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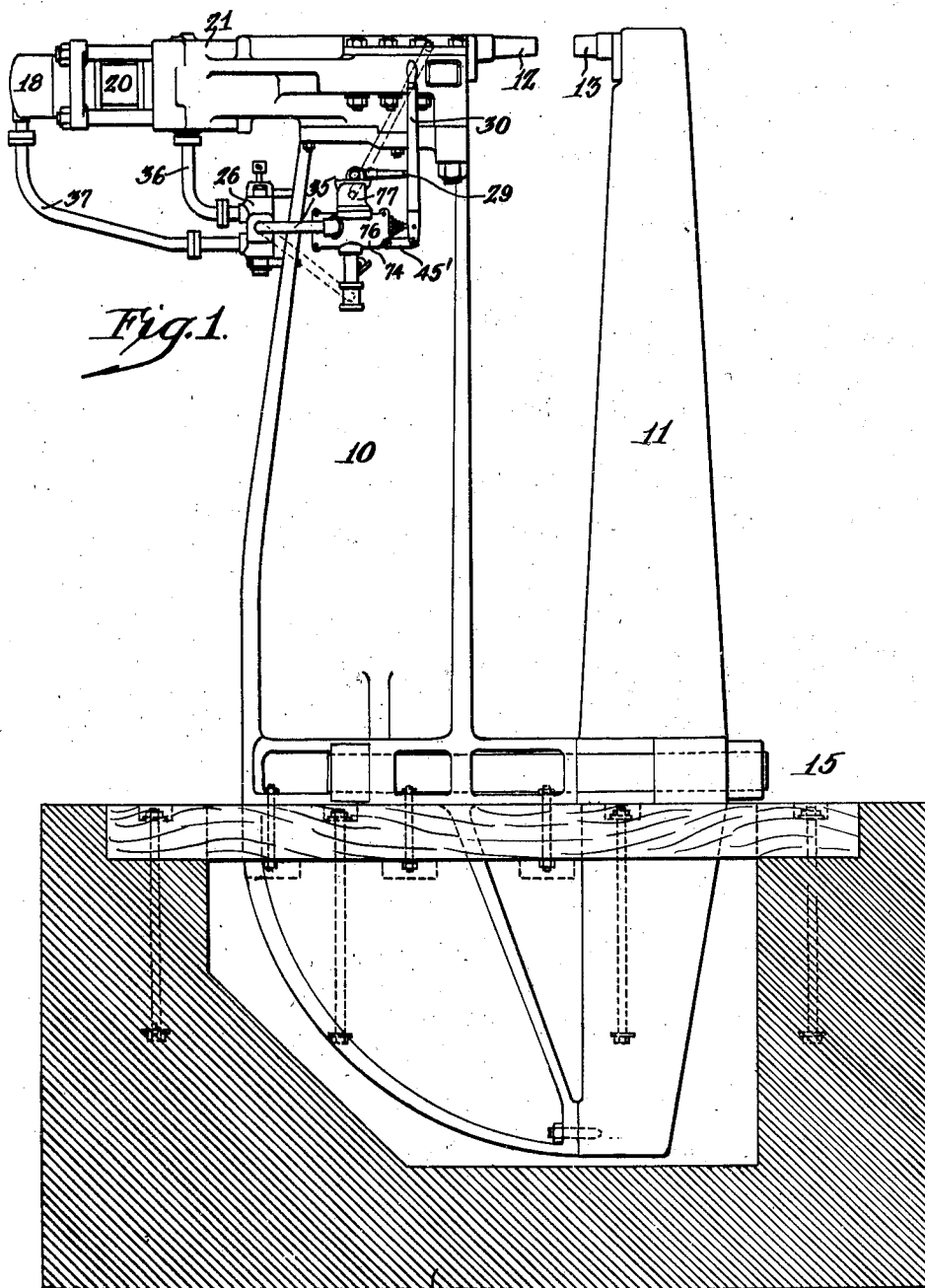
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1,583,296

