Oct. 11, 1949. L. R. WILLIAMSON 2,484,439

HYDRAULIC PUMP

Filed July 16, 1943 4 Sheets-Sheet 1

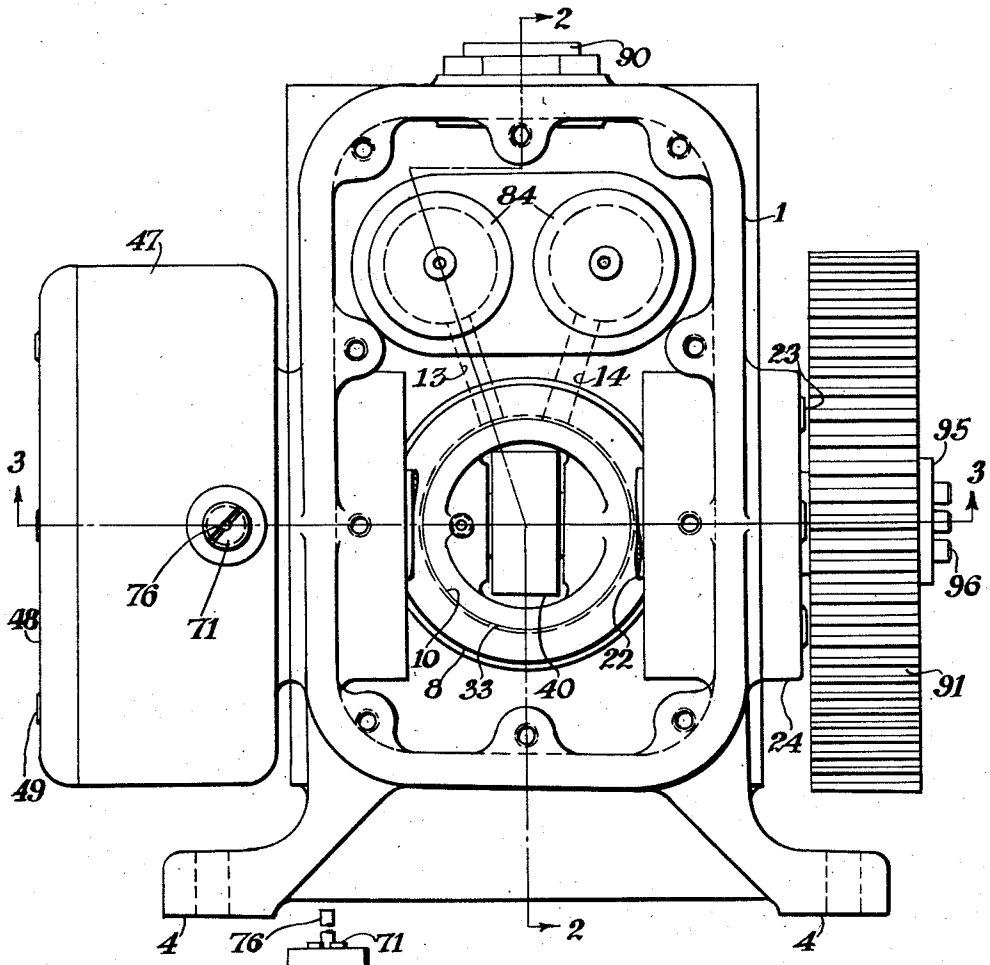

Fig. 1

