

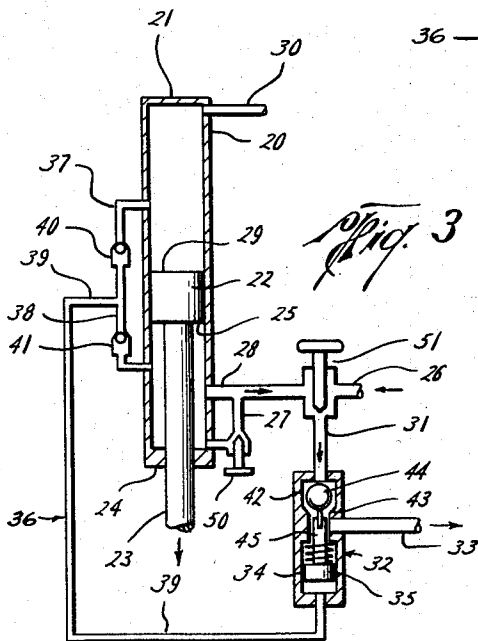
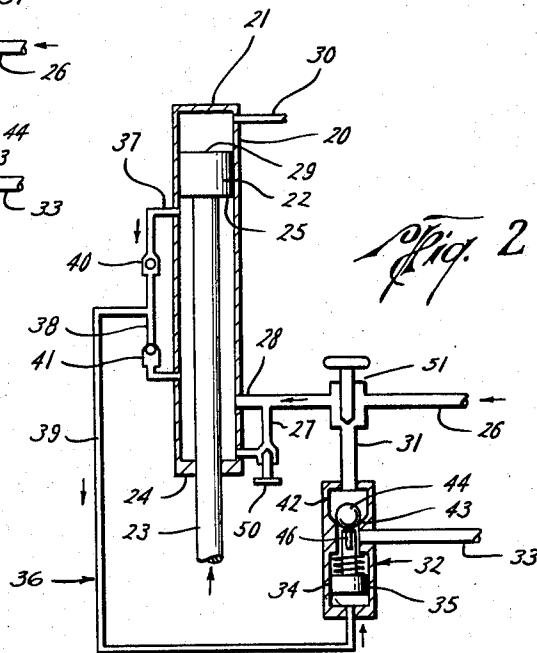
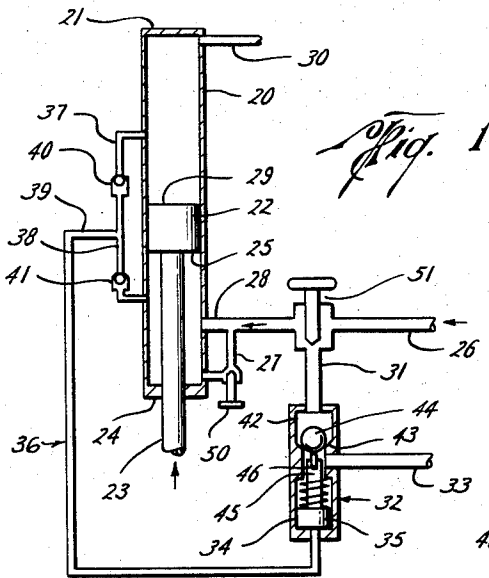
Nov. 24, 1959

R. B. JOHNSTON  
HYDRAULIC PUMPING SYSTEM

2,914,036

Filed April 10, 1956

4 Sheets-Sheet 1



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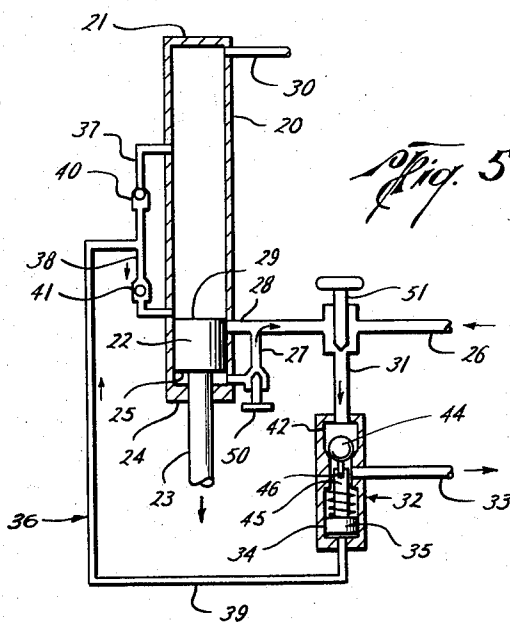
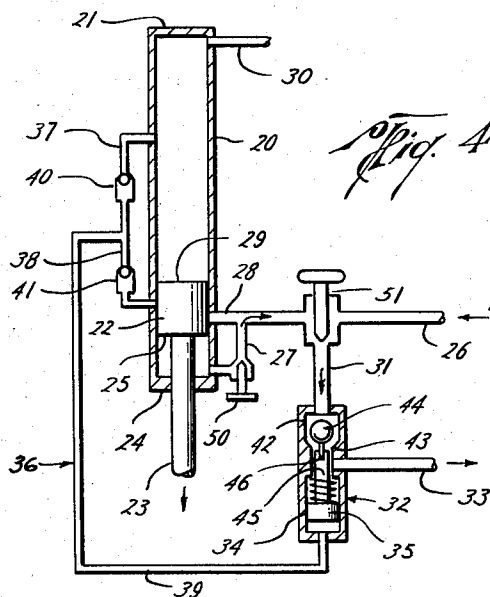
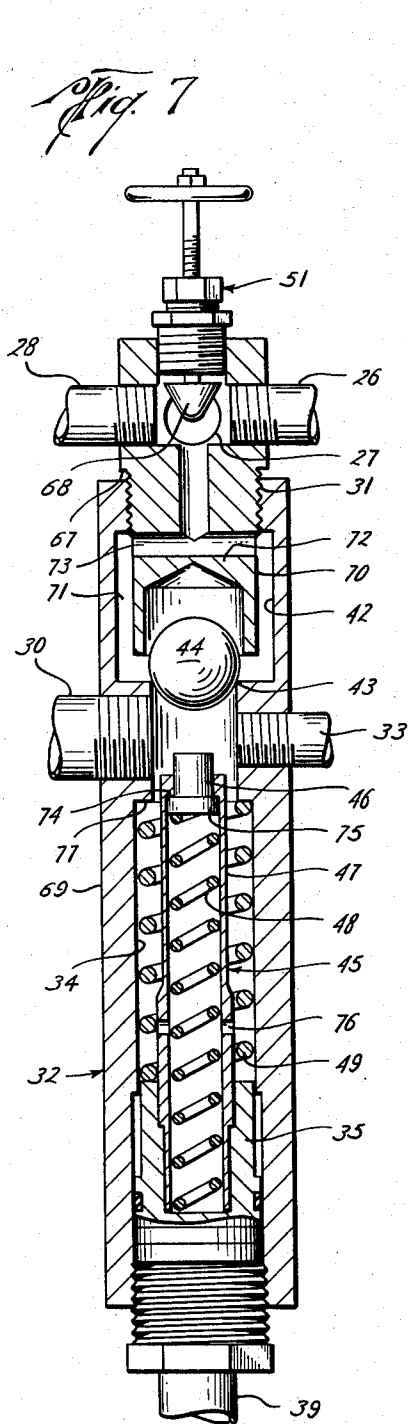
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4 Sheets-Sheet 2



