July 28, 1942. A. R. BENNER 2,290,937

HYDRAULIC MOTOR UNIT

Filed Aug. 14, 1941 5 Sheets-Sheet 1

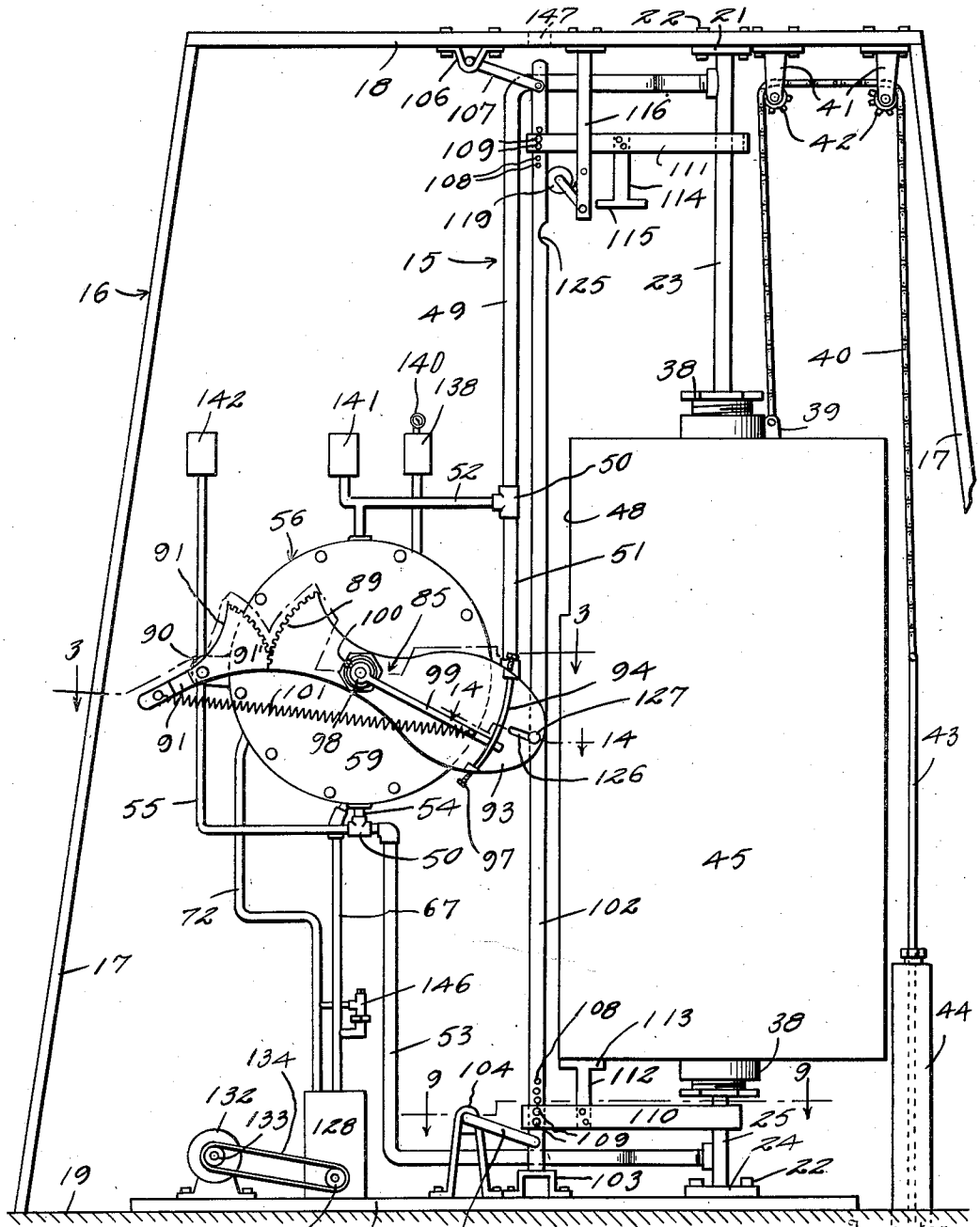


FIG. 1

Inventor

A. R. Benner

By L. F. Randolph

Attorney

July 28, 1942. A. R. BENNER 2,290,937

HYDRAULIC MOTOR UNIT

Filed Aug. 14, 1941 5 Sheets-Sheet 2

Fig. 2.