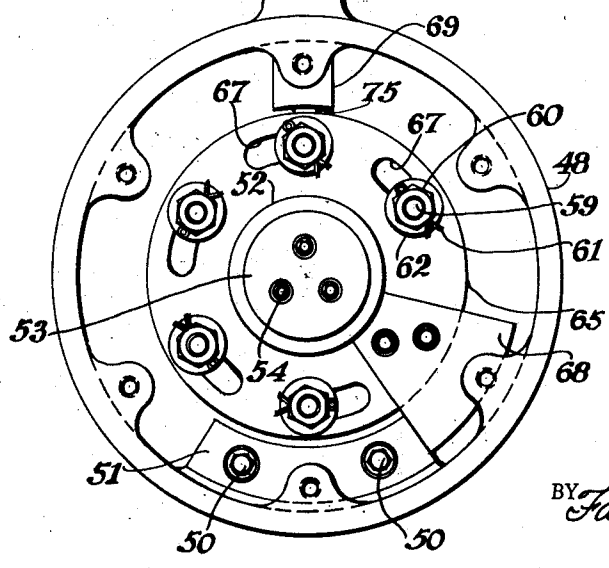

Fig. 4

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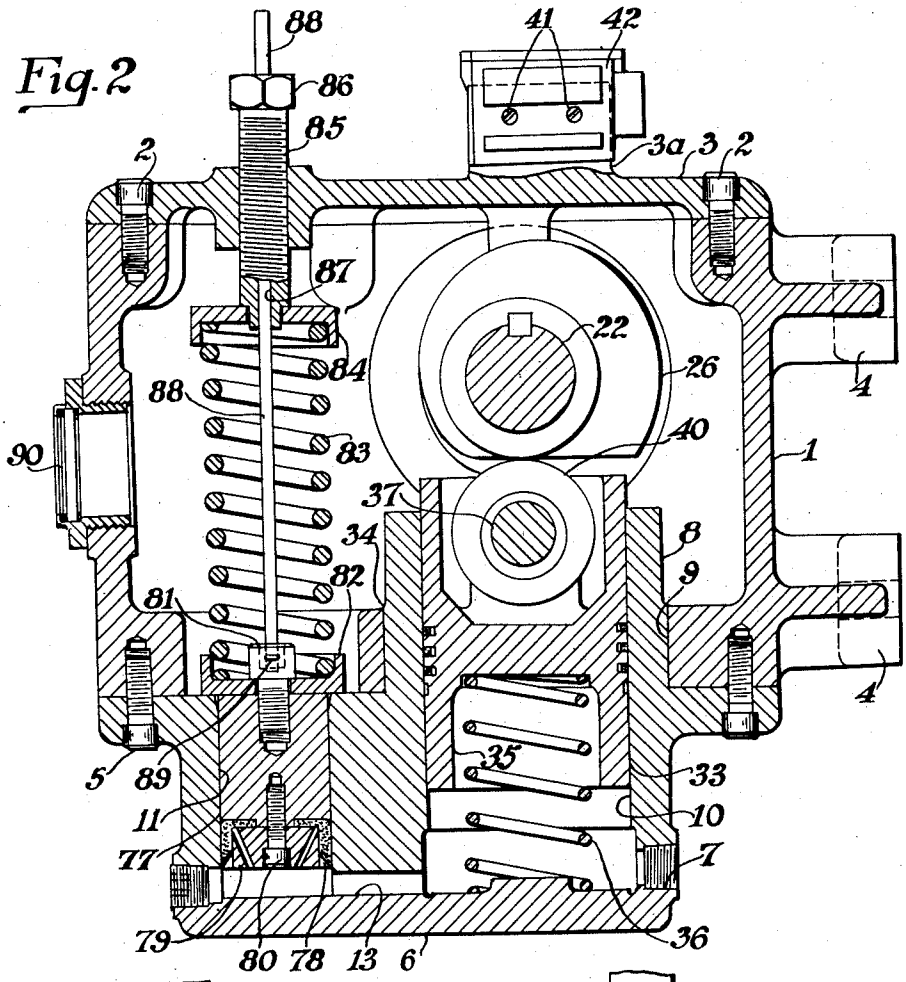
Fig. 2