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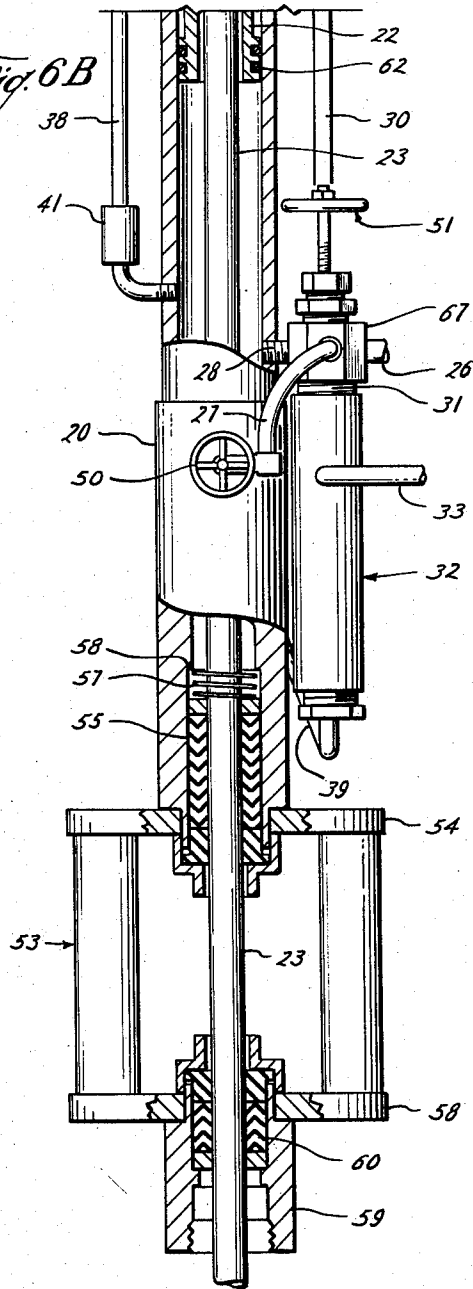
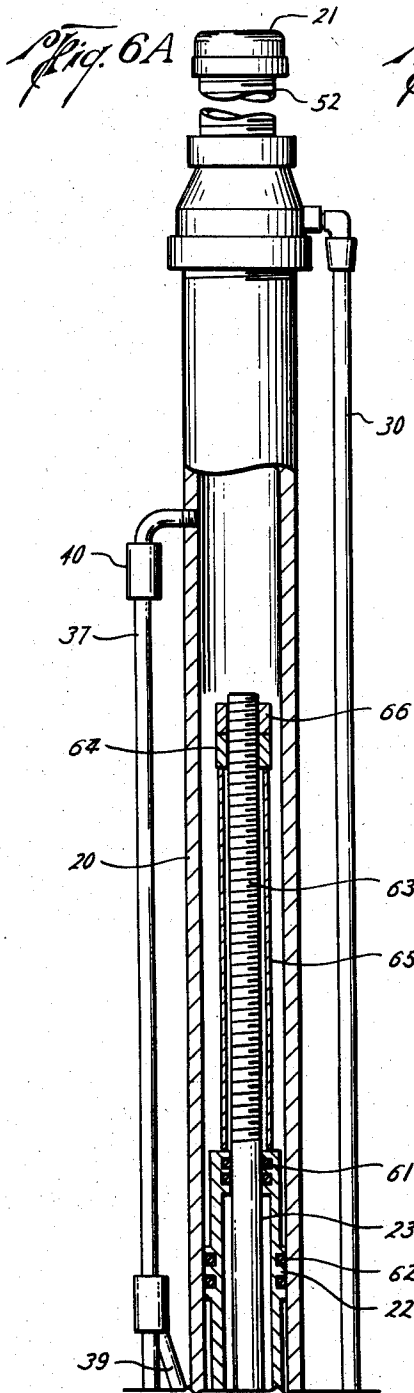
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HYDRAULIC PUMPING SYSTEM

