Nov. 4, 1941. N. W. BUCKNER 2,261,752

FLUID PRESSURE MOTOR

Filed Jan. 24, 1940 4 Sheets-Sheet 1

Fig. 1.

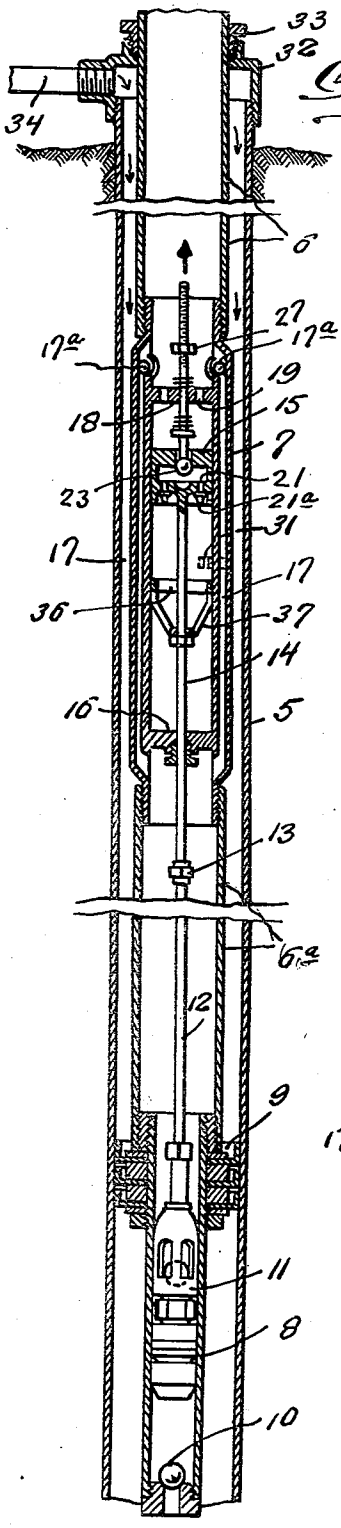


Fig. 4.

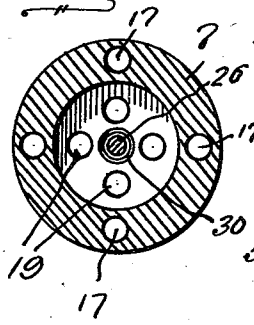


Fig. 5.

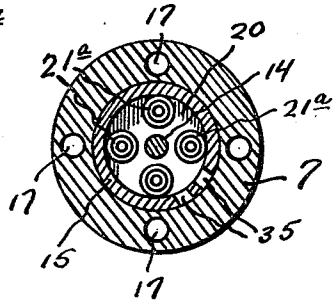
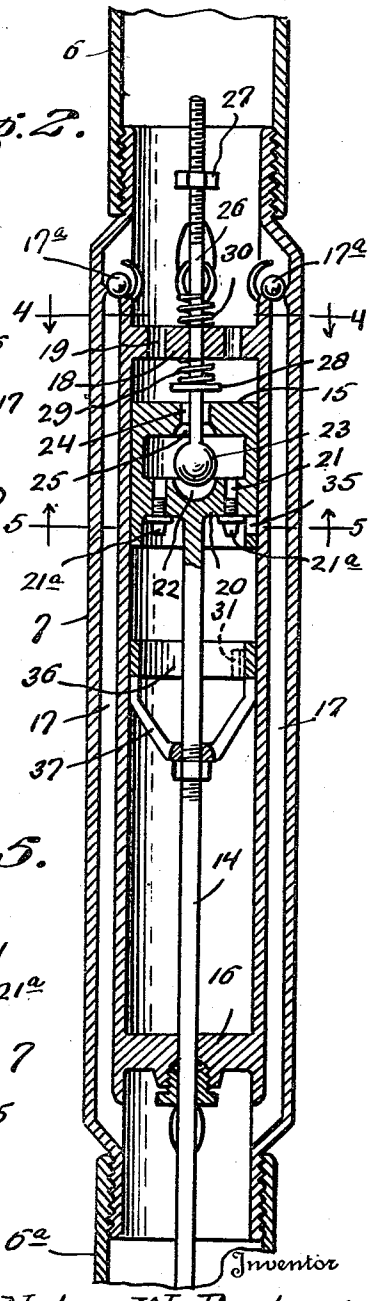


Fig. 2.