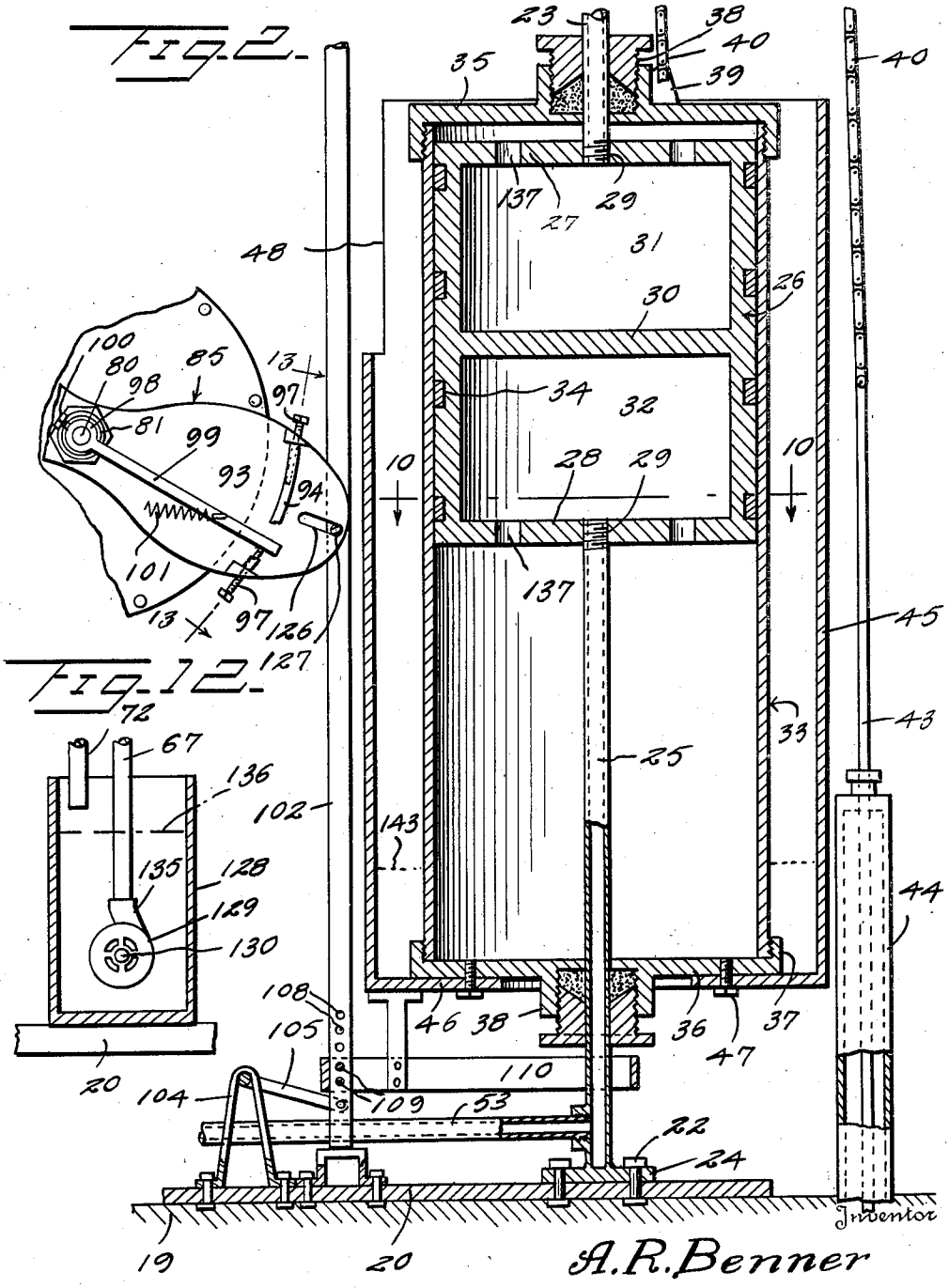


Fig. 12.

Inventor

A. R. Benner

By A. F. Randolph

Attorney

July 28, 1942. A. R. BENNER 2,290,937

HYDRAULIC MOTOR UNIT

Filed Aug. 14, 1941 5 Sheets-Sheet 3

Fig. 4.

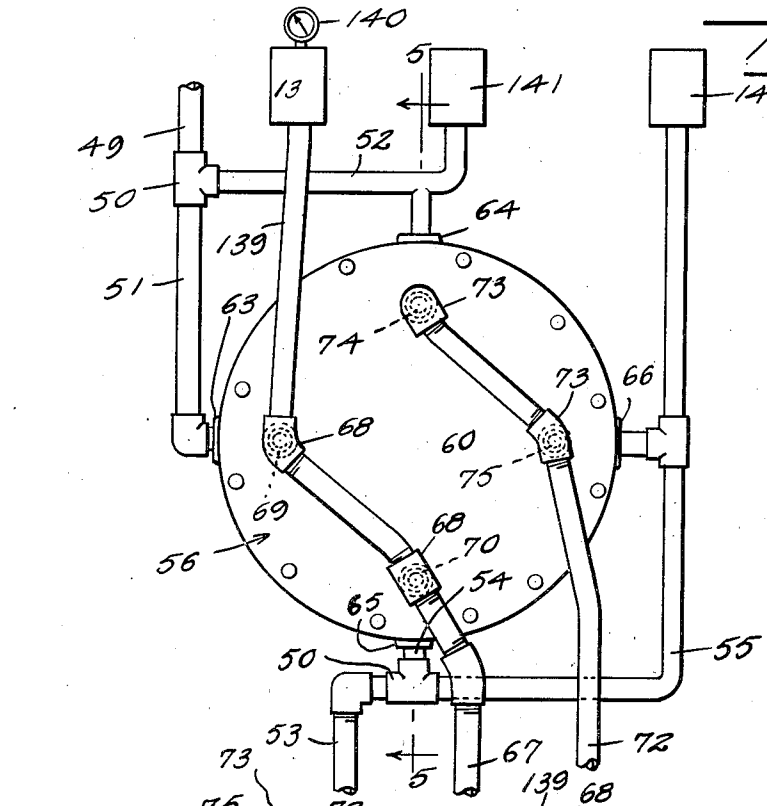


Fig. 3.