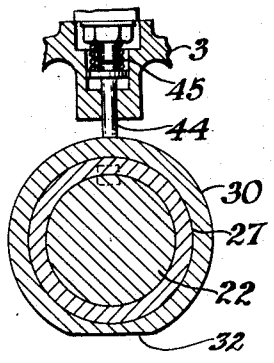


Fig. 7

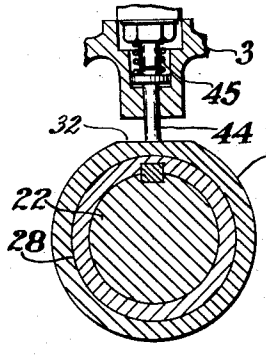


Fig. 8

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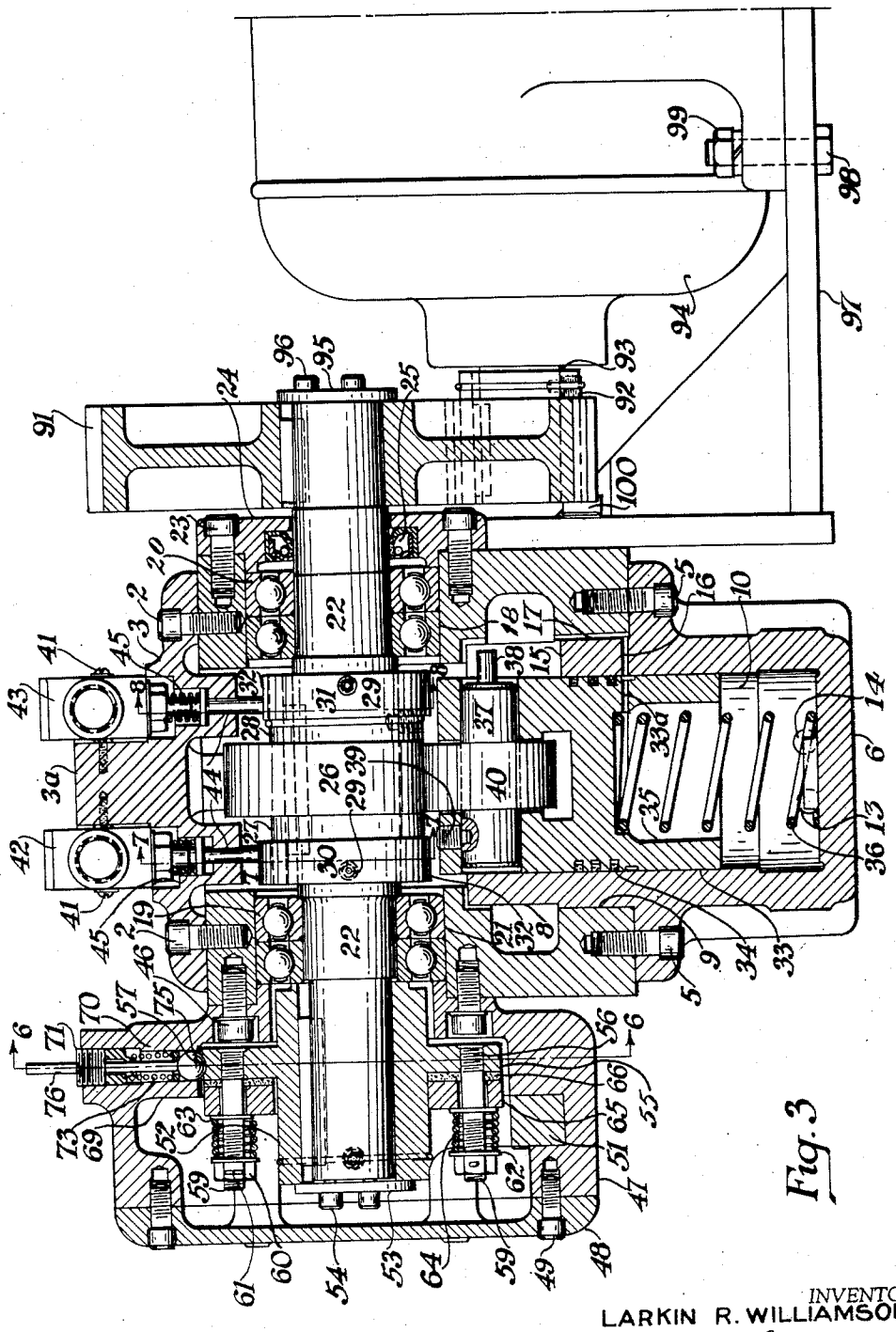