Inventor

Nolan W. Buckner,

By J. Stanley Burch

Attorney

Nov. 4, 1941. N. W. BUCKNER 2,261,752

FLUID PRESSURE MOTOR

Filed Jan. 24, 1940 4 Sheets-Sheet 2

Fig. 3.

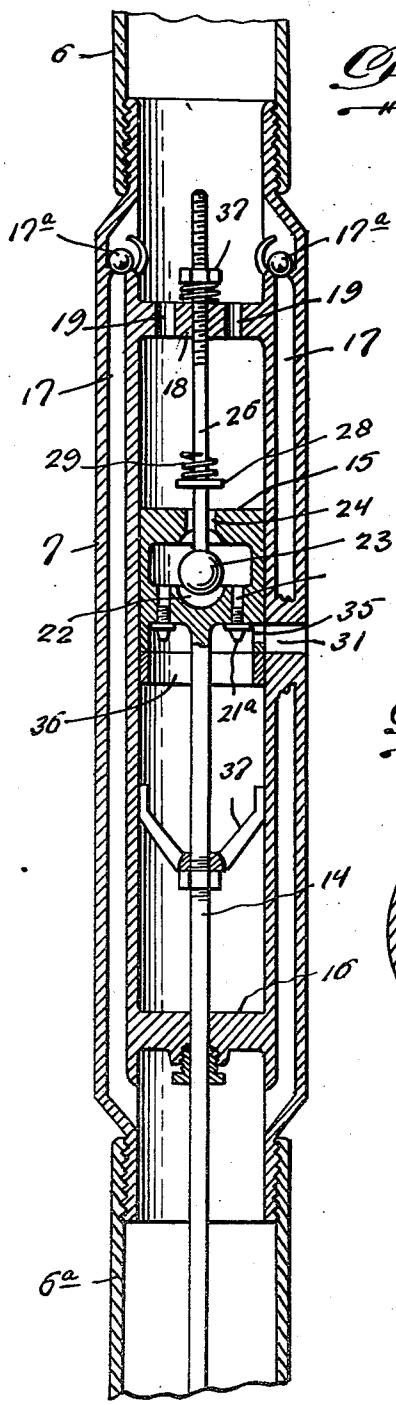


Fig. 6.

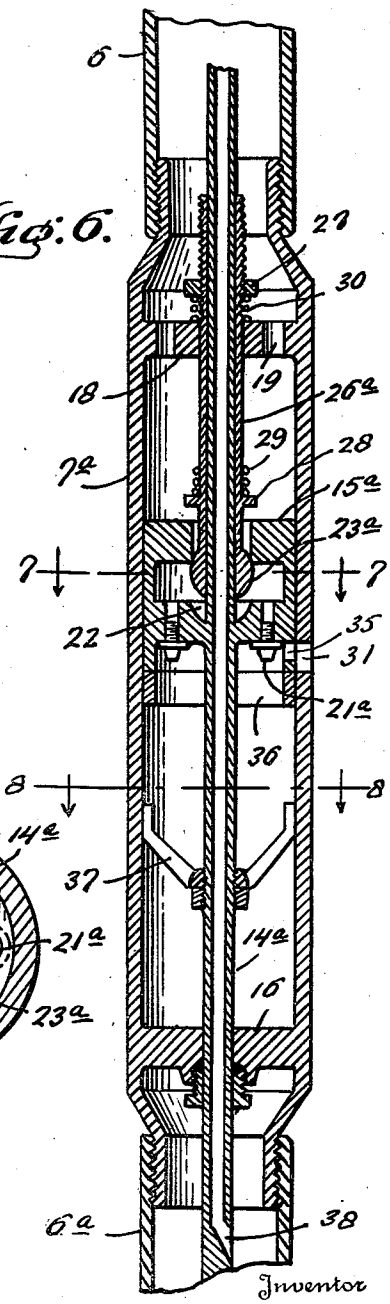
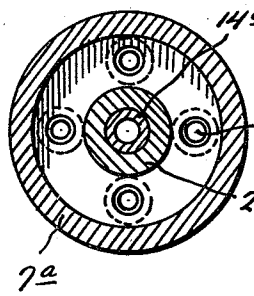


Fig. 7.



