of the valve operation to the lowest possible point. It will be pointed out in the following that the direct actuating means for the valve is a spring which operates a cam mechanism which in turn rotates the valve core. By constructing the valve parts as specified, the friction is so greatly reduced that a comparatively light spring may be used and the burden of the tool carrier in overcoming the action of the spring

accordingly reduced. This tends to prevent the hydraulic system from surging due to sudden increases in the amount of work which it has to accomplish.

The fluid is supplied from a pump (not shown) through the inlet pipe 25 threading in to the rear closure plate 7 of the valve housing. From an inspection of Fig. 3 of the drawings it will be apparent that the fluid is discharged from the inlet pipe into the interior of the valve core 11 passing through the registered ports. It finds its way to one end or the other of the cylinder according to which ports are in registration and the fluid at the opposite end of the cylinder is exhausted through another portion of the valve and the exhaust pipe 27. It is only when the valve is moved to register one pair of ports as an inlet to one end of the cylinder that the exhaust passage through the valve is open. The liquid in the exhaust end of the cylinder is confined therein except when the fluid is being supplied under pressure to the other end of the cylinder. In the exhaust pipe 27 there is provided a manually operable valve 30 for regulating the rate of flow of the fluid through the exhaust and which consequently regulates the rate of movement of the piston in the cylinder 3. The exhaust pipe discharges into a container (not shown) from which it is drawn by the pump and directed to the inlet pipe 25.

An end thrust ball bearing 31 is provided between the valve core and the front closure member of the valve housing, and a conduit 32 is provided in the forward end of the valve so as to permit a portion of the operating fluid to flow into a chamber 33 surrounding said bearing, thereby maintaining it constantly lubricated. It will be apparent from an inspection of Fig. 3 that there is a slight space at the rear of the valve core between the rear edge of same and the rear closure 7. So it will be seen that there is a distribution of the fluid under pressure at both ends of the valve core as well as within and around the same.

The operating mechanism for the valve comprises a forwardly extending stem 40 on the valve core which has a bearing in the sleeve 9 of the front closure plate 8. Suitable packing is provided to prevent leakage of oil and this packing is held in place by a hollow screw member 41 tapped into the forward part of the sleeve and being itself bored to serve as a part or continuation of the bearing for the valve. The forward front part of the closure member 8 of the valve mechanism is in the shape of a short cylindrical boss and mounted on this boss for free rotative movement but held against longitudinal displacement thereon is a plate 42 having a central recession 43 from its upper edge, providing a yoke. The plate 42

carries two links 44 and 45 pivotally supported forwardly thereof as shown clearly in Fig. 2. These links have their free ends equipped with cam rollers 50 and 51 which are constrained to movement towards one another by means of a spring 52 connected at either end to pins 53 and 54 projecting respectively from the rear wall of each link. An operating lever 60 is pivotally mounted on the frame of the machine, the pivot being preferably near the top of the slideway for the tool carriage. This lever has a short forward extension above its pivot providing a handle 61 by which it may be operated. There is also journaled in the rear of the upward extension a roller 62 adapted to be abutted by actuating members or stops 63 and 64 which are adjustably fixed on the tool carrier. The lever 60 has at its lower extremity a roller 70 positioned within the recession 43 of the plate 42 and adapted to bear against one or the other of the side walls of the yoke accordingly as the lever is pivotally moved in one direction or the other. At the forward extremity of the stem 40 of the valve there is fixed a cam member 71 having a depending arm 72. The said arm is formed with stop faces 73 and 74 adapted to abut adjustable stops 75 and 76 provided on the front of the valve housing and consequently in fixed relation with the frame of the machine. The cam member 71 is so shaped as to urge the rollers 50 and 51 of the links on the plate 42 away from each other as the operating handle is moved from one extreme position toward the other. This movement of the links extends the spring 52 and when the handle has reached a point predetermined as being near its opposite extremity of movement, points 77 and 78 of the cam member pass by the rollers 50 and 51 respectively and the spring 52 acts through these rollers on the opposite faces of the cam to cause that member to move quickly to its opposite extremity of movement. The cam member being, as before stated, fixed to the stem of the valve, carries the valve core through a range of angular movement which breaks communication between one set of ports and effects registration of the other set of ports.