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4 Sheets-Sheet 3



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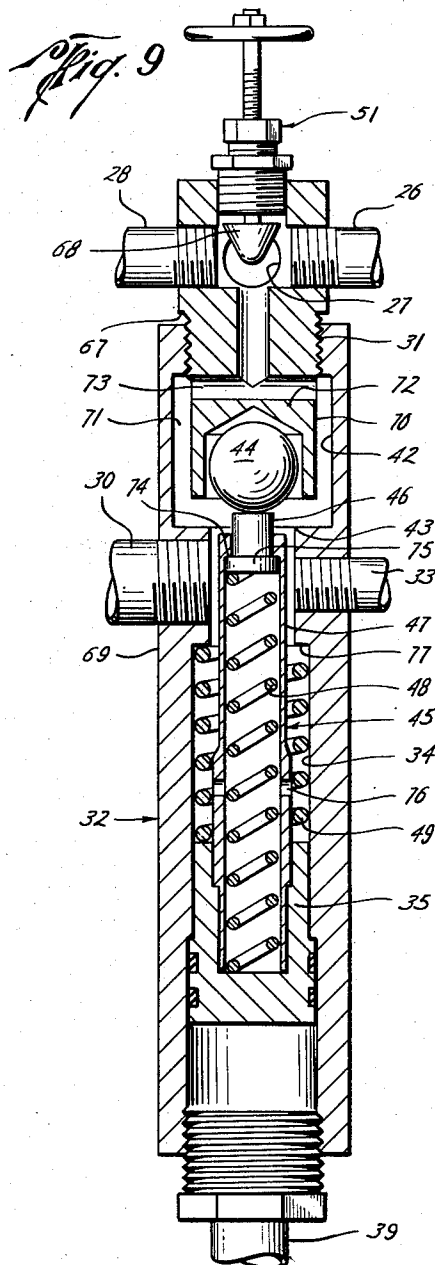
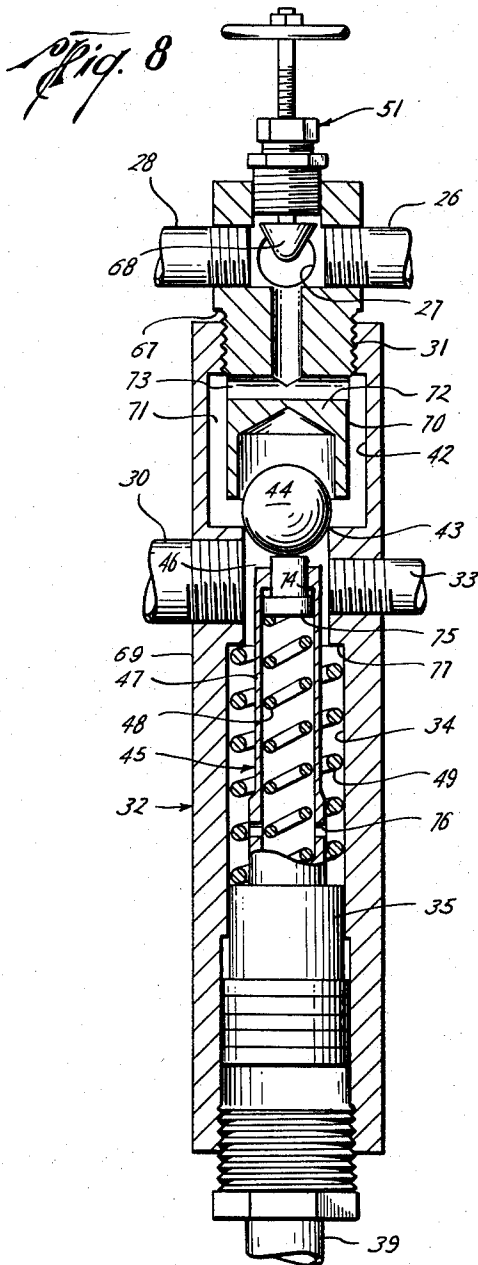
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4 Sheets-Sheet 4



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2,914,036

## HYDRAULIC PUMPING SYSTEM

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Application April 10, 1956, Serial No. 577,435

14 Claims. (Cl. 121—150)

This invention relates generally to an hydraulic pumping system; and, more particularly, to an improved single-acting and essentially automatic hydraulic motor for operating a pump.

Systems of the general type find wide usage in the recovery of oil from strata in which the pressure is insufficient to cause the oil to rise to the surface. In such a case, the motor is disposed at surface level for reciprocating a sucker rod attached to a down-the-well pump piston. Such motors, whether for oil field or other use, customarily include a mechanism for alternately admitting and exhausting hydraulic fluid to and from the working side of the motor piston. In the past, this mechanism has included a pilot valve control so connected to the motor cylinder as to operate a reversing valve for automatically admitting and exhausting the hydraulic fluid, in the manner above-mentioned, responsive to movement of the motor piston into the limits of its working and return strokes.

An object of this invention is to provide a greatly simplified system of this general type.

A more particular object is to provide a single-acting and essentially automatic hydraulic motor having a reversing mechanism which does not require a pilot valve control.

Another object is to provide a novel valve structure for use in such a reversing mechanism, which structure employs spring means in place of the customary pilot valve control for insuring positive seating and unseating of the reversing valve member.

Still another object is to provide, in an hydraulic pumping system of the type described, a novel means by which the height of the down-the-well pump piston may be adjusted, as desired, which avoids the necessity for seals about the sucker rod at both ends of the motor cylinder.

Other objects, advantages and features of this invention will be apparent to one skilled in the art upon a consideration of the written specification, the attached claims and the annexed drawings.