Inventor

Nolan W. Buckner,

By J. Stanley Buck Attorney

Nov. 4, 1941. N. W. BUCKNER 2,261,752

FLUID PRESSURE MOTOR

Filed Jan. 24, 1940 4 Sheets-Sheet 3

Fig. 9

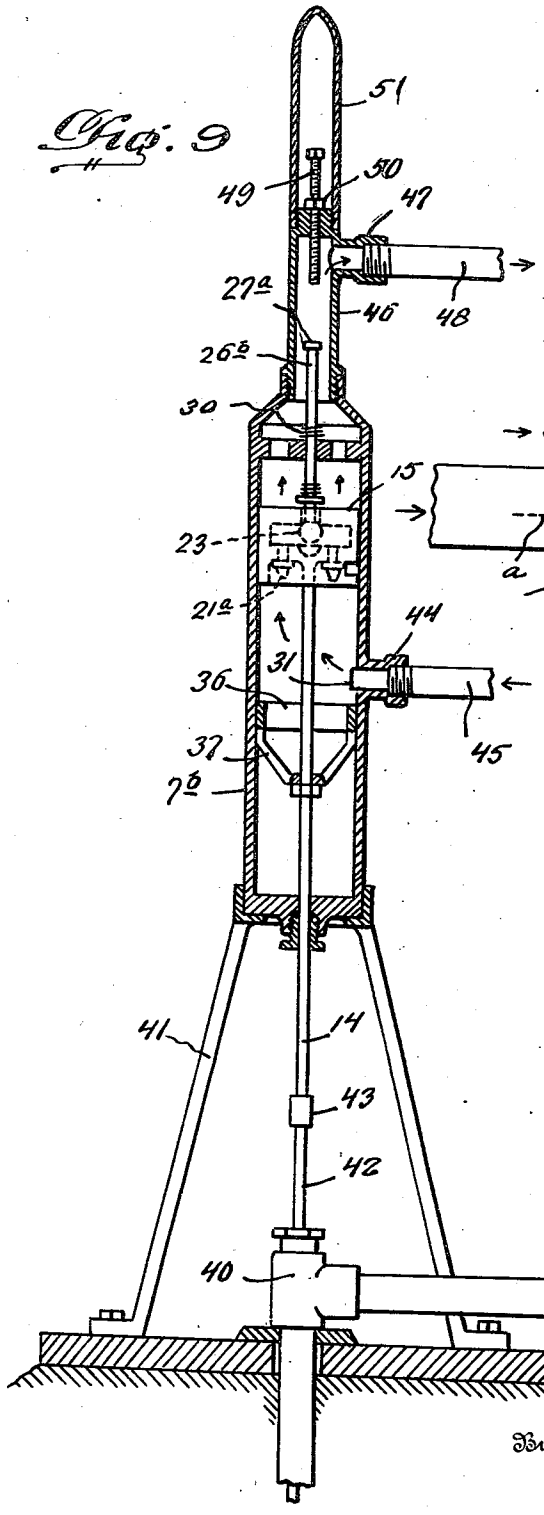


Fig. 10.

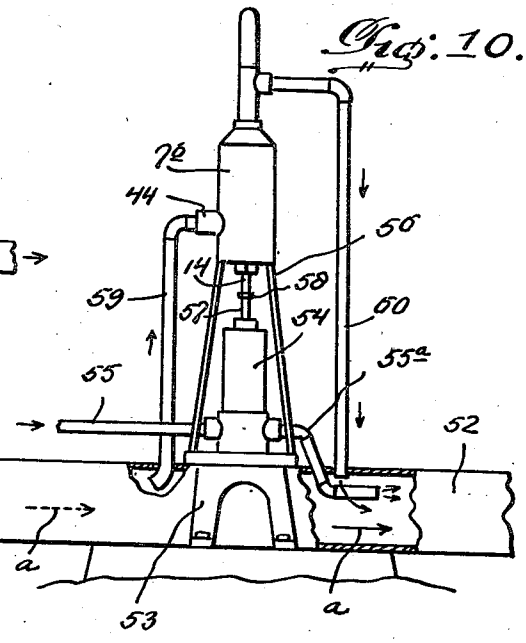
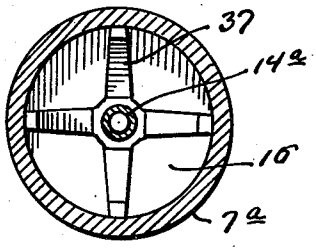


Fig. 8.



Inventor
Nolan W. Buckner;

By J. Stanley Burch
Attorney

Nov. 4, 1941. N. W. BUCKNER 2,261,752

FLUID PRESSURE MOTOR

Filed Jan. 24, 1940 4 Sheets-Sheet 4

Fig. 11.

