Oct. 31, 1950 G. A. CHERRY ET AL 2,527,915

FLUID MOTOR FOR DEEP WELL PUMPS

Filed June 12, 1947 2 Sheets-Sheet 1

FIG. 1

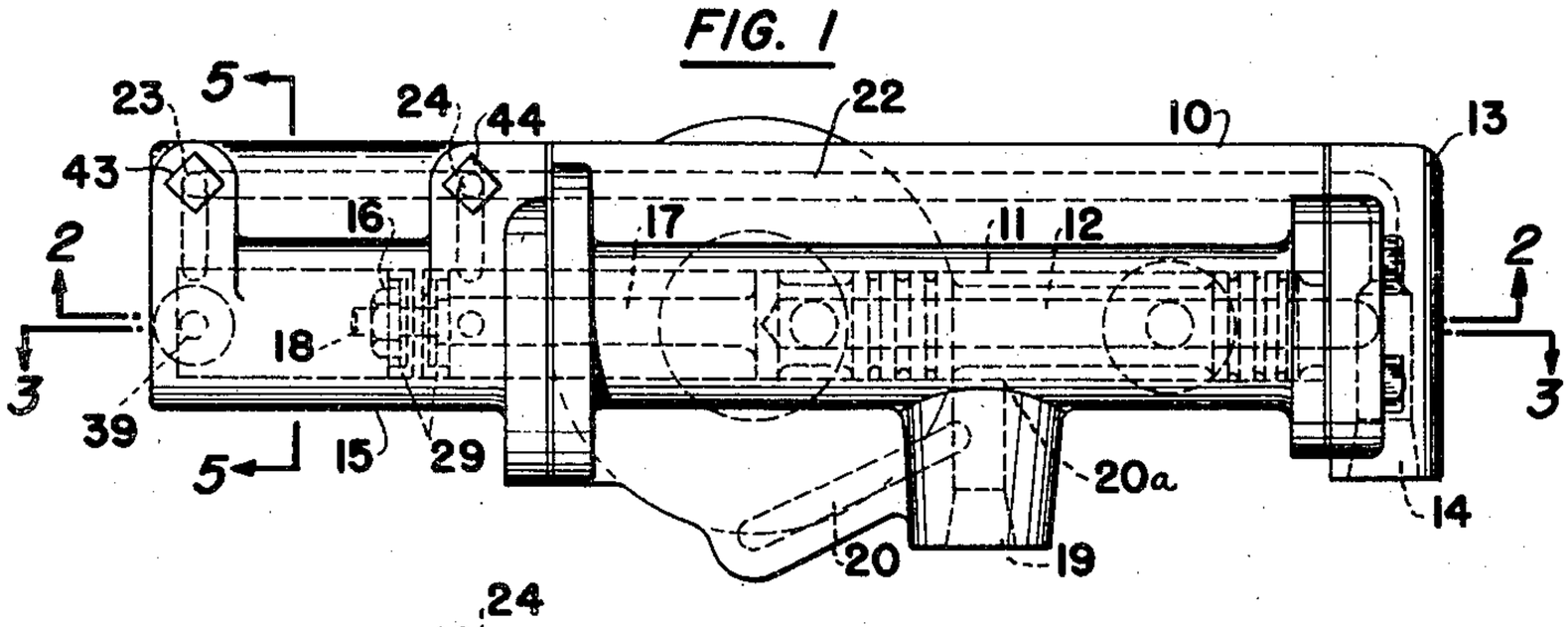
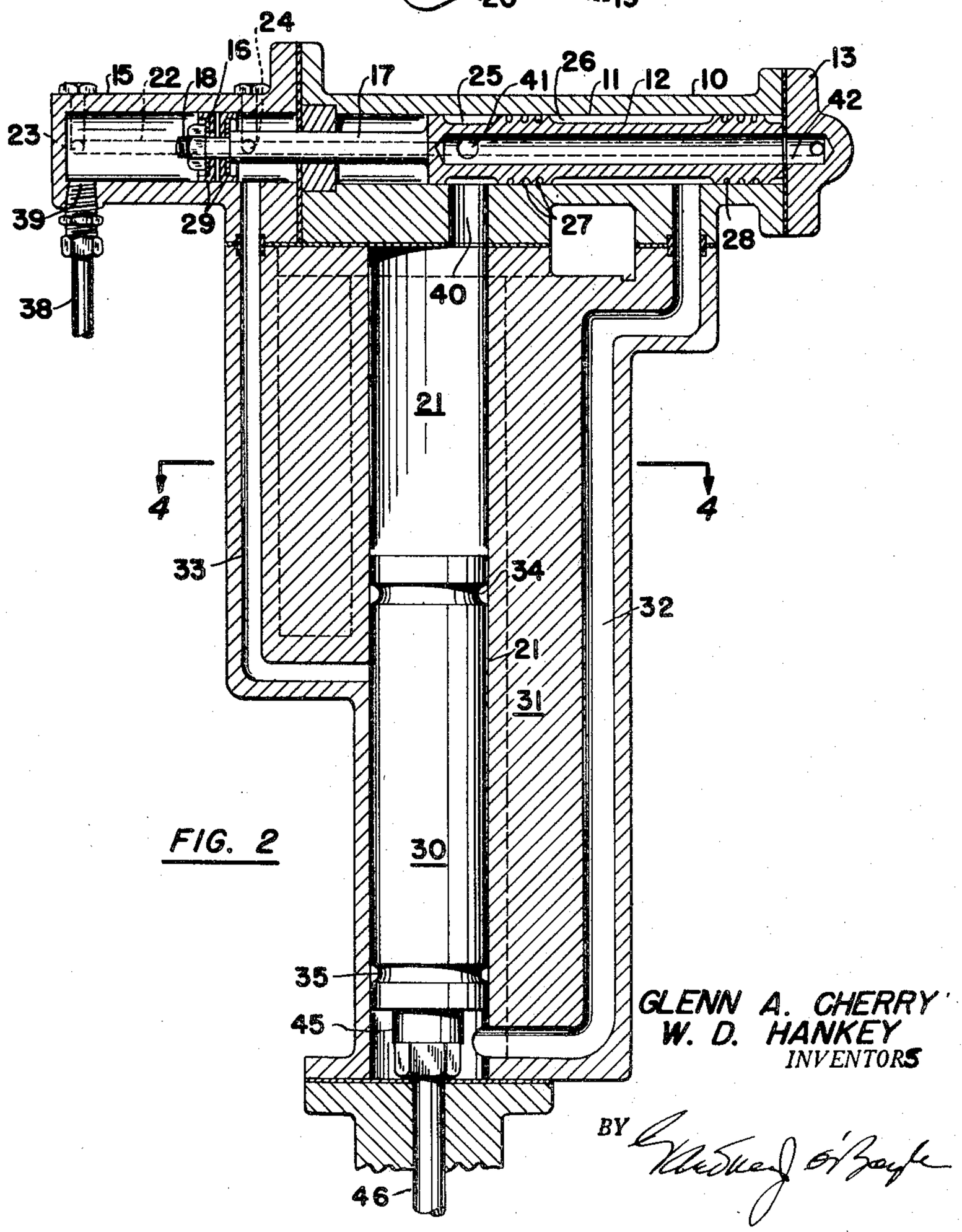