Inventor

A. R. Benner

By K. F. Randolph

Attorney

July 28, 1942. A. R. BENNER 2,290,937

HYDRAULIC MOTOR UNIT

Filed Aug. 14, 1941 5 Sheets-Sheet 4

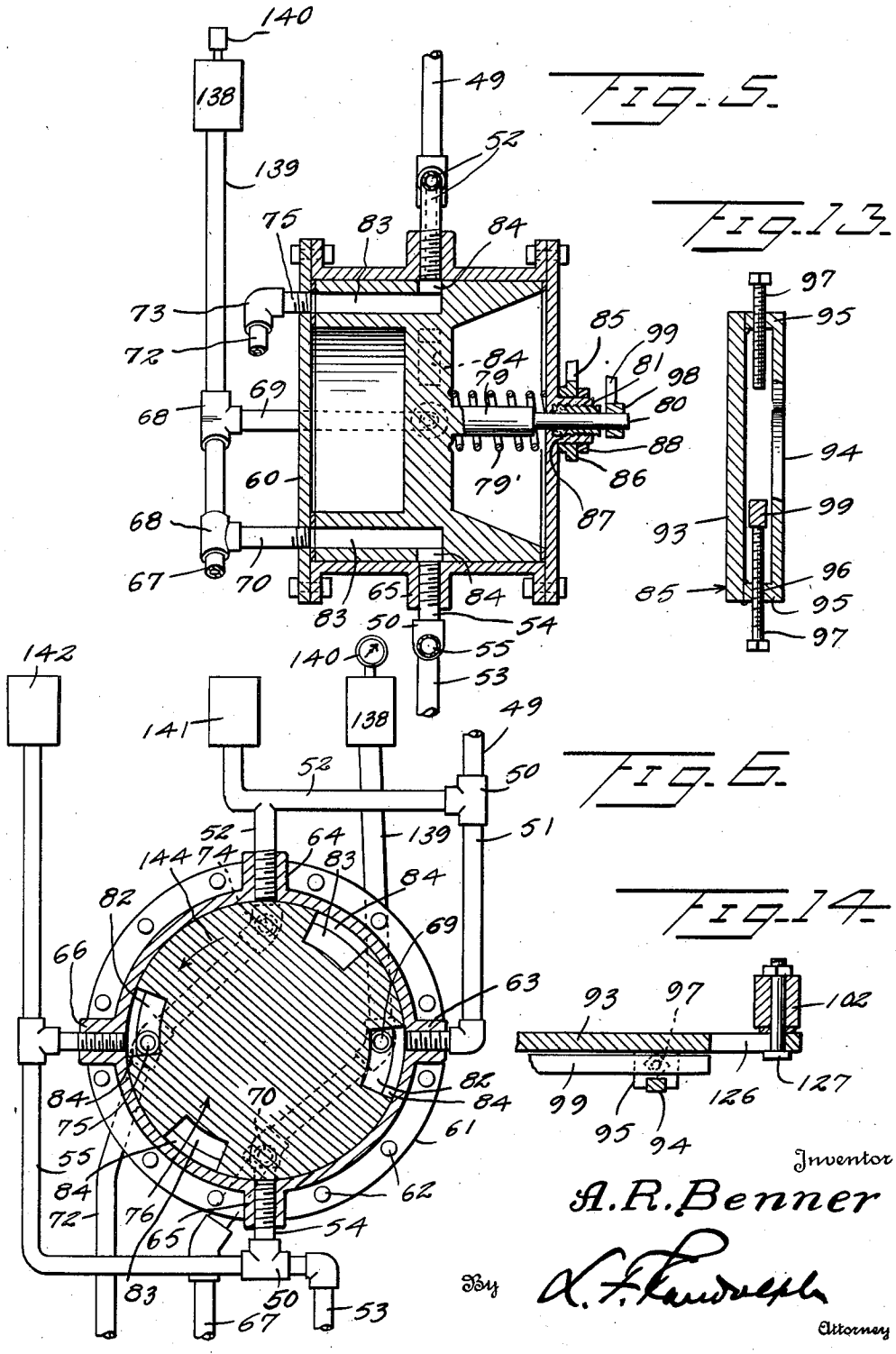


FIG. 5.

FIG. 13.

FIG. 6.

FIG. 14.

Inventor

A. R. Benner

By A. F. Randolph

Attorney

July 28, 1942. A. R. BENNER 2,290,937

HYDRAULIC MOTOR UNIT

Filed Aug. 14, 1941 5 Sheets-Sheet 5

Fig. 7.

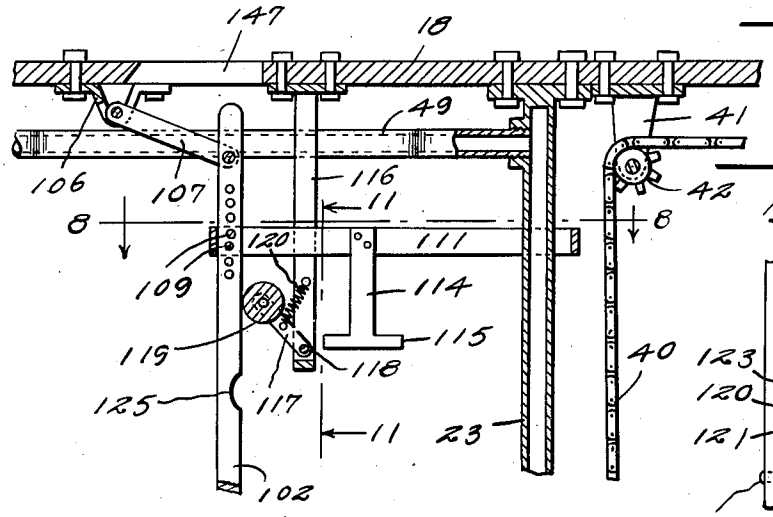
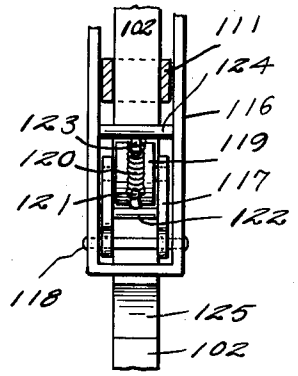


Fig. 11.