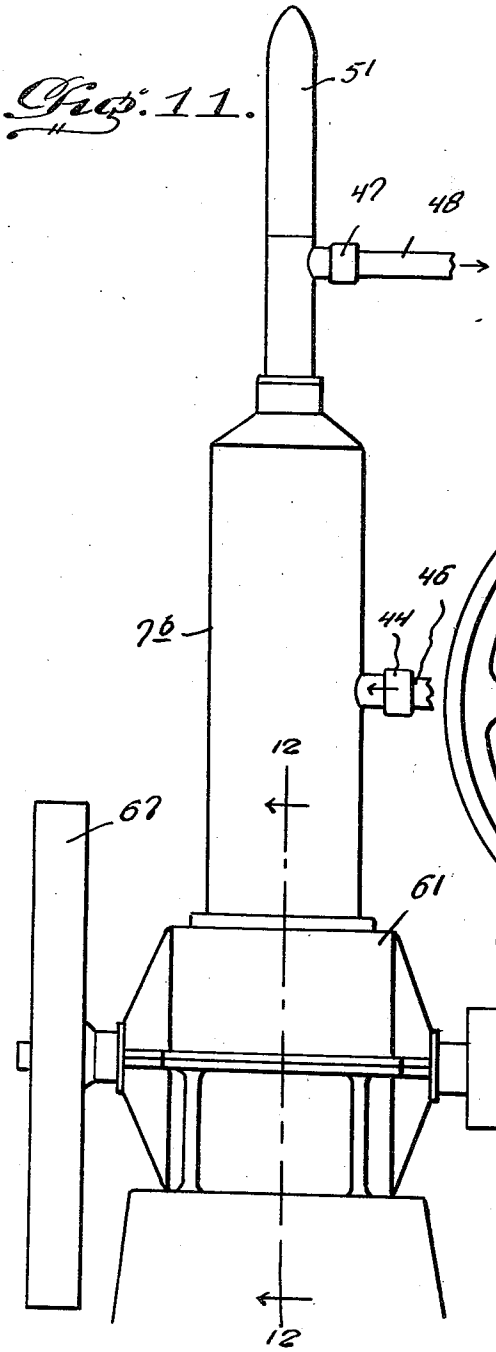
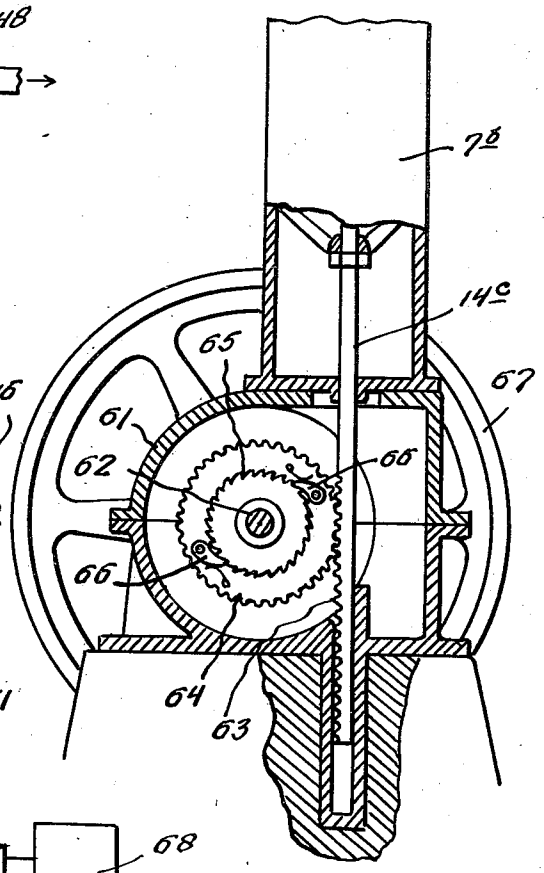


Fig. 12.



Inventor

Nolan W. Buckner,

By J. Stanley Burch

Attorney

Patented Nov. 4, 1941

2,261,752

UNITED STATES PATENT OFFICE

2,261,752

FLUID PRESSURE MOTOR

Nolan W. Buckner, Coalinga, Calif.

Application January 24, 1940, Serial No. 315,422

4 Claims. (Cl. 121—123)

This invention relates to improvements in motors adapted to be actuated by fluid under pressure.