VALVE CONTROL FOR MULTIPLE POWER TOOLS

Filed April 1, 1924

4 Sheets-Sheet 1



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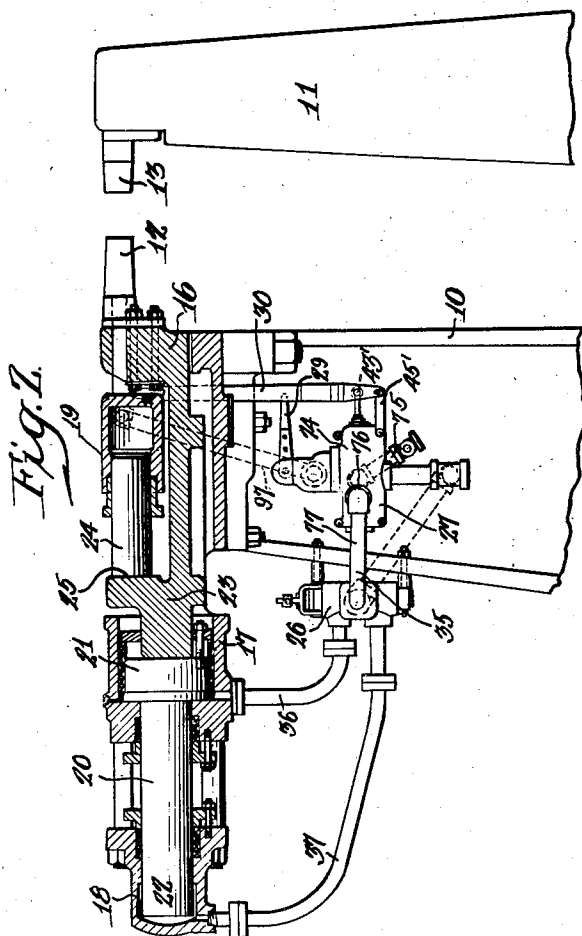
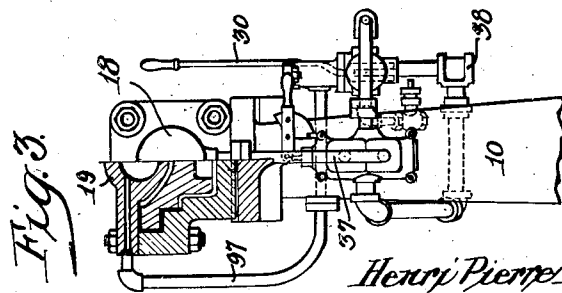
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VALVE CONTROL FOR MULTIPLE POWER TOOLS

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4 Sheets-Sheet 2



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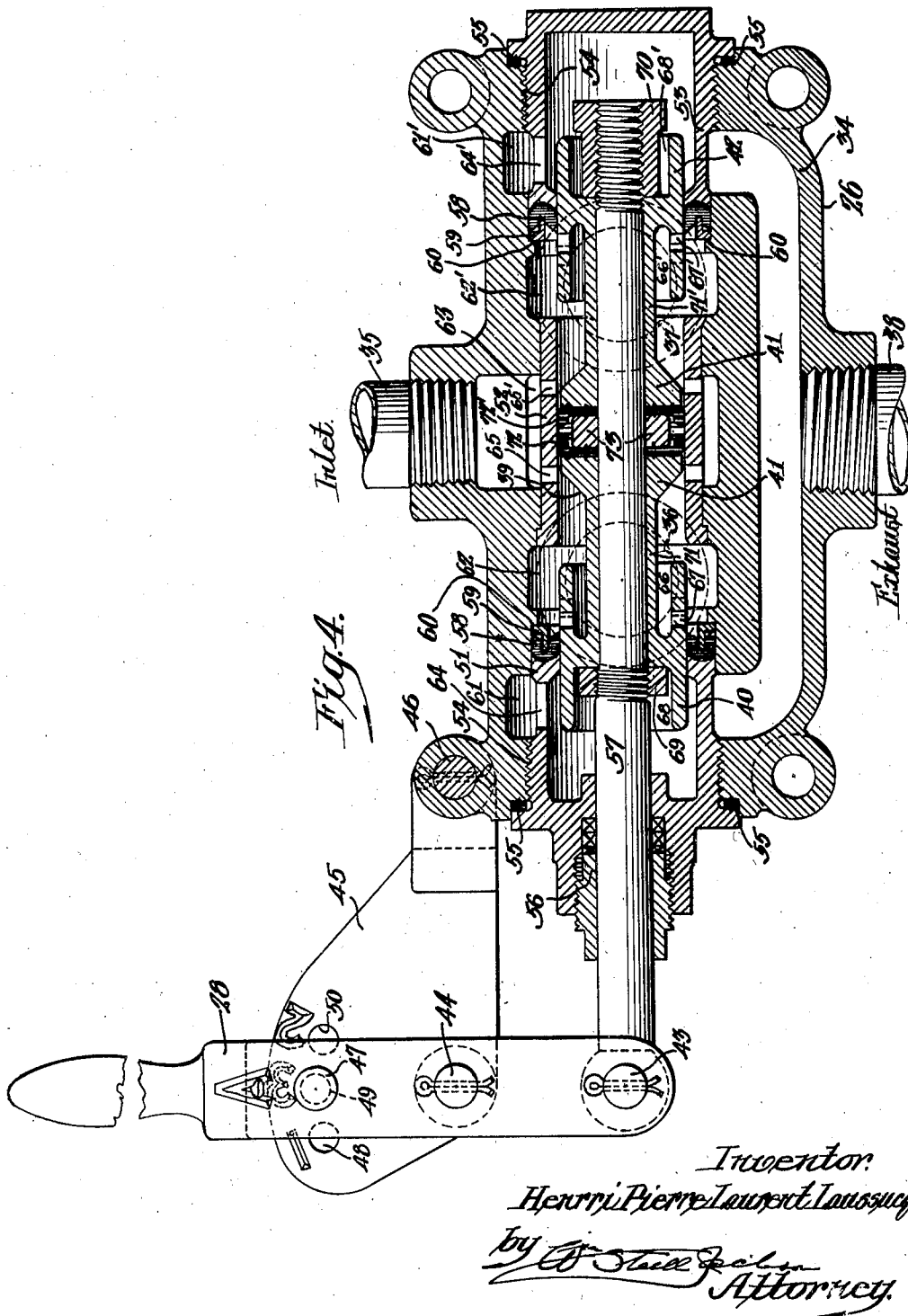
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VALVE CONTROL FOR MULTIPLE POWER TOOLS