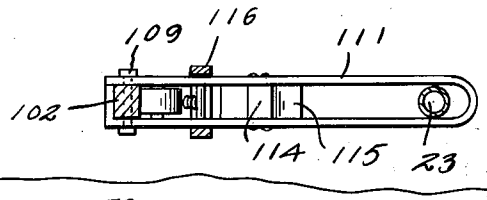


Fig. 8.

Fig. 9.

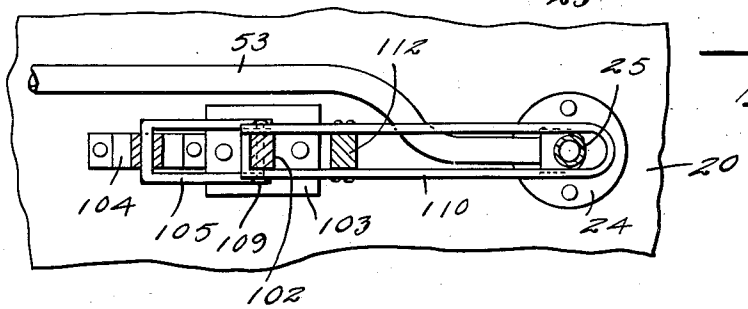
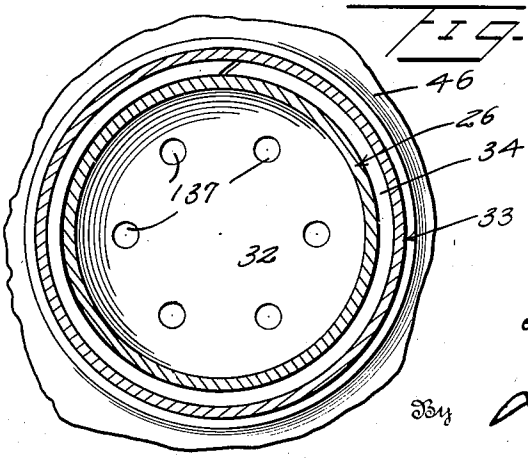


Fig. 10.



Inventor

A. R. Benner

By A. F. Randolph

Attorney

Patented July 28, 1942 2,290,937

UNITED STATES PATENT OFFICE

2,290,937

HYDRAULIC MOTOR UNIT

Arnold R. Benner, Pierce, Tex.

Application August 14, 1941, Serial No. 406,895

1 Claim. (Cl. 60—52)

This invention relates to an hydraulic motor unit especially adapted to be used to operate a well pump for pumping oil when the gas pressure of an oil well fails, and which is also well adapted for pumping other liquids such as water.

It is a particular aim of the invention to provide such a device of very simple construction having very few moving parts and therefore subject to very little wear and which is light in weight and therefore capable of being easily moved.

Still a further object of the invention is to provide an hydraulic motor unit adapted to be actuated by a conventional motor or engine and having automatically actuated valve reversing means for reversing the direction of flow of a driving, compressed medium for reversing the direction of movement of a cylinder which is connected to and which actuates the sucker rod of a pump.

Still a further aim of the invention is to provide a motor unit which can be readily adjusted to increase or decrease the length of the stroke of the element thereof which operates the sucker rod for varying the length of the stroke of the sucker rod.

Still another object of the invention is to provide a motor unit having a novel construction of valve for reversing the direction of flow of the compressed medium and provided with novel actuating means which is constructed and arranged to cause the valve to reverse its position with a quick, snap movement so that the operation of the unit will not be interrupted.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, which illustrate a preferred embodiment thereof, and wherein—

Figure 1 is a fragmentary side elevational view of the hydraulic motor unit in its entirety,

Figure 2 is an enlarged substantially central vertical sectional view, partly in elevation, of a portion of the unit,

Figure 3 is an enlarged horizontal sectional view taken substantially along the plane of the line 3—3 of Figure 1,

Figure 4 is an enlarged fragmentary rear elevational view of the valve, and showing the arrangement of the pipes or tubes connected thereto,

Figure 5 is a longitudinal substantially central vertical sectional view, partly in elevation of the valve taken substantially along the plane of the line 5—5 of Figure 4, and showing the core in a different position from its position of Figure 3,

Figure 6 is a vertical sectional view partly in side elevation of the valve taken substantially along a plane indicated by the line 6—6 of Figure 3,

Figure 7 is an enlarged fragmentary side elevational view, partly in vertical section, of the upper portion of the derrick and the parts disposed adjacent thereto.

Figure 8 is a horizontal sectional view of certain of the parts shown in Figure 7 taken substantially along a plane indicated by the line 8—8 of Figure 7,

Figure 9 is an enlarged horizontal sectional view taken substantially along the plane of the line 9—9 of Figure 1,

Figure 10 is a horizontal sectional view through the cylinder and piston taken substantially along a plane indicated by the line 10—10 of Figure 2,

Figure 11 is a vertical sectional view of certain of the parts shown in Figure 7 and taken substantially along a plane as indicated by the line 11—11 of Figure 7,

Figure 12 is an enlarged vertical sectional view, partly in elevation showing the hydraulic pump and the tank in which it is disposed,

Figure 13 is an enlarged detailed sectional view taken substantially along the plane of the line 13—13 of Figure 2, and

Figure 14 is an enlarged detailed sectional view taken substantially along the plane of the line 14—14 of Figure 1.

Referring more particularly to the drawings, wherein like reference characters designate like or corresponding parts throughout the different views, 15 designates generally the hydraulic motor unit in its entirety, and which includes a derrick, designated generally 16, and which includes supporting legs 17, which support an upper cross member 18 and which are in turn adapted to be supported by a suitable supporting surface, as indicated at 19. A base 20, forming a part of the derrick 16, likewise rests on and is supported by the surface 19.