An object of the present invention is to provide an improved fluid pressure motor of the reciprocating piston type, especially suitable for pump actuation, but capable of general or other specific uses.

With the above object in view, the present invention consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawings and claimed.

In the drawings:

Figure 1 is a fragmentary view, partly broken away, partly in central vertical section, and partly in elevation, illustrating a deep well pump provided with a fluid pressure motor embodying the present invention and operatively arranged within the well casing.

Figure 2 is an enlarged central longitudinal sectional view of the fluid pressure motor shown in Figure 1.

Figure 3 is a view similar to Figure 2 with the power piston of the motor at the end of its down stroke.

Figure 4 is a transverse section on line 4—4 of Figure 2.

Figure 5 is a similar view on line 5—5 of Figure 2.

Figure 6 is a view similar to Figure 3 illustrating a modified form of fluid pressure motor embodying the present invention.

Figure 7 is a horizontal section on line 7—7 of Figure 6.

Figure 8 is a section on line 8—8 of Figure 6.

Figure 9 is a vertical sectional view of a further form of motor embodying the present invention, installed above the surface for actuation of a well pump.

Figure 10 is a somewhat diagrammatic view, partly in elevation and partly broken away and in section, illustrating use of the motor of Figure 9 for operating a pump used to inject a chemical into an oil pressure line.

Figure 11 is an elevational view of a modified form of the motor shown in Figure 9, adapted for general use in driving machinery; and

Figure 12 is a fragmentary vertical section on line 12—12 of Figure 11.

Referring in detail to Figures 1 to 5 inclusive of the drawings, 5 indicates a casing which extends downwardly from the surface of the well to the oil strata. Mounted concentrically within the casing 5 is tubing 6 which extends downwardly in the casing 5 to a point near the oil or water level in the bottom of the well. Secured to the lower end of tubing 6 is the upper end of a power cylinder 7 of the fluid pressure motor forming part of the present invention. Additional tubing 6a is attached to the lower end of power cylinder 7 and connected to the upper end of a pump cylinder 8, and arranged below the power cylinder 7 is a packing assembly 9 which is packed outwardly against the inner surface of the casing 5 to close the oil passage, formed within the casing 5 on the outside of the cylinders 7 and 8 and tubing 6 and 6a, above the packing 9. The pump cylinder 8 extends below the packing 9 into the fluid to be elevated from within the well, and is provided at the bottom with the usual stand valve 10. The usual piston or plunger 11 is provided in the pump cylinder 8. The plunger or piston 11 has an upwardly extending piston rod 12 which is connected at 13 with the lower end of a piston rod 14 extending downwardly from a power piston 15 arranged for reciprocation in the power cylinder 7.

As shown more clearly in Figures 2 and 3, the power cylinder 7 is provided near its lower end with a wall 16 forming a guide for the piston rod 14 and through which the latter slidably extends. The wall of power cylinder 7 is formed with passages 17 which have check valves 17a at their upper ends and communicate at their lower ends with tubing 6a below wall 16, and which communicate at their upper ends with tubing 6 above wall 18. The power cylinder 7 is also provided near the top with another similar wall 18 having perforations or openings 19 which permit passage of actuating fluid and the fluid being pumped upwardly from the power cylinder 7 into the tubing 6 for discharge from the well. The power piston 15 is provided below its head with a wall 20 to which the rod 14 is connected and which is provided with perforations or openings 21 equipped with flow-control nozzles 21a. The wall 20 is formed at the top with a central recess 22 adapted to form a protecting seat for a valve head 23 as will later become apparent. The head of power piston 15 is also provided with a central opening 24 cooperating with the openings 21 in wall 20 to afford a passage through the piston. The underside of the head of power piston 15 is provided with a valve seat 25 for the valve head 23 in surrounding relation to the opening 24, and extending upwardly from valve head 23 is a stem 26 that freely extends through the