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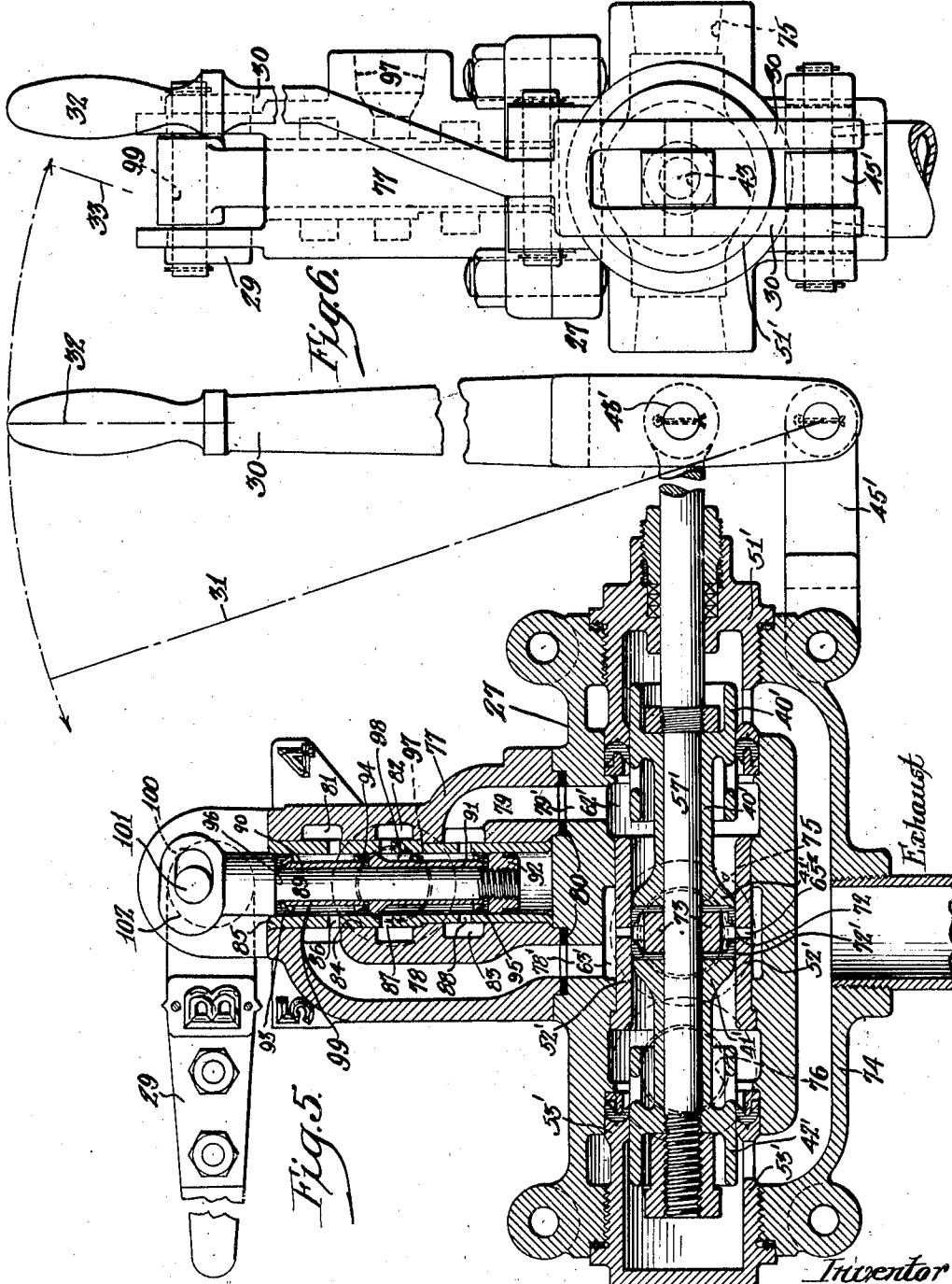
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VALVE CONTROL FOR MULTIPLE POWER TOOLS