In the drawings, wherein like reference characters are used throughout to designate like parts:

Fig. 1 is a schematic sectional view of the hydraulic motor of the system during an intermediate portion of the working stroke of its piston;

Fig. 2 is a view similar to Fig. 1, but with the motor piston at the limit of its working stroke;

Fig. 3 is another similar view during an intermediate portion of the return stroke of the motor piston;

Fig. 4 is a view similar to Fig. 3, but in which the motor piston has descended still further in its return stroke;

Fig. 5 is a further similar view with the motor piston at the limit of its return stroke;

Figs. 6A and 6B are successive elevational views, partly in section, of an hydraulic motor constructed in accordance with the present invention;

Fig. 7 is an enlarged sectional view of the novel reversing mechanism of this invention with the valve member thereof in seated position, as shown in Fig. 1;

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Fig. 8 is a similar view of the reversing mechanism, showing the valve member still seated but engaged by a pressure responsive actuator therefor, as shown in Fig. 2; and

Fig. 9 is a still further enlarged sectional view of the reversing mechanism, showing the valve member lifted from its seat to a fully opened position by means of said actuator.

Referring first to the schematic views of Figs. 1 to 5, the hydraulic motor of the present invention includes a motor cylinder 20 which is closed at its upper end 21, a piston 22 reciprocable in the motor cylinder, and a rod 23 on the piston extending through the lower end 24 of the cylinder. In accordance with a preferred usage of the motor, the rod 23 may be a polish rod for connection with a down-the-well pump piston, in a manner well known in the art.

Means for admitting hydraulic fluid to a side 25 of the piston 22 for moving it in a working or upwardly direction comprises a conduit 26 connected with the motor cylinder through passageways 27 and 28. Obviously, hydraulic fluid may be supplied under pressure from a suitable reservoir (not shown) through conduit 26, as indicated by the arrows, by means of a suitable pump (not shown) connected thereto. Also connected to the cylinder, but at its upper end for continuously venting the other side 29 of the piston, is a conduit 30 having connection at its other end with a source at a pressure substantially less than that of the hydraulic fluid and similar to that to which the hydraulic fluid is exhausted from the working side 25 of the motor piston, in a manner to be described hereinafter.

Connected to the hydraulic fluid supply conduit 26 is another conduit 31 which leads to a reversing mechanism, indicated in its entirety by reference character 32, and having a valve moveable to an open position for exhausting hydraulic fluid from said working side 25 of the motor piston. This exhaust occurs through passageways 27 and 28, conduits 26 and 31, past the valve of the reversing mechanism 32, and outwardly therefrom through conduit 33. As previously mentioned, it is contemplated by the present invention that both conduits 30 and 33 will connect at their other ends (not shown) with sources having the same, or at least substantially the same, pressure. For example, in a continuous pumping system of this type, each of the conduits 30 and 33 may connect with the upper end of a hydraulic fluid reservoir which may be at atmospheric pressure.

The reversing mechanism 32 also includes a pressure responsive means in the form of a cylinder 34 and piston 35 reciprocable therein for movement upon the admission of hydraulic fluid thereto to open the valve. Conduit means, indicated in its entirety by reference character 36, connects the motor cylinder 20 at spaced apart levels therein with the pressure responsive means. Disposed within the conduit means are valve means automatically operable to admit said hydraulic fluid from the motor cylinder to the pressure responsive means in the limit of the working stroke of motor piston 22, as shown in Fig. 2, and to exhaust said hydraulic fluid from the pressure responsive means into the motor cylinder in the limit of its return stroke, as shown in Fig. 5.

More particularly, the conduit means 36 comprises a pair of conduits 37 and 38 each connected to the motor cylinder at said spaced apart levels and having a common connection through conduit 39 with the pressure responsive means of reversing mechanism 32. Disposed within conduit 37 is a check valve 40 automatically operable, upon movement of piston 22 to the position of Fig. 2, for admitting the hydraulic fluid from the cylinder on the working side 25 of the piston to the piston 35. More particularly, the check valve 40 may comprise any suit-

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able construction, such as is shown schematically in Figs. 1 to 5, which is urged to an unseated position by pressure in the end of the conduit 37 connecting with the cylinder 20. The check valve 41 within conduit 38 is automatically operable, upon movement of the piston 22 to the limit of its return stroke, as shown in Fig. 5, for exhausting the hydraulic fluid from the piston 35 through to the cylinder 20 on the opposite side 29 of the piston 22. More particularly, the check valve 41 is of any suitable construction which is urged to a seated position due to pressure in the end of conduit 38 connecting with motor cylinder 20.

Referring now more particularly to the valve portion of the reversing mechanism 32, it will be seen to comprise a passageway 42 through the body of the mechanism connecting at its inlet end with conduit 31 and at its outlet end with conduit 33. Disposed within the passageway 42 intermediate its inlet and outlet is a valve seat 43 upon which a ball-type valve member 44 is adapted to be seated in the closed position of the valve. Connected to the piston 35 and extending in an opposite direction from its pressure responsive face is an actuator 45 adapted, upon reciprocation of piston 35, to alternately engage and be disengaged from the valve member 44 to open and close the valve. As previously mentioned, in its open position, this valve permits the exhaustion through conduit 33 of hydraulic fluid from the motor cylinder 20 beneath the working side 25 of the piston 22, as indicated by the arrows of Figs. 3 to 5. On the other hand, when closed, this valve serves to direct the hydraulic fluid through supply conduit 26 into the motor cylinder beneath the working side 25 of the piston for moving the piston in a working direction, as illustrated by the arrows of Figs. 1 and 2.

As best shown in Figs. 7 and 9, and as will be explained more fully hereinafter, the actuator 45 includes a spring pressed plunger 46 which is moveable with the piston 35 into engagement with ball valve member 44 prior to engagement therewith by a stem 47 fixed to the piston. However, inasmuch as ball 44 is held in seated position by the pressure of the hydraulic fluid acting across seat 43, continued movement of the actuator will depress the plunger 46 and energy will be stored within a relatively weak spring 48. As the piston 35 moves the stem 47 of the actuator into engagement with the ball 44 so as to unseat same, the energy stored in spring 48 will be released so as to urge plunger 46 upwardly, as shown in Fig. 9, to hold the valve member in an open position. The piston 35 is moveable in an opposite direction, upon the exhaustion of hydraulic fluid from its pressure responsive surface and under urging of a retracting spring 49, so as to permit seating of the valve member upon the successive disengagement therewith of the stem and plunger.