Referring to Figures 1 and 2, the upper cross member 18 is provided on its underside with a socket 21 which is secured thereto by fastenings 22 and to which is secured one end of a tube or pipe 23 which depends therefrom. A similar socket 24 is similarly attached by fastenings 22 to the upper side of the base 20 directly beneath the socket 21 and is likewise connected to the lower end of a tube or pipe 25 which extends upwardly therefrom. The remote ends of the pipes 23 and 25 are sealed by the socket members 21 and 24, respectively. Referring to Figure

2, 26 designates generally a piston having an upper end wall 27 and a lower end wall 28, which walls are provided with centrally disposed threaded openings 29 for engaging the adjacent, threaded ends of the pipes 23 and 25 which are thus connected to the end walls 27 and 28, respectively, and which provide means for supporting the piston 26 perpendicularly of the derrick 16. The piston 26 is provided with a hollow interior and has a central transversely disposed dividing wall 30 which combines with the top wall 27 to form an upper chamber 31 and with the bottom wall 28 to form a lower chamber 32 in the piston 26.

A cylinder, designated generally 33 is slidably mounted on the piston 26 and said piston 26 is provided with a plurality of annular grooves in its periphery for receiving conventional piston rings 34 to prevent leakage between the periphery of the piston 26 and the cylindrical side wall of the cylinder 33, for a purpose which will hereinafter become apparent. The cylinder 33 is provided with a detachable upper end wall 35 and a detachable lower end wall 36. The end walls 35 and 36 are provided with annular internally threaded flanges 37 for engaging the externally threaded ends of the cylindrical side wall of the cylinder 33 and the walls 35 and 36 are also provided with centrally disposed stuffing boxes 38 in which the pipes 23 and 25 are slidably mounted to permit the cylinder 33 to slide relatively to the pipes 23 and 25 and to the piston 26.

The upper end wall 35 is provided with an upwardly projecting lug or ear 39 to which one end of a chain 40 is attached. As seen in Figure 1, the cross member 18 is provided with depending bearing hangers 41 in each of which is journaled a sprocket wheel 42. The intermediate portion of the chain 40 is trained over the sprocket wheels 42 and the opposite end thereof is adapted to be connected to the upper end of a sucker rod 43 which is slidably mounted in a pump barrel 44 which is adapted to extend downwardly into the surface 19. Obviously, if desired, a rope or cable or other suitable flexible member, not shown, could be substituted for the chain 40 and pulleys, not shown, could be substituted for the sprocket wheels 42. As seen in Figure 2, an annular walled housing 45 is disposed around and spaced from the cylinder 33 and is provided at its lower end with an annular inwardly projecting flange 46 which is detachably fastened to the lower end wall 36 by means of fastenings 47. The housing 45 combines with the cylinder 33 to form an annular chamber which is adapted to contain counterweights, not shown, for counterbalancing the weight of the sucker rod 43, and the parts carried thereby, as will hereinafter become more fully apparent. The housing 45 is provided with a recessed portion 48 in the upper part thereof and which opens outwardly of its upper edge, for a purpose which will hereinafter become apparent.

A pipe or conduit 49 is connected at one end thereof to the pipe 23, adjacent its upper end, and extends laterally therefrom and is bent downwardly intermediate of its ends. Pipe 49 is provided with a T-joint 50 at its opposite end to which is also connected branch pipes 51 and 52. A pipe 53 is connected at one end thereof to the pipe 25, adjacent its lower end, and extends laterally therefrom and is bent intermediate of its ends to extend upwardly. A T-joint 50 is connected to the opposite end of the pipe 53 and has connected thereto a branch pipe 54 and a branch pipe 55.

Referring particularly to Figures 3 to 6, 56 designates generally a valve including a valve casing designated generally 57 which is composed of a cylindrical side wall 58, a front end wall 59 and a back end wall 60. The cylindrical wall 58 is provided with outwardly projecting flanges 61 at the ends thereof against which the peripheral portions of the walls 59 and 60 abut, and to which they are secured by means of fastenings 62. The cylindrical wall 58 is provided with a nipple 63 which projects outwardly from the right hand side thereof, looking from the front toward the rear of the valve 56 and which is internally threaded. A similar nipple 64 is disposed at the top of the cylindrical wall 58, another similar nipple 65 is disposed at the bottom thereof, and a fourth nipple 66 is disposed at the left hand side of the wall 58 and in opposed relationship to the nipple 63. Said nipples form ports which open into the casing 57, and are each arranged intermediate of the ends thereof and are substantially equally spaced circumferentially relatively to one another. As best seen in Figure 6, the branch pipe 51 is provided with a threaded free end which engages the nipple 63 and which opens into the valve casing 57. The branch pipe 52 is provided with a threaded open end which similarly connects with the nipple 64. The branch pipe 54 is provided with a threaded open end which similarly connects with the nipple 64. The branch pipe 54 is similarly connected at its free end to the nipple 65 and the branch pipe 55 has an open end which is similarly connected to the nipple 66. These pipes, with the pipes 23 and 25 and the pipes 49 and 53 combine to support the valve 56 although additional supporting means could be provided if desired.

As best seen in Figure 4, a pipe 67 extends upwardly from below the valve 56 and has a portion thereof disposed behind the valve, and said portion is provided with spaced couplings 68 from which project branch pipes 69 and 70. The free ends of the branch pipes 69 and 70 are externally threaded to engage threaded openings 71 in the rear wall 60 so that said branch pipes open into the casing 57. The branch pipe 69 is disposed in radial alinement with the nipple 63 and the branch pipe 70 is disposed in radial alinement with the nipple 65. A pipe 72 extends upwardly from below the valve 56 and is provided with a portion disposed behind said valve and which is provided with joints 73 from which project branch pipes 74 and 75 which are similarly connected to openings 71 in the rear wall 60. The branch pipe 74 is in radial alinement with the nipple 64 and the branch pipe 75 is in radial alinement with the nipple 66.