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4 Sheets-Sheet 4



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Patented May 4, 1926.

1,583,296

UNITED STATES PATENT OFFICE.

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VALVE CONTROL FOR MULTIPLE-POWER TOOLS.

Application filed April 1, 1924. Serial No. 703,371.

To all whom it may concern:

Be it known that I, HENRI PIERRE LAURENT LAUSSUCQ, a citizen of the United States, residing at Reading, in the county of Berks and State of Pennsylvania, have invented a certain new and useful Valve Control for Multiple-Power Tools, of which the following is a specification.

My invention relates to hydraulic tools, such as riveting tools, and particularly to means for applying to the tools different pressures for different duties.

The purpose of my invention is to provide a fluid distributing or pilot valve for determining the pressure applied to the tool and an operating valve for admitting and exhausting fluid from the distributing valve.

A further purpose is to have the distributing valve comprise improved means for selective application of available hydraulic pressure to different compartments of a ram carrying the tool.

A further purpose is to automatically relieve the retarding during certain portions of the stroke.

Further purposes will appear in the specification and in the claims.

I have preferred to illustrate my invention by but one form, selecting a form which is practical and highly successful but which has been selected primarily because it well illustrates the principles involved.

Figure 1 is a side elevation, with the foundation sectioned, showing a riveting tool with valves and connections for practicing my invention.

Figure 2 is an enlarged side elevation of a part of Figure 1 and with a portion of the figure in longitudinal section.

Figure 3 is a rear end elevation partly in vertical section through the full-back cylinder in Figure 2.

Figure 4 is a longitudinal section through the distributing or pilot valve in Figure 2.

Figure 5 is a longitudinal section through the operating valve seen in Figure 1.

Figure 6 is an end elevation from the right of Figure 5.

In the drawings similar numerals indicate like parts.

Describing in illustration and not in limitation and referring to the drawings,—

It is desirable in operating hydraulic riveting apparatus by accumulator pressure to

adjust the pressure between the ram and tool to existing duty, using a high driving pressure for example for large rivets and low pressure for small rivets and in general accommodating the pressure to the work, and my invention provides improved means for doing this by selective application of the available fluid pressure of the accumulator to different compartments of the ram.

In the form illustrated a common form of riveter is shown having main cylinder stake 10 and riveting stake 11 by which the co-operating tools 12 and 13 are supported and with respect to which the tool 12 is driven.

The method of supporting and connecting these stakes is old and well known and is shown in Figure 1 but for the purpose merely of completing the illustration. Briefly described the machine is supported from a foundation 14 upon a base 15 tied to the foundation by suitable bolts or other ties. Obviously the machine may be fixed in other positions or could be movable.