Disposed within passageway 27 connecting conduit 26 with the lower end of motor cylinder 20 is a needle valve 50 or other suitable means for restricting the flow of hydraulic fluid therethrough a desired amount. Thus, as will be described more fully hereinafter, the movement of piston 22 during its return stroke may be cushioned toward the limit thereof. A similar means, such as needle valve 51, may be provided for restricting the flow of hydraulic fluid into conduit 31. It is obvious that such an arrangement provides a control over the speed of movement of piston 22 during its entire return stroke since it provides a rate at which the hydraulic fluid may be exhausted from the cylinder beneath the working end 25 of the piston.

It is believed that with the foregoing as a background, the description to follow of the function of the hydraulic motor during one pumping cycle will be easily understood. With reference to Fig. 1, it can be seen that during the working or upward stroke of the motor piston 22, the valve of reversing mechanism 32 will be closed so that

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hydraulic fluid under pressure is admitted through passageways 27 and 28 to the working side 25 of the motor piston. In this intermediate portion of the working stroke of the motor piston, the upper side 29 of the piston as well as the pressure responsive means of the reversing mechanism will be subjected to atmospheric pressure, or at least substantially the same pressure with which conduit 33 is connected. That is, the check valve 40 will unseat so as to provide communication between the source to which conduit 30 connects and the pressure responsive face of the piston 35. On the other hand, the check valve 41 will be urged to seated position by the hydraulic fluid being pumped into the cylinder beneath piston side 25 through passageways 27 and 28.

Upon continued upward movement of the piston 22 in its working stroke, however, the piston will reach the position of Fig. 2 wherein it moves past the connection of conduit 37 with the motor cylinder 20. At this time, hydraulic fluid from the cylinder beneath the working side 25 of the piston will flow into conduit 37 and unseat check valve 40, so as to admit hydraulic fluid from the motor cylinder and through conduits 37 and 39 to the pressure responsive surface of piston 35. As can be seen from the schematic views of Figs. 1 to 5, and more particularly from the detailed views of Figs. 7 and 9, this pressure responsive surface of the piston 35 is sufficiently greater than that across seat 43 for ball valve member 44 so that the hydraulic fluid will urge the piston 35 upwardly against the action of retracting spring 49 so that the actuator 45 unseats ball valve member 44. More particularly, this upward movement of piston 35 will cause the successive engagement with ball valve member 44 of plunger 46 and stem 47 so as to unseat same and then hold the ball in the unseated or open position. At this time, of course, the hydraulic fluid beneath the working side 25 of piston 22 may be exhausted through passageways 27 and 28 into conduits 26 and 31 and out conduit 33.

Obviously, as the piston reaches the limit of its working stroke, as shown in Fig. 2, and the hydraulic fluid is being exhausted from the working side 25 thereof, it will begin to descend in its return stroke. This period of the pumping cycle has been found, in hydraulic pumping systems of this general type, to be critical inasmuch as there is the danger of the piston reaching a "dead center" position. It is for this purpose that prior systems of this type have employed a pilot valve control for positively moving the valve of the reversing mechanism to the open position, whereby the valve member is not permitted to return to a position in which it would throttle the exhaustion of hydraulic fluid from the cylinder. As distinguished from such prior practices, however, the reversing mechanism 32 of the present invention employs spring means of the character previously described for holding the valve member 44 in a fully opened position substantially instantaneously as the valve member is lifted from its seated position. Furthermore, and as also previously described, spring means are also provided for urging the pressure responsive member in a direction to permit closing of the valve upon exhaustion of hydraulic fluid therefrom into the cylinder.

Continuing now with a description of the pumping cycle, it will be understood that as the piston 22 begins its downward movement upon the return stroke, and thus moves down past the connection of conduit 37 with the motor cylinder, as shown in Fig. 3, the check valve 40 will be caused to close due to the pressure of the hydraulic fluid within conduit 39 which opposes the atmospheric pressure to which the upper end of the check valve 40 is subjected through conduit 37. Also, at this stage of the cycle, the pressure of the hydraulic fluid within the cylinder beneath the working side 25 of piston 22 is decreased to the extent that it is subjected to the weight of only the sucker rod string as distinguished from the weight of such string plus the well fluid being

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pumped in the working stroke. On the other hand, there will be a pressure within conduit 33 and the passageway 42 within the reversing mechanism adjacent valve member 44 which is substantially atmospheric.

As the piston 22 reaches the position in its return stroke shown in Fig. 4 wherein it covers the connection of passageway 28 with the motor cylinder, its descent to the limit of the return stroke will be cushioned by the needle valve 50. That is, the exhaustion of hydraulic fluid beneath the piston will no longer be through the substantially unrestricted passageway 28, but rather only through confined passageway 27. However, when the piston reaches the limit of its return stroke, as shown in Fig. 5, it will have moved downwardly past the connection of conduit 38 with the motor cylinder so that the check valve 41 is exposed upon its side nearest the connection of conduit 38 with the motor cylinder to the pressure upon side 29 of the motor piston. Inasmuch as the other side of check valve 41 is exposed to hydraulic fluid pressurized by piston 35 under urging of retracting spring 49, it will be unseated so that the hydraulic fluid will be exhausted from the pressure responsive means into the motor cylinder above the other side 29 of the piston. Obviously, such exhaustion of hydraulic fluid from the pressure responsive face of piston 35 will permit retracting spring 49 to urge such piston to its lowermost position. As previously described, such movement of the piston 35 results in the successive disengagement of stem 47 and plunger 46 from ball member 44, so that the ball member is permitted to reseat upon seat 43, at which time the pumping cycle is complete and the motor is in position for a subsequent cycle, in the manner above-described.