Valve 56 also includes a core, designated generally 76 which snugly fits in the casing 57 and which is substantially circular in cross section and of a proper diameter so that its periphery engages the inner side of the wall 58 relatively snug yet sufficiently loose to permit it to be revolved therein. The length of the core 76 is substantially equal to the interior length of the casing 57 and the core 76 is provided with substantially flat ends. The core 76 is recessed in its ends to form a recess 77 which opens toward the front wall 59 and a recess 78 which opens toward the rear wall 60, which recesses are primarily intended to reduce the weight of the core. A stem 79, which forms a part of the core 76 projects therefrom into the recess 77 and is pro-

vided with a restricted shank 80 which projects from the free end thereof through a stuffing box 81 which is formed on the outer side of the wall 59 and centrally thereof and which is journaled therein. An expansion coil spring 79' is disposed around the stem 79 and has one end thereof abutting against the wall 59 and its opposite end abutting against the bed of the recess 77 for urging the core toward the wall 60 and for holding the rear end of the core in snug engagement therewith, for a purpose which will hereinafter become apparent. As best seen in Figure 6, the core 76 is provided with pairs of longitudinally extending passages 82 and 83 which open outwardly of the rear end thereof toward the wall 60 and which extend to intermediate of the ends of the core. The two passages 82 are disposed in substantially diametrically opposed relationship to one another as are also the passages 83. As seen in Figure 6, the passages 82 and 83 are arranged so that pairs of passages are not at right angles to one another. Passages 82 and 83 are oblong in cross section and are provided with lateral outwardly extending passages 84 at their inner ends, which are similarly shaped in cross section, which open outwardly of the periphery of core 76 and which are each arranged to communicate with nipple 63, 64, 65 or 66, as will hereinafter become apparent. The opposite, first mentioned ends of the passages 82 and 83 are each arranged to communicate with an opening 71 when the core 76 is in certain positions.

A lever 85 is provided with a hub portion 86, adjacent one end thereof which is turnably mounted on a smooth portion 87 of the stuffing box 81 and is held in engagement therewith by a retaining nut 88 which engages a threaded portion of the stuffing box 81. The shorter end of the lever 85 is provided with a gear segment portion 89 and said end extends toward the left hand side of the valve 56, as seen in Figure 1, and is disposed on the outer side of its front wall 59. Said front wall 59 is provided with an extension 90 which projects from the periphery thereof and in substantially the same direction as the nipple 66 to form a support for pivotally mounting a lever 91 which is pivotally mounted thereon, intermediate of its ends, by means of a pivot pin 92. The inner end of the lever 91 is provided with a gear segment 91' the teeth of which mesh with the teeth of the gear segment 89, as best illustrated in Figure 1. The opposite, longer end 93 of the lever 85 is provided with outwardly curved side edges for increasing the width of said end 93. As best seen in Figures 1 and 12, the elongated end 93 is provided with a transversely disposed bar 94 which is curved longitudinally and in a direction outwardly of the end 93 and is provided with inturned ends 95 which are secured in any suitable manner, as by means of welding, to the outer side of the end 93 and adjacent its side edges. The inturned ends 95 are provided with threaded openings 96 for receiving inwardly extending set screws 97. As best seen in Figures 2 and 5, the free end of the shank 80 extends beyond the stuffing box 81 and is engaged by an eye 98 which is formed on one end of an arm 99. A set screw 100 is provided to adjustably secure the eye 98 to the shank 80. The free end of the arm 99 is disposed between the lever end 93 and the guide bar 94 and is swingably mounted therein and relatively to the lever 85, between the set screws 97 which, by adjustment, can vary the extent of movement of the arm 99 relatively to the lever 85. A contractile coil spring 101 is connected at one end thereof to the arm 99, adjacent its free end, and is connected at its opposite end to the lever 91 near its outer end.

A bar or rod 102 is disposed perpendicularly in the derrick 16 and between the member 45 and the valve 56. The base 20 is provided with a rest 103 on which the lower end of the rod 102 is adapted to rest when in a lowered position. A bracket 104 is secured to and projects upwardly from the base 20. A yoke 105 is pivotally connected at one end thereof to the rod 102, adjacent its lower end, and has its opposite end loosely disposed in the bracket 104. A bracket 106 is secured to and depends from the cross member 18 and a yoke 107 is loosely connected at one end thereof in the bracket 106 and is pivotally connected at its opposite end to the rod 102, adjacent the upper end thereof. Between the yokes 105 and 107 and adjacent thereto, the rod 102 is provided with series of longitudinally spaced openings or apertures 108 for selectively receiving fastenings 109 for detachably and adjustably fastening an elongated loop member 110 to the lower portion of the rod 102 and an elongated loop member 111 to the upper portion of the rod 102, as best illustrated in Figures 8 and 9, respectively. A standard 112 is fastened to and projects upwardly from the loop 110 and is provided with a head 113 arranged to be engaged by the member 45 as it aproaches its lowermost position. A hanger 114 is secured to and depends from the loop 111 and is provided at its lower end with a head 115 which is arranged and adapted to be engaged by the upper end of the cylinder 33 as it approaches its uppermost position, as will hereinafter be explained. The pipe 25 extends loosely through the loop 110, as seen in Figure 9, and the pipe 23 is similarly disposed in the loop 111.