In the construction of the machine itself the reciprocating riveting ram 16 carrying the tool 12 is operated by selectively admitting and exhausting hydraulic pressure into and from the main cylinder 17, the rear cylinder 18 and the pull-back cylinder 19. The driving plunger 20 has a forward enlarged portion 21 fitting the main cylinder 17 and a rear portion 22 fitting the rear cylinder 18, butts against the rear face of the ram 23 and exerts a pressure upon this face that is nil when the main and rear cylinders are open to exhaust, and at other times any one of three values dependent upon whether hydraulic pressure is admitted to the rear cylinder, to the main cylinder or simultaneously to both cylinders.

The pull-back plunger 24 within the pull-back cylinder 19 butts against the forward face 25 of the ram and functions to push back the ram to its initial position after each riveting operation, the operating cylinders 17 and 18 being at this time open to exhaust. During the forward stroke of the ram the pull-back cylinder is selectively open to exhaust or to the hydraulic pressure of the accumulator, and as the effective forward pressure of the ram upon the tool is that due to the difference between the forward pressure of the driving plunger and the rearward pressure of the pull-back plunger,

there are selectively available two operating pressures between the ram and tool for each of the three selectively available pressures between the ram and driving plunger, one when the pull-back cylinder is open to exhaust and another when it is opposing the forward motion of the ram. There are thus in the machine illustrated selectively available any one of six effective pressures between the ram and tool by reason of there being selectively three available pressures between the driving plunger and the ram and selectively an opposing pressure within the pull-back cylinder.

In so far as my present invention is concerned all of the foregoing is old, but with valve structures inadequate to meet existing needs, in that settings were not readily apparent from a distance, that it was not fool-proof, permitting settings inconsistent with proper operation, that leakage was serious and at an inconvenient place and that setting required a plurality of movements, relatively tedious and did not provide means for preventing an off-cylinder from exerting a progressively greater drag during the forward stroke.

My present invention aims to overcome these difficulties, to relieve the progressively increasing retardation from pressure in non-working cylinders during the return stroke and to present a combination of distributing and operating valves, 26 and 27 respectively, in which the pressures between the driving plunger and ram are selectively determined by a setting lever 28 of the distributing valve, in which the opposition of the pull-back cylinder is selectively determined by the position of a setting lever 29 at the operating valve, and in which the position of the operating handle 30 of the operating valve determines the admission and exhaust for any settings of the levers 28 and 29. When this handle is to the left with respect to the figures, at 31 of Figure 5, the distributing valve, and thereby the driving cylinders, are open to exhaust. The pull-back cylinder exhaust is shown as connected with the main operating valve in Figure 5 but cannot exhaust until it is in exhaust position, i. e., until the plunger is at the right.

When the handle 30 is in the central position, 32 in Figure 5, the driving cylinders are closed to the accumulator pressure and to the exhaust except as there may be exhaust for one of them due to unbalanced plunger position in the distributing valve. The pull-back cylinder selectively has full pressure or the water in it is trapped, by the setting of the lever 29.

When the handle 30 is in the right hand position, 33, the accumulator pressure is selectively admitted to the driving cylinders through the distributing valve and the pressure within the pull-back cylinder is selec-

tively as in the mid position either that of the accumulator or nil according to the setting of the lever 29.

In order that the operation of these several parts may be clear I will first describe the two valves by which I have chosen to illustrate the distributing and operating means, recognizing however that to those skilled in hydraulic engineering other forms will be apparent for obtaining all or a part of the benefit of my invention.

The distributing valve.

This is best seen in Figures 2 and 4 and comprises a four-way channeled and ported cylindrical body 34 communicating at 35 with the operating valve 27, at 36 with the main cylinder 17, at 37 with the rear cylinder 18 and at 38 with exhaust, and a circumferentially recessed plunger 39 having spaced piston portions 40, 41 and 42 fitting the cylinder and in different positions within the body respectively placing the inlet 35 from the operating valve in communication with either or both of the inlets 36 and 37 to the driving cylinders 17 and 18, and placing either of the outlets 36 and 37 in communication with the exhaust outlet 38 when the connection to the other is open.

The setting lever 28 is pivotally connected at 43 to the end of the plunger and pivotally connected at 44 to the link member 45 pivoted at 46. The setting lever is provided with a spring-pressed latch 47 adapted to fit into notches shown at 48, 49, 50 and corresponding to the three positions of the plunger and therefore to the three settings of the valve. The setting can be seen at a distance and any kind of indicator can be attached to the lever to show at any distance.