Fig. 3

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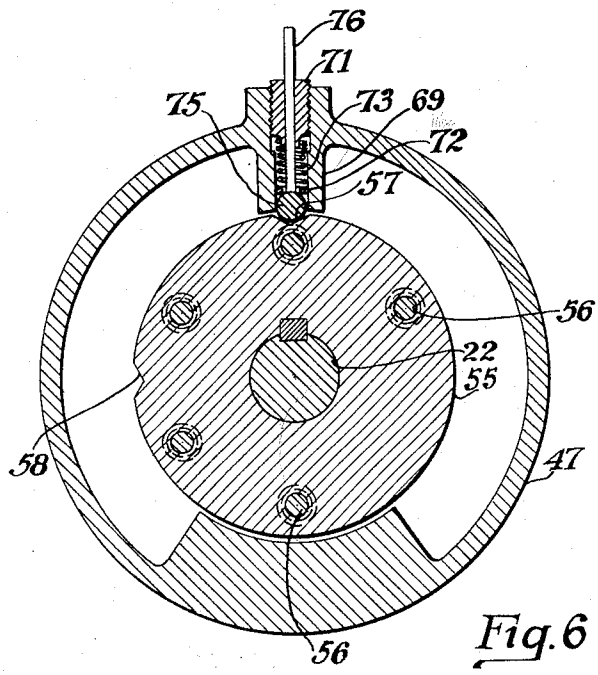

Fig. 6

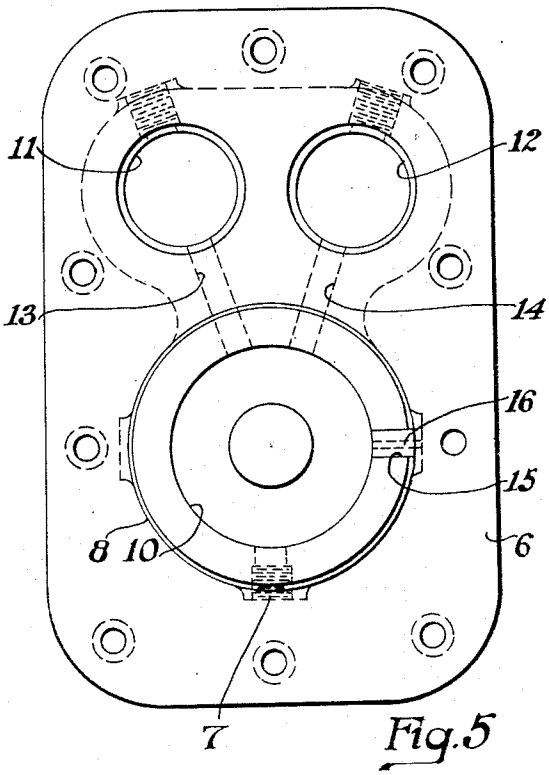

Fig. 5

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UNITED STATES PATENT OFFICE

2,484,439

HYDRAULIC PUMP

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Application July 16, 1943, Serial No. 494,917

6 Claims. (Cl. 103—11)

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This invention relates, as indicated, to hydraulic pumps, but has reference more particularly to a pump designed expressly for the operation of clutches for operating power presses, shears, brakes, etc.

In my United States Patent No. 2,269,328, I have disclosed an hydraulically-operated clutch for controlling the movement of the ram of a power shear, in which the clutch is actuated by the admission of oil under pressure to a pair of opposed cylinders.

The present invention is directed more specifically to a novel pump for supplying oil for actuating a clutch of the aforesaid type, but which may be used for various other purposes in which oil under pressure is required for intermittently actuating various machine and press parts.

A primary object of the invention is to provide a pump of the character described which will operate quickly and efficiently to actuate clutches such as those to which reference has been made.