FIG. 2



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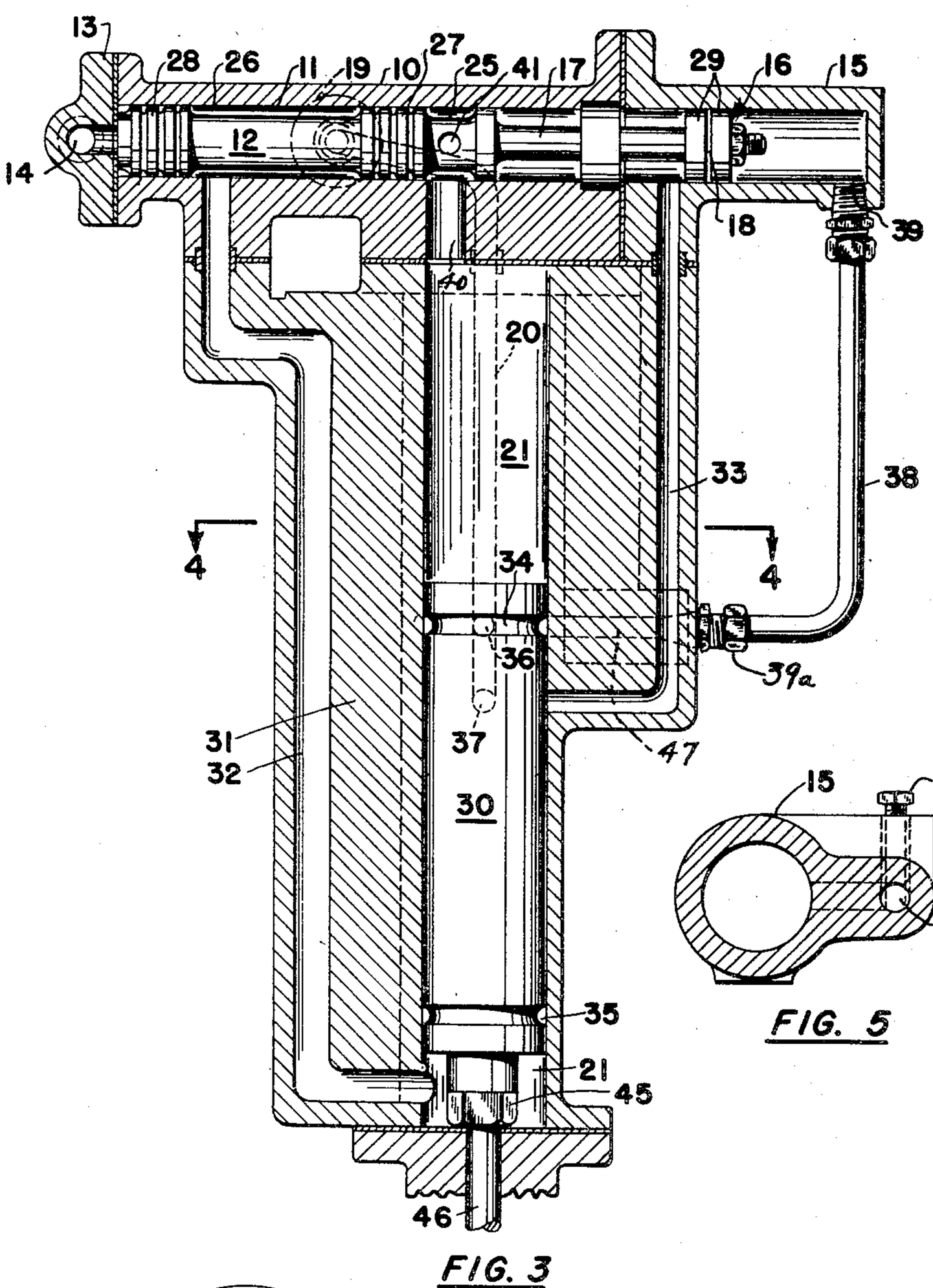