The body portion 34 of the distributing valve is provided with ported sleeve linings, 51, 52 and 53, fitting and sealing the piston portions 40, 41 and 42 of the plunger.

The lining members 51 and 53 also cap the ends of the body, screwing to place at 54 and packed at 55, the member 51 being provided with a gland 56 about the shaft 57 of the plunger. The inner ends of the sleeves 51 and 53 are grooved to fit the cup packing rings 58 which are clamped to place about the respective piston members between the sleeves and the recessed rings 59 stopped against circumferential flanges 60 of the body member 34.

The body member 34 is internally circumferentially channeled at 61, 61', 62, 62' and 63, and the sleeves 51 and 53 are ported at 64 and 64' into the channels 61, 61', and the sleeve 52 ported at 65, 65' into the channel 63.

The front and rear pistons 40 and 42 are longitudinally recessed and ported at 66, 67 and 66', 67' respectively to give conduit communication past the piston into the ex-

haust through ports 64, 64' in extreme positions of the piston. These pistons are also recessed longitudinally on their outer ends at 68, 68' respectively to accommodate respectively the nuts 69 and 70 between which the reversely turned counterpart sleeve portions 71, 71' and the reversely facing packing portions 72, 72' clamp upon the ring member 73.

The ports 65, 65' in the sleeve 52 comprise spaced circumferential rows of ports upon either side of the packing when the piston is in mid position, thus placing the outlets 36 and 37 respectively to the main and rear cylinders 17, 18 both in conduit communication with the outlet 35 to the operating valve during the mid setting of the distributor valve. Either of pistons 40 and 42 is by-passed to exhaust when in its outer position through the ports 67 or 67' by reason of these ports moving past the packing rings 58 or 58', thus placing the corresponding outlet to one of the driving cylinders, 17 or 18, to exhaust while the outlet to the other driving cylinder, 18 or 17, is sealed by the piston at the other end from the exhaust and is in communication with the outlet 35 to the operating valve 34.

The operating valve.

The operating valve for convenience combines in one valve mechanism, two valve structures capable of separate and distinct use but united in order that they may utilize the same inlet and exhaust and be more readily controlled from a single position. The main control valve comprises a body 74 having pressure inlet 75, outlet 76 to the inlet of the distributing valve connected to it by pipe 77 and exhaust. Within the valve body are sleeves or linings 51', 52' and 53' corresponding generally with 51, 52 and 53 of the other valve and 51' and 53' having packing corresponding to that of the distributing valve but differing as to 52' in that there is a single row 65² of apertures only through it to the space 63'.

The shaft 57' carries plunger members 40', 41' and 42' corresponding generally to the plunger members of the other valve and similarly compressed by nuts to hold the packing 72, 72' about the block 73.

As shown, in the neutral position, the inlets from the accumulator pressure are cut off from the outlet 76 and also from the exhaust. When the lever is thrown to a position 33 at the right of the figure the outlet 76 is connected with the accumulator pressure to apply the pressure to either one or both of the cylinders 17 and 18 according to the connections in the distributing valve.

In the position with the lever at the left, at 31 in Figure 5 the outlet 76 to the distributing valve is connected with the exhaust so as to correspondingly exhaust the

cylinder or cylinders with which it is connected through the distributing valve.

The mounting of the lever is reversed as compared with Figure 4 in that the fulcrum is at the end of the lever in link 45' and the rod 57' is connected with the lever at an intermediate bearing point 43'.

Superimposed upon the body 74 is a supplemental valve body 77 connected with it so that passage 78 is continuously connected with the accumulator pressure from inlet 75 and passage 79 is continuously connected with the space 62' within the valve body 74. These two passages are connected through corresponding passages 78' and 79' and the joints are packed at 80.

Within the body 77 there are three annular spaces 81, 82 and 83 and the longitudinally extending cylindrical opening 84 is bushed at 85, the bushing being suitably peened if necessary to hold it in place and make it fluid tight. This bushing is apertured at 86, 87 and 88 into the corresponding annular spaces 81, 82 and 83.