Referring now to the elevational views of Figs. 6A and 6B of an illustrative embodiment of the hydraulic pumping motor of the present invention, the upper end 21 of the motor cylinder 20 is provided with a removable head 52 which is reduced and relatively long, for a purpose to be described hereinafter. The lower end of the cylinder is supported upon an open framework 53, which may be disposed at the well-head when the motor is used for reciprocating a down-the-well piston. As shown in Fig. 6B, this framework 53 is provided with an upper horizontal member 54 which supports packing 55 about polish rod 23 at the lower end of the housing. More particularly, the lower end of the housing is provided with a downwardly facing annular shoulder 58 against which a spring 57 may be disposed for compressing the packing 55 tightly about the reciprocating sucker rod.

A lower horizontal member 58 of the open framework is cooperable with a support 59 for confining packing 60 therebetween about a portion of the reciprocating rod 23 beneath that sealed by packing 55. Thus, there is provided intermediate the packings 55 and 59 an open portion of polish rod 23 which may be held against rotation as well as longitudinal movement by any suitable means and for a purpose to be described hereinafter.

As shown in Fig. 6A, the piston 22 is annular and provided with O-rings 61 about its inner diameter sealably surrounding and slidably longitudinally of an intermediate portion of the polish rod 23 and seal rings 62 about its outside diameter for sealing engagement with the inside of motor cylinder 20. The upper end of the rod is threaded as at 63 for receiving an adjusting nut 64, and a cylindrical spacer sleeve 65 is received in spaced relation about the rod between the adjusting nut 64 and the upper end of the annular piston 22. Obviously, with the hydraulic fluid acting upon the bottom or working face of the piston 22, it will be constantly urged into bearing engagement with the lower end of sleeve 65 which, in turn, is urged into engagement with the bottom of adjusting nut 64. Thus, if there should be occasion to adjust the height of the pump piston within the well, the head 52 of the cylinder 20 could be removed and the polish rod held against rotation, as previ-

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ously suggested, so that the adjusting nut 64 could be manipulated to raise or lower the rod relative to piston 22. There may also be provided a lock nut 66 above adjusting nut 64 on the upper threaded end 63 of the polish rod for maintaining the adjusting nut in a desired position. From the foregoing, it will be understood that the removable head 52 of the cylinder may be reduced in diameter inasmuch as it need accommodate only the outside diameter of spacer sleeve 65.

Many of the various parts of the motor described and shown schematically in connection with Figs. 1 to 5 will be recognized from the corresponding reference characters in Figs. 6A and 6B. It should be noted, however, that the illustrative embodiment of Figs. 6A and 6B is compact and simplified of construction in the manner in which each of these various parts is arranged relative to one another. For example, with reference to Fig. 6B, as well as Figs. 7 to 9, it will be seen that each of the conduit 26 and passageways 27 and 28 may connect with an integral fitting 67. More particularly, each of the conduit 26 and passageways 27 and 28 may intersect at a T into which the valve member 68 of needle valve 51 may be lowered for controlling the speed of the piston on its return stroke. As also shown in Fig. 6B, the needle valve 50 for cushioning the lowermost portion of the return stroke of the piston may comprise an assembly disposed upon the exterior of such piston and connected with the passageway 27 threaded into the T connection of the fitting 67, as shown in Figs. 6B and 7 to 9.

It is also contemplated that the conduit 30 connecting with the upper end of motor cylinder 20 for continuously venting the side 29 of piston 22 may be connected at its opposite end, as shown in Figs. 7 to 9, with the reversing mechanism 32 adjacent the connection therewith of conduit 33 for exhausting hydraulic fluid from the motor cylinder. More particularly, this conduit may extend from the upper end of the cylinder, as shown in Figs. 6A and 6B, for connection with the passageway 42 through the mechanism 32 beneath valve seat 43 but above piston 35 of the pressure responsive valve actuator. As previously mentioned, the conduit 33 may lead to a source of atmospheric pressure, such as the upper end of a hydraulic fluid reservoir, so that the pressure both above the side 29 of piston 22 as well as within the reversing mechanism intermediate valve seat 43 and piston 35 will be substantially less than that of the hydraulic fluid.

The reversing mechanism 32 will be seen from Figs. 7 to 9 to comprise a cylindrical body 69 which is threaded at its upper end to receive the fitting 67, such threaded connection therebetween providing the conduit 31 connecting conduit 26 with the passageway 42 within the embodiment. More particularly, and as previously mentioned, the conduit 31 provides the inlet to passageway 42 and conduit 33 threadedly and laterally received within an intermediate portion of the body 69 provides the outlet from such passage. As also mentioned previously, the ball type valve member 44 is seatable upon the annular valve seat 43 intermediate the inlet to and outlet from the passageway 42 for closing same.

Disposed intermediate the inlet to the passageway and the valve seat 43 is a cage 70 for guiding the movement of ball valve member 44 between the seated position of Figs. 7 and 8 and the unseated position of Fig. 9. As can be seen from Figs. 7 and 9, this cage comprises a cylindrical sleeve which is spaced from the passageway 42 undercut within body 69 as well as from the passageway inlet and valve seat so as to provide an annular flow path 71 between the inlet and valve seat about the exterior of the sleeve. Furthermore, an imperforate blind 72 is disposed across the interior of the sleeve so that the flow of hydraulic fluid through conduit 31 and into passageway 42 will be directed into the flow path 71. The portion of the interior of the sleeve intermediate the blind and its end nearest the valve seat is of a diameter

closely approximating that of the ball valve member but slightly greater than such member so as to loosely receive same during its movement between seated and unseated positions. Thus, with the ball valve member in an unseated position, as shown in Fig. 9, it will be protected against the surge of hydraulic fluid downwardly through conduit 31 and into the passageway 42, which surge might otherwise urge the ball 44 against the actuator 45 and prematurely close the valve. As also shown in the drawings, the cylindrical sleeve making up the cage 70 may be a part of fitting 67 and have lateral ports 73 therethrough communicating the conduit 31 with the annular flow path 70. The lower end of this sleeve is spaced from the valve seat 43 so as to provide for the flow from flow path 71 therebeneath and through the valve seat in the open position of the valve.