FIG. 3

FIG. 5

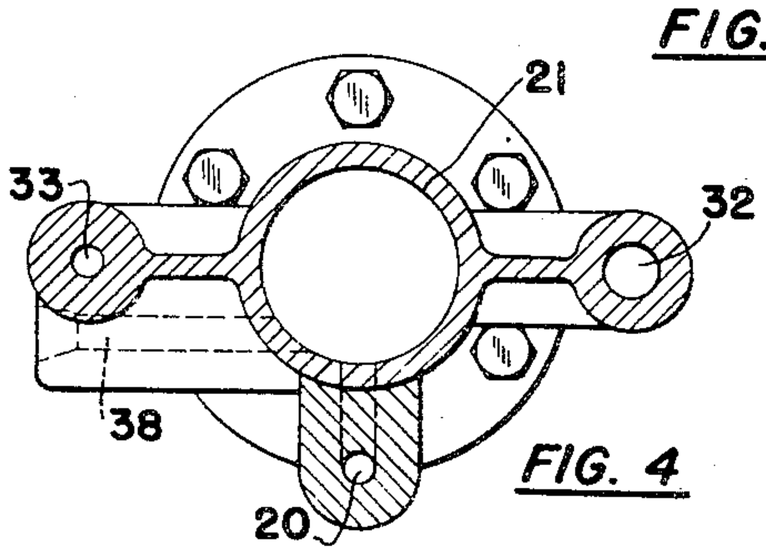

FIG. 4

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FLUID MOTOR FOR DEEP WELL PUMPS

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Application June 12, 1947, Serial No. 754,294

4 Claims. (Cl. 121—150)

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This invention relates to fluid motors of the reciprocating piston type and, more particularly, to a fluid motor combined and cooperating with a fluid driven control valve.

Heretofore, fluid motors have been widely used for the operation of well pumps. Generally, the action of the pistons in such fluid motors has been in one direction, upward; gravity and the weight of the piston and its connecting rods have been relied upon to reposition the piston for each stroke. In addition, fluid motors have been exceedingly complex in construction and, therefore, costly to maintain.

One of the objects of the present invention is to provide a fluid motor of the reciprocating piston type combined with a fluid operated control valve, the fluid motor having a piston which is positively acted upon and driven alternately in each direction.

Another object is to provide a fluid motor of the reciprocating piston type combined with a fluid operated control valve of simple and in expensive construction.

A further object is to provide a fluid motor of the type described, efficient in operation and of relatively few working parts.

With these and other objects in view, which may be incident to our improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements, comprising our invention may be varied in construction, proportions and arrangements, without departing from the spirit and scope of the appended claims.

In order to make our invention more clearly understood, we have shown in the accompanying drawing means for carrying the same into practical effect, without limiting the improvements in their useful applications to the particular constructions, which for the purpose of explanation, have been made the subject of illustration.

In the drawings:

Figure 1 is a plan view of the fluid motor and its control valve;

Fig. 2 is a sectional view along line 2—2 of Fig. 1;

Fig. 3 is a sectional view along line 3—3 of Fig. 1;

Fig. 4 is a sectional view along line 4—4 of Figs. 2 and 3; and

Fig. 5 is a sectional view along line 5—5 of Fig. 1.

Referring to the drawings, and more particularly to Fig. 1, there is shown a valve chamber

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housing 10, having a valve chamber 11, within which a hollow control valve 12 reciprocates. The valve chamber housing 10 has at one end a block 13 containing an outlet port 14, hereinafter described in detail, and at the other end a housing member 15 for a driving piston, designated generally by numeral 16, attached to the valve 12. Valve driving piston 16 is attached at 18 to control valve 12 by means of a connecting rod 17. The main inlet port 19 enters the valve chamber housing 10 at 20*a*; branching from this inlet port 19, prior to its entrance to the valve chamber 11, is a passage 20, connected to the main piston chamber 21 as shown in Figs. 1 and 3. Parallel to the valve chamber 11 is an outlet passage 22, connected at one end to outlet port 14, the opposite end portion of the passage being connected to ports 23 and 24, which open into the chamber of the valve driving piston 16.