Within the bushing is located a plunger made up of a stem 89, plunger sleeves 90, 91, nut 92 and packing 93, 94 and 95 held in place by the nut, the plunger elements and the shoulder 95. As thus constructed the plunger has two positions, that shown in Figure 5 with the lever 29 at the left, at 31 in which the accumulator pressure, always full on in passage 78, is cut off from space 82 and hence from outlet 97 by packing 94. The outlet 97 (hence the pull back cylinder) is connected by piston passage 98 with valve compartment 62' exhausting the pull back cylinder or trapping the liquid in it according to the position of lever 30.

With lever 29 at the right of the figure, at 33 the pull back cylinder is connected with the passage 78 through ports 86, piston passage 99, and ports 87, applying pull back pressure.

The lever 29 has bearing at 100 and carries an eccentric or crank pin 101 which is allowed lateral play in an opening 102 in the upper end of the supplementary plunger but which lifts or lowers this plunger to control the pull back pressure or exhaust in the two positions of the lever 29.

Operation.

In operation the distributing or pilot valve must first be set to determine the connections with cylinders 17 and 18. In the position shown in Figure 4 the accumulator pressure is "on" each of these cylinders. With the lever at the left in this figure, position 1, the pressure is applied to the cylinder 17 only and cylinder 18 is connected with the exhaust. In position two with the lever 28 at the right in Figure 4 the pressure is applied to cylinder 18 only and cylinder 17 is connected with the exhaust.

As determined by the distributing valve the pressure is applied to or exhausted from the correspondingly connected cylinder or cylinders through the operating valve with or without opposition by pressure within the pull-back cylinder.

It will be noted that the exhaust from the pull-back cylinder is controlled not only by the position of the plunger 89 in the supplemental valve body connected with the main operating valve but also by the main operating valve plunger and that the pull-back cylinder will be connected to exhaust when the pressure is "on" the distributing valve and under this condition only, safe-guarding the operating plunger of the tool which is therefore either under pull-back pressure or with the fluid in the pull-back cylinder trapped at all times when the pressure is not being applied to one or both of the cylinders 17 and 18. Remembering then that the pull-back cylinder cannot exhaust except when the lever 30 is at the right in Figure 5, the pressure upon the pull-back cylinder and its exhaust as far as the space 62' of the main operating valve is controlled wholly by lever 29, being applied on when the lever 29 is in the right hand position of this figure and being off in the position of lever 29 at the left shown in Figure 5.

In each of the three combinations (the cylinders 17 and 18, applying cylinder 17 alone or cylinder 18 alone or both cylinders), the pressure can be opposed by the pressure of the pull-back cylinder or not as desired, providing six combinations.

Packing for the cylinder 17 is shown and the plugged drainage opening for the pull-back cylinder of use when desired.

In view of my invention modifications and variations will doubtless become evident to others skilled in the art to meet individual whim or particular need and I claim all such as fall within the reasonable spirit and scope of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a hydraulic ram, a driving plunger having two rearwardly directed faces, two hydraulic cylinders thereabout whose pressure is exerted upon said faces, a distributing valve having connections for pressure for each of the two cylinders with coincident exhaust for the other and for pressure for both cylinders simultaneously, and an operating valve having pressure admission and exhaust positions therein for controlling fluid pressure at the distributing valve.

2. In a hydraulic ram, a driving plunger having two rearwardly directed faces, two hydraulic cylinders thereabout whose pressure is exerted upon said faces, a distributing valve having connections for pressure for each of the two cylinders with coinci-

dent exhaust for the other and for pressure for both cylinders simultaneously, a pull-back cylinder and plunger for returning the driving plunger, operating connections for maintaining pressure on the pull-back valve or exhausting it for any of the positions of the distributing cylinder and an operating valve for supplying pressure to and exhausting from the distributing valve.

3. In a hydraulic ram, a driving plunger having two rearwardly directed faces, two hydraulic cylinders thereabout whose pressure is exerted upon said faces, a distributing valve having connections for each of the two cylinders with coincident exhaust for the other and exhaust for both cylinders simultaneously, a pull-back cylinder and plunger, an operating cylinder for supplying pressure to and exhausting from the distributing valve and a valve mounted upon the operating cylinder and exhausting through it for applying pressure to or exhausting from the pull-back cylinder.