Referring now to the preferred construction of the pressure responsive means for actuating the valve member 44, the plunger 46 and spring 48 which urge same to its uppermost position are disposed within a hollow portion of the sleeve 47. The upper end of the hollow sleeve is provided with a downwardly facing shoulder 74 which serves as a stop for an enlarged annular shoulder 75 on the lower end of plunger 46. Ports 76 may be provided through the hollow stem for communication with the exterior thereof to prevent a pressure buildup within the hollow stem as the plunger 46 is reciprocated. The retracting spring 49 is disposed between a downwardly facing shoulder 77 on the cylinder 34 of the reversing mechanism and the uppermost portion of piston 35 so as to constantly urge the piston to its lowermost position, as shown in Fig. 7.

As the piston 35 is moved from the position of Fig. 7 to that of Fig. 8, the upperwardly projecting, spring-pressed plunger 46 will be the first portion of actuator 45 to engage the ball valve member 44. However, in view of the pressure of the hydraulic fluid above the seated ball valve member 44 at this stage of the pumping cycle, and further in view of the relatively weak nature of the spring 48, the plunger 46 will be depressed so that energy is stored within the spring 48. However, upon continued upward movement of the actuator 45 from the position shown of Fig. 8 to the position of Fig. 9, where further movement of the stem is prevented by engagement of the enlarged diameter portion 78 of piston 35 with a downwardly facing shoulder 79 on cylinder 34, the upper end of stem 47, which is fixedly secured to the piston 35, will force the ball valve member from its seat 43 and thus permit the exhaustion of hydraulic fluid from the motor cylinder. It will be understood that as soon as the ball valve member is unseated and the pressure of the hydraulic fluid across valve seat 43 relieved, the energy stored within spring 48 will cause the spring to expand and thus raise plunger 46 to the position shown in Fig. 9, wherein the ball valve member is held in a fully open position above the valve seat 43. Inasmuch as this action takes place substantially instantaneously with unseating of the valve member, it will be understood that there will be no opportunity for throttling or other adverse effects about the valve member 44 which might cause the motor piston to reach the position of "dead center." To the contrary, the energy stored in spring 48 will cause the plunger 46 to actually throw the ball valve member upwardly into the sleeve of the cage 70 with a snap action, wherein it is protected from surges of the hydraulic fluid being exhausted from the motor cylinder. Thus, such fluid will flow easily about the ball valve member through the annular flow path 71.

At such time in the pumping cycle that the hydraulic fluid is exhausted from the pressure responsive face of piston 35, the piston will begin to descend under the urging of retracting spring 49. As the piston descends, and as previously mentioned, the upper end of stem 47 and plunger 46 will be successively disengaged from the

ball valve member 44. Obviously, without such support, the ball valve member will return to the seated position shown in Fig. 7.

It will be noted that the cylinder 34 of the pressure responsive valve actuating means is substantially aligned with the valve seat 43 as well as conduit 31, and that the spring 48 is disposed concentrically within retracting spring 49, and more particularly within the hollow portion of stem 47, so that the body 69 of the reversing mechanism may be made cylindrical and of a minimum diameter.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. In an hydraulic pumping system, a motor cylinder and a piston reciprocable therein, means for admitting hydraulic fluid to one face of the piston for moving it in a working direction to a first extreme position, means including a valve member movable to an open position to exhaust said hydraulic fluid from said one piston face to permit its movement in an opposite direction, means automatically operable in response to movement of the piston to its first extreme position for opening said valve member, and spring means operable responsive to said opening of the valve member for holding said valve member in said open position.

2. In an hydraulic pumping system, a motor cylinder and a piston reciprocable therein, means for admitting hydraulic fluid to one side of the piston for moving it in a working direction to a first extreme position, means for continuously venting the other side of the piston, means including a valve movable to an open position for exhausting said hydraulic fluid from said one piston side to permit its movement in an opposite direction into a second extreme position, pressure responsive means movable, upon the admission of hydraulic fluid thereto, to open the valve, conduit means including a pair of conduits connecting the cylinder at said spaced apart levels with said pressure responsive means, valve means in one of said conduits automatically operable in the first extreme position of the piston to admit said hydraulic fluid from said cylinder on said one side of the piston and through one of said connections to the pressure responsive means, additional valve means in the other of said conduits automatically operable in the second extreme position of the piston to exhaust said hydraulic fluid from said pressure responsive means and through said other connection into the cylinder on said other side of the piston, said valve means and additional valve means being operable during substantially the entire reciprocation of the piston intermediate said extreme positions to prevent communication between said pressure responsive means and said one side of the piston, and spring means responsive to movement of the valve to open position for holding the valve in such position.

3. In a system of the character defined in claim 2, additional spring means responsive to exhaustion of said hydraulic fluid from said pressure responsive means for moving said pressure responsive means in a direction to permit closing of the valve.