Referring to Fig. 2, the valve chamber housing 10, the reciprocating control valve 12, and the housing 15 which contains the valve piston 16 to drive the control valve 12 are shown in greater detail. It will be noted that the control valve 12 has cut-out portions 25 and 26, and that the circumferentially notched portions 27 and 28 are in sliding contact with the walls of valve chamber. It will also be noted that the valve piston head 16 comprises opposed cup-shaped resilient discs 29 attached to the valve connecting rod 17 at 18 by any suitable means, the discs being constructed and arranged so that they are urged outwardly into contact with the inner walls of the housing 15.

The main piston 30 (Figs. 2 and 3) reciprocates within the main piston chamber 21. The housing 31 which contains the piston chamber and piston is provided with passages 20, 32, and 33; passage 20 leads from points midway the length of the piston chamber 21 to main inlet port 19 (Fig. 1); passage 32 connects the valve chamber 11 to the piston chamber 21 at a point below the piston 30; passage 33 connects the valve piston chamber 15 to the main piston chamber 21 at a point in the same horizontal plane with the lower port of entry of passage 20. The main piston 30 is provided with circumferential grooves 34 and 35, the grooves being positioned in such manner that they are adapted to coact with passages between the main piston chamber and the valve control unit.

Referring to Fig. 3, which is the reverse of Fig. 2, inlet port 19 and passage 20 are shown by dotted lines. Passage 20, as explained above, connects points midway the length of the main piston

chamber 21 to the inlet port 19; this passage is provided with two inlet ports 36 and 37, arranged in spaced vertical relationship, port 36 being adapted to register with groove 34 when the piston 30 is in the lowermost position of its stroke and port 37 being adapted to register with groove 35 when the piston 30 is at the peak of its stroke.

The valve piston housing 15 is connected to the main piston chamber 21 by means of a tube 38, provided with suitable fittings 39 and 39a. It will be noted that tube 38 is connected to the main piston chamber at a point in the plane of the inlet 36 (Fig. 3). Valve chamber 11 is also connected directly to piston chamber 21 by means of passage 40, adapted to coact with cut-out portions 25 and 26 of the control valve 12. The control valve 12 is formed with a passage 42 lengthwise thereof, said passage opening into the exhaust port 14, and into the cut-out portion 25 through an opening 41 (Fig. 2).

The disposition of the passages around the piston and valve chambers, respectively is shown in Figs. 4 and 5. It will be noted in Fig. 5 that an adjustable set screw 43 is provided whereby the outlet from the piston housing 15 may be restricted to passage 22. A similar set screw 44 is provided for outlet 24 (Fig. 1).

As will be seen in Figs. 2 and 3, the main piston 30 is suitably connected as at 45 to a pumping mechanism (not shown) by means of rod 46. It is readily apparent that when main piston 30 reciprocates within its chamber 21, rod 46 is positively driven alternately up and down.

The operation of the above-described fluid pump and its control valve is simple and effective. Hydraulic fluid, preferably oil, is forced into the pump under pressure by any conventional means, for example, an electric motor and an oil pump, not shown. With the control valve 12 in the position shown, in Figs. 2 and 3, fluid under pressure enters port 19 into the cut-out portion 26 of valve 12, through passage 32, and into the cavity beneath main piston 30 within piston chamber 21, forcing piston 30 upwardly until groove 35 in the piston registers with passage 33. Fluid entering port 19 also enters passage 20, which branches off from entry 19, and flows to inlet port 37 in the main piston chamber 21. When main piston 30 has been driven upwardly, the full extent of its stroke, groove 35 is aligned with inlet port 37 and passage 33. Fluid entering port 37 flows around groove 35 in piston 30, out through passage 33, and upwardly into the valve piston housing 15, where it acts upon the inner face of valve piston head 16. Under this pressure, control valve 12 is forced to a position opposite from that shown in Figs. 2 and 3. When the control valve 12 is forced to its new position, that is to say, when piston 16 has reached the outer limit of its travel in housing 15, fluid entering port 19, passes into cut-out portion 26 of the control valve 12 and into passage 40, which is directly connected to the cavity above the main piston 30 in the piston chamber 21, thus forcing the main piston downwardly. Upon downward movement of the main piston 30, the fluid therebelow, which was utilized to raise the piston, is forced out of the chamber 21, back through passage 32, into valve chamber 11 and out through 14 into a storage or supply tank, not shown. When the piston 30 reaches its full stroke downward, groove 34 registers with port 36 and passage 47 which leads to the tube 38. Fluid entering passage 20 now proceeds around groove 34, through tube 38, and into valve