The arm 72 of the cam member has at its lower end a spring detent 80 which during the automatic operation of the machine is locked inoperative by the tongue and groove device indicated at 81 but which may be utilized to lock the valve in any one of the three desired positions. The actuating blocks 63 and 64 by which the handle is automatically operated are applied to the tool carrying slide by means of T bolt locking devices, the heads of which are slidably adjustable in a T slot 85 extending longitudinally of the tool carrying slide. By this construction the actuating blocks may be

quickly and conveniently moved to and locked in any desired position. The bodies of the actuating blocks are pivotally mounted so that if desired they may be swung about their pivot to a position where they will not be intercepted by the roller 62 of the operating lever 60 during the movement of the tool carrier. For limiting the extent of movement of the yoke member 42 there are provided on the flange 5 of the valve housing 4 adjustable stops 86 and 87.

As many changes might be made in the above construction and as many apparently widely different embodiments of the invention might be made without departing from the scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. In a machine of the character described, in combination, a cylinder having a port at each end, a piston in said cylinder, a reversing valve, said reversing valve including a cage having ports in communication with the cylinder ports, a plug having ports adapted alternately to communicate with the ports of said cage, and an operating member; said plug having an interior inlet and a rotative bearing in said cage by means of partitions adjacent the plug ports, and a passage exteriorly of said plug permitting fluid flow between the cage and plug for exhaust from said cylinder.

2. In a machine of the character described in combination, a reversing valve comprising a cage having a pair of ports and a third port for exhaust, a hollow plug rotatively mounted in said cage having ports capable of alternate registration with the said pair of cage ports, valve partitions bordering said plug ports and a third partition on said plug co-operative with the said exhaust port, and means for effecting a relative rotative movement of said plug and cage; the ports and partitions being so constructed and spaced as to effect communication between one of said pair of cage ports and the exhaust ports through a passage formed between the plug and cage around the said partitions and simultaneously effect registration of the other of said pair of cage ports with its co-operating plug port.

3. In a reversing valve, a cage having a rotary bore and three ports one of which is an exhaust port, a hollow plug rotative in said cage having a body of general exterior diameter less than the bore of said cage, partitions on said body adjusting the same to an easy rotative fit in said cage, ports in two of said partitions alternately registrable with two cage ports, the partitions and ports being so spaced and arranged that when one co-operating pair of ports is registered

an exhaust passage is established from the third cage port completely around the plug to the exhaust port of said cage, and a valve inlet opposite the hollow end of said plug.

- 5 4. In a reversing valve a cage having a rotary bore and three ports one of which is an exhaust port, a hollow plug rotative in said cage having a body of general exterior diameter less than the bore of said cage, partitions on said body adjusting the same to
10 an easy rotative fit in said cage, ports in two of said partitions alternately registrable with the two cage ports, the partitions and ports being so spaced and arranged that
15 when one co-operating pair of ports is registered an exhaust passage is established from the third cage port completely around the plug to the exhaust port of said cage, a valve inlet opposite the hollow end of said plug,
20 and an operating device for causing relative rotation of said plug and cage comprising a quick throw mechanism and stop whereby registration of the other set of co-operating ports is effected.
- 25 5. In a reversing valve for a hydraulic cylinder in combination, a valve housing, openings therein adapted to communicate with opposite ends of the cylinder, inlet and exhaust openings in said housing a cage
30 having a pair of ports respectively communicating with the said openings to said cylinder and a third port communicating with the exhaust, a hollow plug having a body of less diameter than the cage interior
35 and provided with a plurality of spaced partitions exteriorly to fit the cage, two of

said partitions having each a port adapted for registration with one or the other of said pair of cage ports, said ports and partitions being so arranged as to open an exhaust passage around the plug interiorly of the cage while registration is maintained between either set of co-operating ports. 40

6. In a reversing valve, in combination, a cage having two cylinder ports and an exhaust port, a plug having two cylinder ports co-operative respectively with the cylinder ports of the cage, means permitting fluid flow from the interior of said plug through a pair of co-operating ports and having provision for simultaneously exhausting fluid through the other cylinder port of said cage around the exterior of the plug to the cage exhaust port. 45

7. In a reversing valve, a cage having a rotary bore and three ports one of which is an exhaust port, a hollow plug rotative in said cage having a body of general exterior diameter less than the bore of said cage, partitions on said plug adapting the same to an easy rotative fit in said cage, ports in two of said partitions alternately registrable with the two cage ports, the partitions and ports being so spaced and arranged that when one co-operating pair of ports is registered an exhaust passage is established from the third cage port completely around the plug to the exhaust port of said cage, a valve inlet opposite the hollow end of said plug, and means for operating said plug within said cage.

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