4. In an hydraulic pumping system, a motor cylinder and a piston reciprocable therein, a first conduit con-

necting with the cylinder for admitting hydraulic fluid to one side of the piston for moving it in a working direction to a first extreme position, a body having a passageway connecting with the first conduit, a valve seat in the passageway intermediate its connection with the first conduit and an outlet from the passageway, a valve member seatable upon said valve seat to close said passageway and being urged into seated position by hydraulic fluid admitted through said first conduit, pressure responsive means for unseating said valve member to permit hydraulic fluid on said one side of the piston to be exhausted through said outlet, and means automatically operable in response to movement of said piston to said first extreme position for admitting said hydraulic fluid from the cylinder on said one side of the piston to said pressure responsive means, said pressure responsive means having a greater pressure responsive area than across said valve seat so that it is moved to valve member unseating position in response to admission of said hydraulic fluid.

5. In a system of the character defined in claim 4, means continuously venting the other side of the motor piston, said last-mentioned means and said passageway outlet being subject to a pressure which is substantially less than that of the hydraulic fluid.

6. In a system of the character defined in claim 4, spring means responsive to unseating of the valve member for holding said valve member unseated.

7. In an hydraulic pumping system, a motor cylinder and a piston reciprocable therein, a first conduit connecting with the cylinder for admitting hydraulic fluid to one side of the piston for moving it in a working direction to a first extreme position, means for continuously venting the other side of the piston, a body having a passageway connecting with the first conduit, a valve seat in the passageway intermediate its connection with the first conduit and an outlet from the passageway and being urged into seated position by hydraulic fluid admitted through said first conduit, a valve member seatable upon the valve seat to close said passageway, pressure responsive means for unseating said valve member for exhausting hydraulic fluid from said one side of the piston to permit said piston to move in an opposite direction to a second extreme position, and means automatically operable, upon movement of said piston to said first extreme position, for admitting said hydraulic fluid from the cylinder on said one side of the piston to said pressure responsive means, and, upon movement of said piston to said second extreme position, for exhausting said hydraulic fluid from said pressure responsive means to the cylinder on said other side of the piston, said pressure responsive means having a greater pressure responsive area than across said valve seat so that it is moved to valve member unseating position in response to admission of said hydraulic fluid.

8. In a system of the character defined in claim 7, said automatically operable means including a pair of valve-controlled conduits connecting with the cylinder at spaced apart levels therein and having a common connection with the pressure responsive means.

9. In a system of the character defined in claim 7, wherein said pressure responsive means includes a cylinder and a piston movable therein, and a stem on the piston adapted to engage and disengage from said valve member upon reciprocation of the piston.

10. In an hydraulic pumping system, a motor comprising a cylinder and a piston reciprocable therein, means for admitting hydraulic fluid to one side of the piston for moving it in a working direction to a first extreme position, means for continuously venting the other side of the piston, means including a reversing valve movable to an open position for exhausting said hydraulic fluid from said one piston side to permit its movement in an opposite direction to a second extreme position, pressure responsive means movable, upon the

admission of hydraulic fluid thereto, in a direction to open the valve and, upon the exhaustion of hydraulic fluid therefrom, in a direction to permit closing of the valve, conduit means connecting the cylinder at spaced apart levels therein with the pressure responsive means, valve means in said conduit means automatically operable, in the first extreme position of the piston, to admit said hydraulic fluid from said cylinder on said one side of the piston and through one of said connections to the pressure responsive means and, in the second extreme position of the piston, to exhaust said hydraulic fluid from said pressure responsive means and through said other connection into the cylinder on said other side of the piston, said valve means being operable during movement of the piston between its first and its second extreme positions to prevent communication through said conduit means between said pressure responsive means and said one side of the piston, and means responsive to movement of the pressure responsive means in a direction to open the valve for maintaining said valve in its open position.

11. An hydraulic system of the character defined in claim 10, including means urging said pressure responsive means in a direction to permit closing of the valve during exhaustion of hydraulic fluid from said pressure responsive means.

12. An hydraulic system of the character defined in claim 10, wherein said last mentioned means comprises spring means carried by the pressure responsive means.

13. In an hydraulic pumping system, a motor cylinder and a piston reciprocable therein, a conduit for admitting hydraulic fluid to one side of the piston for moving it in a working direction to a first extreme position, means for continuously venting the other side of the piston, a valve body having a passageway therein connecting with the conduit and an outlet therefrom, a valve seat across the passageway intermediate its connection with the conduit and the outlet, a valve member seatable upon the seat to close the passageway, pressure responsive means movable, upon the admission of hydraulic fluid thereto, to unseat said valve member and thereby permit hydraulic fluid on said one side of the piston to be exhausted through said outlet and, upon the exhaustion of hydraulic fluid therefrom, to permit seating of the valve member, valve means automatically responsive to movement of the piston into said first extreme position to admit said hydraulic fluid from the cylinder on said one side of the piston to said pressure responsive means and, responsive to movement of the piston from said first toward said second extreme position, to prevent communication between the cylinder and said pressure responsive means, and means responsive to movement of the pressure responsive means during at least the initial portion of such prevention of communication to maintain said valve member unseated.

14. In an hydraulic pumping system, a motor cylinder and a piston reciprocable therein, a first conduit connecting with the cylinder for admitting hydraulic fluid to one side of the piston for moving it in a working direction to a first extreme position, a body having a passageway connecting with the first conduit, a valve seat in the passageway intermediate its connection with the first conduit and an outlet from the passageway, a valve member seatable upon said valve seat to close said passageway and being urged into seated position by hydraulic fluid admitted through said first conduit, pressure responsive means for unseating said valve member to permit hydraulic fluid on said one side of the piston to be exhausted through said outlet, and means automatically operable in response to movement of said piston to said first extreme position for admitting said hydraulic fluid from the cylinder on said one side of the piston to said pressure responsive means, said pressure responsive means having a greater pressure responsive area than across said valve seat so that it is moved to valve member un-

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seating position in response to admission of said hydraulic fluid, and means responsive to movement of the pressure responsive means in unseating said valve member to maintain said valve member unseated.

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