4. In a hydraulic ram, a driving plunger having two rearwardly directed faces, two hydraulic cylinders thereabout whose pressure is exerted upon said faces, a distributing valve having connections for pressure for each of the two cylinders with coincident exhaust for the other and for pressure for both cylinders simultaneously, a pull-back cylinder and plunger, an operating valve having pressure supply thereto, supplying pressure to and permitting exhaust from the distributing valve and a pull-back cylinder receiving its pressure from the supply of the operating valve and adapted to connect the pull-back cylinder to pressure or to exhaust.

5. In a hydraulic tool, a driving plunger having two diameters, a cylinder surrounding the part of larger diameter, a cylinder surrounding the part of smaller diameter, a distributing valve having connections with each of the cylinders, means within the connections for directing fluid to either of the cylinders at will with coincident exhaust from the other cylinder or to both of the cylinders together, an operating valve having an outlet connected with the inlet of the distributing valve, connections within the operating valve for applying pressure, holding the pressure or exhausting to or from the outlet, a pull-back cylinder, a plunger therein and connections for returning the driving plunger and means for applying the same pressure to the pull-back cylinder as to the operating cylinder.

6. In a hydraulic ram, a driving plunger having two rearwardly directed faces, a pull-back plunger having a forwardly directed face, two hydraulic pressure main cylinders forwardly closed by the plunger to confine liquid against the rearwardly directed faces, a pull-back cylinder rearwardly closed by the pull-back plunger, a

four-way distributing plunger valve having an inlet, an exhaust and a conduit connection to each main cylinder and adapted to selectively connect the inlet of the distributing valve with either or both of the cylinders, the exhaust of the distributing valve being respectively in communication with the other main cylinder or with neither, a source of hydraulic pressure, means for selectively connecting the pull-back cylinder with either exhaust or hydraulic pressure whenever the inlet is set in connection with hydraulic pressure, and operating means for connecting the inlet at will to hydraulic pressure or to exhaust.

7. In a hydraulic ram, a driving plunger having two rearwardly directed faces, cylinders about them, forwardly closed by the plunger to confine liquid against the rearwardly directed faces, a pull-back plunger, a pull-back cylinder rearwardly closed by the pull-back plunger, a distributing valve having an inlet, an exhaust and conduit connection to each main cylinder and adapted to selectively connect the inlet of the distributing valve with either or both of the cylinders, the exhaust of the distributing valve being respectively in communication with the other main cylinder or with neither, a source of hydraulic pressure, means for selectively setting the pull-back cylinder in connection with either exhaust or hydraulic pressure whenever the inlet is set in connection with hydraulic pressure, and operating means for connecting the inlet at will to hydraulic pressure or to exhaust.

8. In a hydraulic ram, a driving plunger having two rearwardly directed faces, a pull-back plunger having a forwardly directed face, two hydraulic pressure main cylinders forwardly closed by the driving plunger to confine liquid against the rearwardly directed faces, a pull-back cylinder rearwardly closed by the pull-back plunger, a four-way distributing plunger valve hav-

ing an inlet, and exhaust and conduit connection to each main cylinder and adapted to selectively connect the inlet of the distributing valve with either or both of the cylinders, the exhaust of the distributing valve being respectively in communication with the other main cylinder or with neither, a source of hydraulic pressure, means for selectively setting the pull-back cylinder with either exhaust or hydraulic pressure whenever the inlet is set in connection with hydraulic pressure, and operating means for connecting the inlet at will to hydraulic pressure or to exhaust, said means for selective setting and operating comprising a four-way device connected respectively to the source of hydraulic pressure, to said inlet, to the pull-back cylinder and to exhaust.

9. In a hydraulic ram, a driving plunger having two rearwardly directed faces, a pull-back plunger having a forwardly directed face, two hydraulic pressure main cylinders forwardly closed to confine liquid against the rearwardly directed faces, a pull-back cylinder rearwardly closed by the pull-back plunger, a four-way distributing plunger valve having an inlet, an exhaust and a conduit connection to each main cylinder and adapted to selectively connect the inlet of the distributing valve with either or both of the cylinders, the exhaust of the distributing valve being respectively in communication with the other main cylinder or with neither, a source of hydraulic pressure, means for selectively connecting the pull-back cylinder with either exhaust or hydraulic pressure whenever the inlet is connected with hydraulic pressure, and operating means for connecting the inlet at will to hydraulic pressure or to exhaust, said means comprising a four-way valve connected respectively to the source of hydraulic pressure, to said inlet, to the pull-back cylinder and to exhaust.

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