central opening 24 in the head of piston 15 and slidably extends through a central opening in the wall 18 of power cylinder 7. Adjustably threaded on the upper end of stem 26 is a stroke-adjustment nut 27, and provided on the stem 26 below the wall 18 and above the valve head 23 is a valve trip stop 28. A relatively short helical compression spring 29 is loosely arranged on the stem 26 above the valve trip stop 28 and beneath the wall 18, while a similar spring 30 is arranged on said stem 26 above the wall 18 and below the stroke-adjustment nut 27. The arrangement is such that the stem 26 has a limited sliding movement through the springs 29 and 30 before the latter are respectively engaged by the stroke-adjustment nut 27 and valve trip stop 28, for a purpose which will presently become apparent. Provided in the side of power cylinder 7 is an inlet opening 31 for actuating fluid, and such actuating fluid is adapted to be suitably pumped under pressure from the surface into the space between the well casing 5 and the tubing 6 and power cylinder 7. For this purpose, the casing 5 may have a head 32 at its upper end provided with a suitable packing gland 33 through which the tubing 6 extends, said head 32 being provided with a side opening for connection with a pipe 34 extending from a suitable source of fluid under pressure. The skirt of power piston 15 is preferably of a length to have its lower end portion slide across the inlet opening 31 at the end of the downstroke of piston 15, and this lower portion of the skirt of power piston 15 has an opening 35 adapted to register with the inlet opening 31 to permit entrance of actuating fluid into the power cylinder 7 and within the piston 15 at the end of such down stroke. Also, the arrangement is such that when the power piston 15 reaches its downward limit of movement, the stroke-adjustment nut 27 has engaged spring 30 and compressed the latter slightly so as to stop further downward travel of stem 26 and cause engagement of valve head 23 with its seat 25 in the head of piston 15 as shown in Figure 3. On the other hand, near the end of the up-stroke of power piston 15, valve trip stop 28 will have engaged and compressed spring 29 to prevent further upward movement of stem 26 and cause unseating of valve head 23 from its seat 25.

In operation, the stroke-adjustment nut 27 strikes the bumper spring 30 at the end of the down stroke of the piston 15, and the valve 23 in the piston closes. The pressure of the actuating fluid then forces the valve 23 and piston 15 upwardly until the valve trip 28 causes spring 29 to strike the wall 18 of the cylinder 7 and stop upward travel of the valve 23. The piston still continues to rise so that the valve 23 is unseated and then drops into the valve protecting seat 22. A free passage is thus caused through the entire piston, and all moving parts then travel downward with the actuating fluid passing upwardly through the piston until the stroke-adjustment nut 27 strikes the bumper spring 30 again, closing the valve 23 for a repetition of the cycle of operation. Obviously, reciprocation of power piston 15 in this way causes corresponding reciprocation of pump plunger or piston 11 so as to cause the fluid in the well to be pumped upwardly through the tubing 6a, passages 17 in the walls of power cylinder 7 and tubing 6 to the surface, such well fluid passing through the tubing 6 with the actuating fluid.

In order to secure better operation of the fluid pressure motor, the inlet port 31 of power cylinder 7 is preferably valve-controlled so that it is closed when the power piston 15 reaches its limit of upward movement and while said power piston undergoes its down stroke. For this purpose, a valve band or ring 36 is frictionally fitted in the cylinder 7 below the piston 15 so that it will remain in any position to which it is slid longitudinally of said cylinder 7 unless forcibly moved. A suitable actuating element 37 is rigidly carried by the piston rod 14 below the valve band 36, and this actuating element is arranged to engage band 36 on the upstroke of piston 15 and shift said valve band upwardly to the position of Figure 2 wherein said valve band 36 overlies and completely closes the inlet port 31. For most of the down stroke of piston 15, the valve band 36 will remain in place to keep the inlet port 31 closed, the actuating element 37 lowering away from valve band 36 with piston rod 14. As the piston 15 approaches its lower limit of movement, the skirt of said piston engages the valve band 36 and shifts the same downwardly so as to uncover the port 31 as shown in Figure 3. The use of valve band 36 for controlling inlet port 31 is optional, and it serves to close the inlet port 31 on the upstroke of the piston 15 and to keep it closed during most of the down stroke thereof. However, elimination of valve band 36 and continuous flow of the actuating fluid through the piston on the down stroke of the latter will not materially affect the operation if such fluid is freely vented through the piston at that time by openings 21 and 24. The length of the stroke of piston 15 can be set by adjusting the stroke-adjustment nut 27, the length of the stroke being equal to the distance between the stroke-adjustment nut 27 and the valve trip stop 28.