piston housing 15, where it acts upon valve piston 16, forcing the control valve 12 to the position shown in Figs. 2 and 3.

Referring to Fig. 1, the fluid used to force valve piston 16 from its initial position as shown in Figs. 2 and 3, escapes through restricted port 24 into passage 22 and out through port 14, when the valve piston returns to its original position. It will be understood that fluid which has forced piston 16 to its initial position escapes through restricted port 23 into passage 22 and out through port 14, when the valve piston reverses. Fluid which has forced the main piston 30 downward must escape when the piston starts its upward stroke; this fluid, no longer under pressure as the piston starts upward, since pressure is now directed to the bottom of piston, escapes through passage 40, into cut-out portion 25 of control valve 12, through outlet 41, in the control valve, through passage 42, and out through port 14 to the oil supply tank.

It will thus be seen that main piston 30 is forced up and down by fluid pressure which is directed alternately to either end of said piston by the reciprocating action of control valve 12. When the piston is caused to reciprocate positively in this manner, it is apparent that rod 46 moves effectively up and down, which movement may be utilized to operate a well pump or any other mechanism. This pumping head is designed to operate directly over a well with the power unit located at any convenient place, preferably in a dry shelter, that affords protection to the power unit.

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not confine ourselves to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention or exceeding the scope of the appended claims.

We claim:

1. A fluid motor of the character described, comprising a piston chamber having a freely movable piston therein, a housing having a control valve chamber and a chamber for a piston to actuate a control valve, a control valve slidably mounted in said valve chamber and a piston slidably mounted in said piston chamber, a connecting rod between the piston and the valve whereby the valve and piston move as a unit, the chamber for the control valve actuating piston having a pair of fluid inlet ports and a pair of outlet ports, one inlet port and one outlet port of each pair being connected to opposite ends of the chamber, means to connect said fluid pressure inlet ports to the chamber of the freely movable piston at points intermediate the ends thereof, the control valve chamber having a fluid pressure inlet port, a pair of outlet ports and an exhaust port, means to connect said fluid pressure inlet port at points intermediate of the ends of the chamber of the freely movable piston, a pair of fluid passages connecting the outlet ports of the control valve chamber with opposite ends of said chamber of the freely movable piston, said passages serving as inlet and exhaust lines for fluid from the control valve chamber to the chamber of the freely movable piston and from said chamber to the exhaust port of the control valve chamber, means formed on the freely movable piston adapted to alternately coact with the fluid pressure inlet ports of its chamber and

the passages from said chamber to the valve piston chamber, whereby to introduce liquid under pressure at alternate ends of the chamber of the freely movable piston and reciprocate the piston therein.