A hanger 116, which is U-shaped, as seen in Figure 11, is fastened to and depends from the member 18 and extends below the loop 111, which extends therethrough. A lever 117 is pivotally connected at one end thereof to a pin 118 which extends through the lower portion of the U-shaped hanger 116. A roller 119 is rotatably connected to the free end of the lever 117. The lever 117 extends upwardly relatively to the hanger 116 and toward the rod 102. An expansion coil spring 120 has one end engaging a stud 121 and bearing against a crossbar 122 carried by the lever 117, and its opposite end engaging a stud 123 and bearing against a crossbar 124, carried by the hanger 116. The spring 120 acts to urge the lever 117 outwardly and downwardly relatively to the hanger 116 to hold the roller 119 in engagement with the rod 102. The rod 102 is provided with a depression 125 adapted to be engaged by the roller 119, when the rod 102 is in a raised position, not shown, as will hereinafter be explained.

The end 93 of the lever 85 is provided with a longitudinally extending slot or elongated opening 126, adjacent the free end thereof, which slidably and pivotally engages a pin 127 which is connected to the rod 102.

A tank 128 is supported on the base 20 and has a pump 129, as seen in Figure 12, disposed therein and provided with a driven shaft 130 which projects outwardly through the tank 128 and which is provided at its outer end with a pulley 131. As seen in Figure 1, a motor or engine 132, of any suitable, conventional construction is secured to the base 20 and is provided with a driven

shaft having a pulley 133. A belt 134 is trained over the pulleys 131 and 133 for driving the shaft 130 of the pump 129. The discharge end 135 of the pump 129 is fastened to an end of the pipe 67 and a corresponding end of the pipe 72 discharges into the tank 128 which is adapted to contain an hydraulic fluid, as indicated by the liquid level line 136, in Figure 12.

Referring to Figures 2 and 10, the ends of the piston 26 are provided with a plurality of apertures 137 which connect the compartment 31 to the upper end of the cylinder 33 and the compartment 32 to the lower end of the cylinder 33. An excess pressure receiver or ram 138 is connected by a pipe 139 to pipe 67 and is provided with a pressure gage 140. A similar excess pressure receiver or ram 141 is connected to the conduit 49 by means of an extension of the branch pipe 52 and a third ram 142 is connected to the conduit 53 by a continuation of the pipe 55. The excess pressure receivers or rams may be of any conventional construction and are provided to insure the smooth and quiet operation of the pumping unit 15, as will hereinafter be described.

Assuming that the parts of the motor unit 15 are in the positions as seen in Figure 1, which constitutes the lowermost position of the cylinder 33, when the cylinder is in this position, the sucker rod 43 is at the upper end of its stroke and the valve core 76 is in the position as seen in Figure 6, in which position one of the passages 82 thereof forms a connecting conduit between the branch pipe 51 and the branch pipe 69 for connecting the conduit 49 to the supply conduit 67. The other passage 82 is in communication with the branch pipe 55 and the branch pipe 75 to form a connecting conduit between the return pipe 72 and the conduit 53. Consequently, if the motor 132 is in operation for actuating the pump 129 the hydraulic liquid will be pumped upwardly through the supply pipe 67 and its branch 69, through the first mentioned passage 82 to the branch 51, through pipes 49 and 23 to chamber 31, and through the apertures 137 of end 27 to impinge against the head 35 to force the cylinder 33 upwardly. At the same time, the other passage 82, which is to the left of Figure 3, will be in communication with the branch pipe 55 and the branch pipe 75 of the return conduit 72 will allow the fluid in the lower end of the cylinder 33 to flow back through the ports 137 of the wall 28, through pipe 25 and conduit 53, through the pipe 55 and the last mentioned passage 82 into the branch 75, and thence back through the return conduit 72 to the tank 128. This return flow of the liquid will be under pressure caused by the upward movement of the cylinder 33. As the cylinder moves upwardly, the weight of the sucker rod will cause said rod to move downwardly and the cylinder in moving upwardly will have to lift the counterweights 143, which are contained in the space between the cylindrical wall of the cylinder and the member 45, and which may be of any suitable form and of sufficient weight to counterbalance the weight of the sucker rod 43 and the parts carried thereby, not shown. As the cylinder 33 approaches the upper extremity of its movement its head 35 will contact the head 115 of the member 114 to force the loop member 111 upwardly to thereby raise the rod 102. As the rod 102 moves upwardly it will swing the outer end 93 of the lever 85 upwardly thereby causing the lever 91 to be swung by engagement of the gear segments 89 and 91' so that the levers 85 and 91 will swing in opposite directions. Just after the levers 85 and 91 have passed the positions when their longitudinal axes are disposed in alinement and in substantially a horizontal plane, the arm 99 will have been moved by the lever end 93 to a position at which the spring 101 will have moved across the dead center of the arm 95 after which it will react to swing the free end of the arm out of engagement with the set screw 97, as seen in Figure 13, and into engagement with the end of the other set screw 97. While the lever 85 is swinging upwardly and to the point, just previously described, when the arm 99 is swung in a counterclockwise direction, as seen in Figure 1, by the in a counterclockwise direction as indicated by spring 101, the core 76 is being turned rapidly in a counterclockwise direction as indicated by the arrow 144 of Figure 6. During this movement of the core 76 the passages 82 will remain in communication with the pipes 51 and 69 and the pipes 55 and 75, due to the elongated cross sectional shape of the passages 82, so as not to interrupt the flow of the liquid, as previously described, through the valve 56. Likewise, during this movement the passages 83 will not be moved sufficiently to expose the branch pipes 52 and 74 or the branch pipes 54 and 70. However, when the spring reacts to swing the arm 99 in a counterclockwise direction the passages 82 will be moved to closed positions and the passages 83 will be moved to open positions, as seen in Figure 6, and the ends of these passages 83, which are most adjacent to the passages 82 will be substantially in alinement with the nipples 65 and 64, so that when the lever is initially moved in the opposite direction, as will hereinafter be described, for turning the core 76 in a clockwise direction the passages 83 will remain in communication with the nipples 64 and 65 until the lever 85 has been swung in a clockwise direction sufficiently to allow the spring 101 to swing the arm 99 in a clockwise direction. When the cylinder 33 has reached its fully raised position the loop 111 and the hanger 114 will have been moved upwardly sufficiently thereby to move the rod 102 upwardly until the roller 119 seats in the notch 125 to frictionally retain the bar in a raised position. The recessed portion 48 in the member 45 is provided to accommodate the lever 117 and roller 119, when the cylinder 33 is in a raised position, not shown, and the hanger 116 is disposed in the space formed by the cylinder 33 and member 45. The cross member 18 is rovided with an opening 147 to receive the upper end of rod 102, when in a raised position. The slot 126 permits the pin 127 to slide relatively to the lever 85 when said lever is swinging past a horizontal position so that the lever can move relatively to the rod 102 which is guided by means of the yokes 105 and 107 and the brackets 104 and 106, respectively, and which cause the rod 102 to move substantially vertically and which hold the rod, when in a raised position, so that its notch 125 will be engaged by the roller 119. When the cylinder 33 thus reaches a raised position and valve core 76 has moved to the position of Figure 5, it will be readily apparent that the upper passage 83 will connect the branch pipes 52 and 75 for connecting the conduit 49 to the return pipe 72 and the lower passage 83 will be disposed for connecting the branch pipes 54 and 70 to connect the conduit 53 to the supply pipe 67. Consequently, the hydraulic medium will be forced under pressure from the pipes 67 through pipe 53 and pipe 25 into the chamber 32 from