The modified form of the fluid pressure motor shown in Figures 6 and 7 is identical in all general respects to that shown in Figures 1 to 5 inclusive, but said form of Figures 6 and 7 embodies a piston rod 14a which is hollow and extends through and well above the piston 15a, the bore of rod 14a opening through one side of the latter below the cylinder 7 as at 38. This permits the pumped liquid or oil to pass from the tubing 6a into and through the rod 14a so that it is discharged into the tubing 6 above the power cylinder 7a before mixing with the actuating fluid admitted to cylinder 7a for operation of power piston 15a. Accordingly, the walls of cylinder 7a need have no passages like those at 17 in Figure 2, but the stem 26a and valve head 23a are hollow so that the rod 14a slidably extends therethrough. Otherwise, the construction of Figures 6 and 7 is similar to that of Figures 1 to 5 inclusive, and remaining like parts of both forms are indicated by similar reference characters.

When using the present fluid pressure motor for sub-surface power for deep well pumps, all rods can be eliminated from the surface to the point where the power piston is located. It will be seen that I have provided a very simple and compact construction which will be durable and efficient in operation, and minor changes in the exact details of construction illustrated and described are contemplated within the spirit and scope of the invention as claimed.

In Figure 9, I have shown a further modified form of the present motor installed above the surface for actuation of a well pump 40. The power or motor cylinder 7b is mounted upon a suitable support 41 disposed directly over the pump 40, and the piston rod 14 of the motor is

coupled at its lower end to the upper end of the pump piston 42 as at 43. In this embodiment, the power cylinder 7b is provided with means 44 to facilitate connection of a pressure fluid supply pipe 45 therewith directly in communication with the inlet port 31 of the motor. The upper end of the power cylinder 7b is closed by means of a hollow vertically elongated cap 46 having a lateral outlet 47 for the motive fluid connected with a discharge pipe 48. Also, in this embodiment, the valve stem 26b has a fixed head 27a on the upper end thereof instead of being threaded and provided with an adjustable stroke-adjustment nut as in the previously described forms. In this embodiment, the stroke adjustment is effected by means of a vertically adjustable screw 49 threaded through the top of the cap 46 and having its lower end arranged in the path of the stem 26b. Obviously, by vertically adjusting the screw 49, the upward travel of stem 26b can be properly limited so as to govern the particular time in the upward movement of the piston 15 when the valve 23 will be unseated. The head 27a engages and compresses the spring 30 in the same way as this is accomplished by the nut 27 in the form of Figures 1 and 2, to effect seating of the valve 23 at the proper time when the piston completes its downward stroke. In this way, a very great amount of stroke adjustment may be had, and a jamb nut 50 may be used to secure the screw 49 in adjusted position. A further protecting cap 51 may be threaded on the upper end of the cap 46 to enclose and protect the upper end of the adjusting screw 49. Otherwise, the construction of the motor is substantially the same as that shown in Figure 2 and remaining like parts are indicated by similar reference characters in Figures 2 and 9.

In Figure 10 I have illustrated the motor of Figure 9 installed for use in operating a pump employed to inject a chemical into an oil pressure line, as is practiced in the oil industry to break down the emulsion before the oil is suitable for refining purposes. In this installation, 52 is the oil line conveying the oil under pressure in the direction indicated by the arrows a. Mounted over the line 52 on a support 53 is the chemical injecting pump 54 having a supply line 55 for the chemical and a discharge line 55a, through which the chemical is forced into the oil line 52 in the direction of the oil flow, said discharge line 55a passing into the line 52 as illustrated. The present motor of the form shown in Figure 9 is illustrated as mounted upon the base 53 directly above the pump 54 by supporting means 56, the piston rod 14 of the motor being coupled to the piston rod 57 of the pump 54 as at 58. It will of course be understood that the motor, in installations of the kind illustrated in Figures 9 and 10, will not require either the passages 17 of the form shown in Figure 2 or the hollow rod 14a as in Figure 6. The pressure fluid may consist of the oil under pressure in the line 52, the same being conducted from said line by means of a pipe 59 entering the line 52 at one end and communicating with the inlet 31 of the pump the same as pipe 45 in Figure 9. The discharge line 60, which is similar to the discharge line 48 of Figure 9 extends into the oil line 52 down stream with respect to the supply line or pipe 59. Thus, the oil under pressure and flowing through the oil line is used as the motor fluid for the motor which operates the pump arranged to discharge or inject a chemical into the oil in said oil line, as stated.