Another object of the invention is to provide a pump of the character described, in which the fluid is delivered under predetermined pressures developed through cam-actuated means.

Another object of the invention is to provide a pump of the character described, in which the fluid is delivered under fairly high pressures, but in which means have been incorporated to relieve the pressure in the event that it exceeds a predetermined maximum.

Another object of the invention is to provide a pump of the character described having pressure relieving means, and in which means are also provided for visually indicating the absence or presence of such excess pressures.

A further object of the invention is to provide a pump of the character described, in which the fluid is delivered by motor-actuated piston means, and in which the motor is effectively braked at the ends of its movements.

A further object of the invention is to provide a pump of the character described having a brake of novel construction, and in connection with which means are provided for visually indicating the extreme limits of movement of the motor.

A still further object of the invention is to provide, in connection with a pump of the character described, a motor for actuating the pump, as well as means responsive to the operation of the pump

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for deenergizing the motor at the ends of its movements.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter duly described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain structure embodying the invention, such disclosed means constituting, however, but one of various structural forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a top plan view of a pump embodying the invention, but with the cover removed to more clearly reveal some of the internal construction;

Fig. 2 is a transverse cross-sectional view of the pump, taken on the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal cross-sectional view of the pump, taken on the line 3—3 of Fig. 1, and showing the torque motor drive for the pump;

Fig. 4 is an elevational view of the brake, with the cover thereof removed;

Fig. 5 is a tap plan view of the cylinder block;

Fig. 6 is a cross-sectional view, through the brake housing, taken on the line 6—6 of Fig. 3;

Fig. 7 is a fragmentary cross-sectional view, taken on the line 7—7 of Fig. 3, and

Fig. 8 is a fragmentary cross-sectional view, taken on the line 8—8 of Fig. 3.

Referring more particularly to the drawings, the pump will be seen to comprise a housing 1, having secured thereto, as by screwbolts 2, a cover 3. The housing is provided with bracket-like extensions 4, whereby the housing may be secured to a suitable portion of a power press or other machine, in connection with which the pump is to be used.

Secured to the lower end of the housing 1, as by screwbolts 5, is a cylinder block 6, having an oil outlet opening 7, and a cylindrical extension 8, which extends into a bore 9 in the housing, the extension 8 and the portion of the block from which this extension projects forming a cylinder 10. The block is also provided with a pair of smaller cylindrical recesses 11 and 12 (Fig. 5), and these are in communication with the cylinder 10 by means of passageways or bores 13 and 14 respectively. The oil outlet opening 7 extends radially from the lower end of the cylinder 10. The extension 8 has a longitudinally extending

slot or recess 15 in its upper end, and is also provided at a point somewhat below this slot with an oil inlet hole 16 (Fig. 3). The housing 1 is also provided with a vertically extending groove 17 in the wall of the bore 9, and the lower end of this groove communicates at all times with the hole 16, the function of which, together with that of groove 17, will presently be described.

The housing 1 is provided at opposite sides thereof with bores 18 and 19, in which are mounted ball bearings 20 and 21 respectively. A cam shaft 22 is journalled in these bearings, and projects outwardly at both ends through the aforesaid bores.

Secured as by screwbolts 23 to the housing 1 adjacent the bore 18 is a retainer 24 for the bearing 21, an oil seal 25 being interposed between this retainer and the shaft 22.

The cam shaft 22 has keyed thereto intermediate its ends, a cam 26, having hub portions 27 and 28, to which are secured, as by setscrews 29, cams 30 and 31, respectively, these latter cams having flat portions 32, whose function will be presently described.

Mounted for reciprocal movement in the cylinder 10 of the cylinder block 6, is a piston 33, provided with cord type piston rings 34, and having a recess 35 in its lower end, in which is mounted a compression coil spring 36, the lower end of which abuts the cylinder block 6. The piston is also provided with an oil inlet hole 33a, which, in the position shown, is in registry with the hole 16 in the extension 8. Mounted in the upper portion of the piston 33, and extending transversely thereof, is a roller pin 37 having a projecting pin 38 which is disposed in the recess 15 in the extension 8 of the cylinder block so as to maintain the piston against rotation during reciprocation thereof. The pin 37 is secured against rotation as well as axial displacement by means of a set screw 39. The pin 37 has journalled thereon intermediate its ends a cam roller 40, which is constantly maintained in engagement with the cam 26, due to the action of the spring 36.