which it will pass through the apertures 137 in the end wall 28 to impinge against the lower end wall 36 for forcing the cylinder 33 downwardly. At the same time, as the cylinder 33 moves downwardly the hydraulic fluid that is in the chamber 31 and in the upper part of the cylinder 33 will be returned through pipe 23, conduit 45, and through the upper passage 83 to the return pipe 72.

As the cylinder 33 approaches its lowermost position the member 45 will engage the head 113 for forcing the loop 110 downwardly to return the rod 102 to its position of Figure 1, and to forcefully move the notch 125 out of engagement with the roller 119. This will cause the lever 85 to be swung in a clockwise direction, as seen in Figure 1, to turn the core 76 in a direction opposite to the direction, as indicated by the arrow 144, until the spring 101 is moved below the arm 99 after which it will snap the arm 99 downwardly in a clockwise direction to return the core 76 to the position, as seen in Figure 6, to allow the hydraulic fluid to flow into the upper end of the cylinder 33 for again moving it upwardly.

On the downstroke of the cylinder 33 the chain 40 will be actuated thereby for raising the sucker rod 43 to thus accomplish the upstroke thereof and as previously described the weight of the sucker rod will be counterbalanced by the elements 143 so that substantially the same amount of force will have to be exerted by the hydraulic fluid to raise the cylinder 33 as to lower it. It will be readily obvious that this operation will continue automatically so long as the motor 132 remains in operation.

The set screws 97 are adapted to be adjusted for adjusting the extent to which the arm 99 swings relatively to the lever 85 and consequently to adjust the extent that the arm 99 and the core 76 turn so as to insure that the passages 82 and 83 will move to open and closed positions and will remain in open and closed positions until the cylinder 33 has reached the full extent of its movement in either direction. Likewise, the loops 110 and 111 are made adjustable by providing the apertures 108 so that the length of the stroke of the cylinder 33 can be varied to increase or decrease the length of the stroke of the sucker rod 43.

A relief valve 146, as seen in Figure 1, may be provided and is adapted to be connected to the supply pipe 67 and the return pipe 72 so that should excess pressure be built up in the pipe 67 the hydraulic liquid can pass the valve 146 and flow from the pipe 67 into the return pipe 72. The rams 138, 141 and 142 will take care of the excess pressure which will occur momentarily in the system while the core is in action of changing flow, and the gage 140 on the ram 138 will afford a visual indicator to indicate when too much pressure is being built up in the supply pipe 67.

It will likewise be readily obvious that the rings 34 will prevent the hydraulic fluid from passing from one end to the other of the cylinder 33 and the stuffing boxes 38 will prevent the escape of the fluid from the ends of the cylinder 33. Also, the stuffing box 81 will serve the same purpose for preventing the fluid from escaping from the valve casing 57.

Various modifications and changes are contemplated and may obviously be resorted to as only a preferred embodiment of the invention has been disclosed.

I claim as my invention:

A hydraulic operating means comprising a member mounted to be reciprocated, conduits communicating with opposite ends of said member, a valve, including a casing and core, to which said conduits are connected, a pump for a compressed medium, a supply conduit and a return conduit connected to the pump and to the valve, said core having passages for connecting the first and last mentioned conduits and being movable in the casing for alternately connecting the first mentioned conduits to the supply conduit and return conduit for reciprocating said member, a lever pivotally mounted on the valve casing and connected to and actuated by said member as it approaches the extremities of its movement, an arm connected to the core, spaced abutments on the lever between which the arm is swingably mounted, a contractile spring connected to the arm and arranged to be moved across the pivot of the lever, when the lever is actuated by said member, so that the spring will move the arm from engagement with one abutment into engagement with the other abutment, to reverse the valve to reverse the flow through the first mentioned conduits, said lever being pivotally mounted intermediate its ends, a second lever pivotally mounted intermediate its ends on the valve casing, said levers having meshing gear segments at their adjacent ends, and said spring being connected at one of its ends to the free end of the second lever.

ARNOLD R. BENNER.