The present motor is also adaptable for general use in driving machinery and the like, in which case the power cylinder 7b may be mounted upon a hollow base 61 as shown in Figures 11 and 12, the piston rod 14c of the motor being operatively connected with a driven shaft 62 horizontally arranged to extend through the base 61 and journaled in opposite sides of the latter. The operative connection may be of any desired kind, although the form shown is preferable as it readily permits adjustment of the piston stroke of the motor as contemplated and by means of the adjustment means illustrated in Figure 9. This operative connection consists in providing the lower end of the rod 14c with rack teeth 63 meshing with a gear 64 rotatably fitted on drive shaft 62 and provided with ratchet means whereby the gear 64 may cause turning of shaft 62 when said gear is turned in one direction and to permit the gear 64 to idle or turn relative to shaft 62 when said gear 64 is rotated in the opposite direction. Such ratchet means may consist of a ratchet wheel 65 keyed on shaft 62 and engaged by similarly facing spring-pressed pawls 66 pivoted on one side of the gear 64. In this way, as the piston of the motor is reciprocated, intermittent rotation of gear 64 is caused in one direction so as to drive the shaft 62, the gear 64 being idly turned backwardly or in the opposite direction. In other words, upon the upward or power stroke of rod 14c, the gear 64 will be turned and will cause rotation of shaft 62, while on the return or down-stroke of the piston rod 14c, the gear 64 will be turned freely backwardly relative to the shaft 62 without interfering with the continued rotation of said shaft 62 in the first-mentioned direction. In a drive of this kind it is desirable to provide the shaft 62 on one projecting end thereof with a fly wheel 67, and power may be transmitted from the motor to any desired machinery or apparatus in any suitable way, such as by a transmission belt passing around a pulley 68 keyed on the opposite projecting end of shaft 62. Otherwise, the construction of the motor in Figures 11 and 12 is identical with that of Figure 9, and remaining similar parts are indicated by like reference characters in both of these views.

What I claim as new is:

1. In a device of the class described, a fluid pressure motor including a cylinder open at its upper end for the outlet of pressure fluid, a piston having a passage therethrough and operatively mounted in said cylinder, the cylinder having a pressure-fluid inlet below the piston, means including a valve carried by the piston for automatically closing the passage therethrough when said piston approaches its lower limit of movement and for automatically opening said passage when said piston approaches its upward limit of movement, said last-named means including an apertured wall in said cylinder, a stem carried by said valve and slidably projecting upwardly through said wall, stop members carried by said stem in spaced relation to and above and below said wall, and relatively short springs arranged on said stem at opposite sides of said wall.

2. In a device of the class described, a fluid pressure motor including a cylinder open at its upper end for the outlet of pressure fluid, a piston having a passage therethrough and operatively mounted in said cylinder, the cylinder having a pressure-fluid inlet below the piston, means including a valve carried by the piston for automatically closing the passage there-

through when said piston approaches its lower limit of movement and for automatically opening said passage when said piston approaches its upward limit of movement, said last-named means including an apertured wall in said cylinder, a stem carried by said valve and slidably projecting upwardly through said wall, stop members carried by said stem in spaced relation to and above and below said wall, and relatively short springs arranged on said stem at opposite sides of said wall, said piston having an apertured wall below the head thereof provided in its upper side with a valve protecting seat arranged to receive said valve when unseated.

3. In a device of the class described, a fluid pressure motor including a cylinder open at its upper end for the outlet of pressure fluid, a piston having a passage therethrough and operatively mounted in said cylinder, the cylinder having a pressure-fluid inlet below the piston, and means including a valve carried by the piston for automatically closing the passage therethrough when said piston approaches its lower limit of movement and for automatically opening said passage when said piston approaches its upward limit of movement, said piston having a skirt provided at its lower portion with an opening adapted to register with the pressure fluid inlet of the cylinder when said piston reaches its lower limit of movement.

4. In a device of the class described, a fluid pressure motor including a cylinder open at its upper end for the outlet of pressure fluid, a piston having a passage therethrough and operatively mounted in said cylinder, the cylinder having a pressure-fluid inlet below the piston, means including a valve carried by the piston for automatically closing the passage therethrough when said piston approaches its lower limit of movement and for automatically opening said passage when said piston approaches its upward limit of movement, a valve band frictionally fitted in said cylinder below the piston and arranged to open and close said pressure-fluid inlet, said valve band being movable to open position by said piston when the latter approaches its lower limit of movement, a rod carried by and depending from said piston, and an actuating element carried by and movable with said rod for moving said valve band to closed position when said piston approaches its upward limit of movement.

NOLAN W. BUCKNER.