2. A fluid motor of the character described, comprising a piston chamber having a freely movable piston therein, a housing positioned at 90° to the axis of the piston chamber, said housing have a control valve chamber and a chamber for a piston to actuate a control valve, a control valve slidably mounted in said valve chamber and a piston slidably mounted in said piston chamber, a connecting rod between the piston and the valve whereby the valve and piston move as a unit, the chamber for the control valve actuating piston having a pair of fluid inlet ports and a pair of outlet ports, one inlet port and one outlet port of each pair being connected to opposite ends of the chamber, means to connect said fluid pressure inlet ports to the chamber of the freely movable piston at points intermediate the ends thereof, the control valve chamber having a fluid pressure inlet port, a pair of outlet ports and an exhaust port, means to connect said fluid pressure inlet port at points intermediate of the ends of the chamber of the freely movable piston, a pair of fluid passages connecting the outlet ports of the control valve chamber with opposite ends of the chamber of the freely movable piston, said passages serving as inlet and exhaust lines for fluid from the control valve chamber to the chamber of the freely movable piston and from said chamber to the exhaust port of the control valve chamber, means formed on the freely movable piston comprising a circumferential groove in the vicinity of each end of the piston adapted to alternately coact with the fluid pressure inlet ports of its chamber and the passages from said chamber to the valve piston chamber, whereby to introduce liquid under pressure at alternate ends of the chamber of the freely movable piston and reciprocate the piston therein.

3. A fluid motor of the character described, comprising a piston chamber having a freely movable piston therein, a housing positioned at 90° to the axis of the piston chamber, said housing having a control valve chamber and a chamber for a piston to actuate a control valve, a control valve slidably mounted in said valve chamber and a piston slidably mounted in said piston chamber, a connecting rod between the piston and the valve whereby the valve and piston move as a unit, the chamber for the control valve actuating piston having a pair of fluid inlet ports and a pair of outlet ports, one inlet port and one outlet port of each pair being connected to opposite ends of the chamber, means to connect said fluid pressure inlet ports to the chamber of the freely movable piston at points intermediate the ends thereof, the control valve chamber having a fluid pressure inlet port, a pair of outlet ports and an exhaust port, a conduit connecting the fluid pressure inlet port to the chamber of the freely movable piston at vertically spaced points approximately midway of the length of the chamber, a pair of fluid passages connecting the outlet ports of the control valve chamber with opposite ends of the chamber of the freely movable piston, said passages serving as inlet and exhaust lines for fluid from the control valve chamber to the chamber of the freely movable piston and from said chamber to the exhaust port of the control valve chamber, means formed on the freely movable piston adapted to alternately coact with the fluid pressure inlet ports of its chamber and the passages from said chamber to the valve piston chamber, whereby to introduce liquid under pressure at alternate ends of the chamber of the freely movable piston and reciprocate the piston therein.

4. A fluid motor of the character described, comprising a piston chamber having a freely movable piston therein, a housing positioned at 90° to the axis of the piston chamber, said housing having a control valve chamber and a chamber for a piston to actuate a control valve, a control valve slidably mounted in said valve chamber and a piston slidably mounted in said piston chamber, a connecting rod between the piston and the valve whereby the valve and piston move as a unit, the chamber for the control valve actuating piston having a pair of fluid inlet ports and a pair of outlet ports, one inlet port and one outlet port of each pair being connected to opposite ends of the chamber, means to connect said fluid pressure inlet ports to the chamber of the freely movable piston at points intermediate the ends thereof, the control valve chamber having a fluid pressure inlet port, a pair of outlet ports and an exhaust port, a conduit connecting the fluid pressure inlet port to the chamber of the freely movable piston at vertically spaced points approximately midway of the length of the chamber, means to connect said fluid pressure inlet ports at points intermediate of the ends of said chamber, a pair of fluid passages connecting the outlet ports of the control valve chamber with opposite ends of the chamber of the freely movable piston, said passages serving as inlet and exhaust lines for fluid from the control valve chamber to the chamber of the freely movable piston and from said chamber to the exhaust port of the control valve chamber, means formed on the freely movable piston comprising a circumferential groove in the vicinity of each end of the piston adapted to alternately coact with the fluid pressure inlet ports of its chamber and the passages from said chamber to the valve piston chamber, whereby to introduce liquid under pressure at alternate ends of the chamber of the freely movable piston and reciprocate the piston therein.

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