Projecting upwardly from the cover 3 is a block 3a, to the opposite sides of which are secured, as by screws 41, micro-switches, one of which, 42, is hereinafter referred to as the forward micro-switch, and the other of which, 43, is hereinafter referred to as the reverse micro-switch. These micro-switches are adapted to be energized and deenergized as a result of the movements of the cams 30 and 31, and for this purpose, each cam engages a plunger 44 mounted for reciprocal movement in the cover 3, and normally urged into engagement with the cams by means of springs 45.

Secured to the housing 1, as by means of screw bolts 46, is a cylindrical brake housing 47, to the outer face of which is secured a cover 48, as by means of screws 49. The housing has secured within the lower portion thereof, as by means of screws 50, a stop block 51, whose function will be presently described.

A portion of the shaft 22 extends into the housing 47, and has keyed thereto a brake hub 52, which retains the bearing 21 in position, and is, in turn, retained against axial displacement by means of a washer 53 secured to the end of the shaft by means of screws 54.

The brake hub 52 has a radial flange 55 which is provided at circumferentially-spaced points with threaded openings 56, and at points on the periphery thereof spaced 90 degrees

apart with V-notches 57 and 58 (Fig. 6). Studs 59 are threadedly secured to the openings 56 of the brake hub, and these have secured to the outer ends thereof nuts 60, which are secured against rotation by means of cotter pins 61. Mounted on each of the studs 59 is a pair of washers 62 and 63, between which are interposed springs 64. These springs serve to yieldingly urge a brake disc 65 toward the flange 55 of the brake hub, a lining 66 of friction material being interposed between the brake disc and the flange 55.

The brake disc 65 is provided at circumferentially-spaced points with arcuate slots 67, a stop piece 68 being secured to the disc 65 at a point intermediate two of such slots. The studs 59 extend through the slots 67, and the stop piece 68 is disposed in the plane of the stop block 51, being, in fact, adapted to engage the ends of the stop block, as will be presently described.

At a point substantially diametrically opposite the stop block 51, the housing 47 is provided with a boss 69, through which a bore 70 extends, this bore being threaded in its upper portion for the reception of a spring adjusting screw 71. Disposed in the bore 70, between the lower end of the screw 71 and a washer 72, is a spring 73, which bears at its lower end against a ball 75. This ball bears against the periphery of the flange 55 of the brake hub, and engages an indicator rod 76 which extends through the bore 70 and through an axial opening in the screw 71, being visible above the screw.

Disposed within the cylindrical recesses 11 and 12 of the cylinder block 6 are accumulator pistons 77, each of which is provided at its lower end with a leather cup 78, which is secured to the piston by means of a seat 79, which, in turn, is secured to the piston by a screw 80.

Secured to the upper end of each piston 77, as by means of a bolt 81, is a cup-like spring retainer 82, which provides a seat for the lower end of a compression spring 83, the upper end of which abuts a retainer 84, similar to retainer 82, and maintained against axial displacement by an adjusting screw 85. The screw 85 is threadedly secured in the housing cover 3, and is provided with a head 86 whereby it may be adjusted to increase or decrease the compression of the spring 83. The screw has an axial passageway 87 through which an indicator rod 88 extends, the lower ends of the rods 88 being secured to the heads of the bolts 81 by means of cotter pins 89. An oil gauge 90 is also secured to the housing 1, so that the oil level in the housing may be visually inspected at all times.

The pump further includes a gear 91 which is keyed to one end of the shaft 22, and is adapted to be driven by a pinion 92 on the end of the shaft 93 of a torque motor 94. The gear 91 is maintained against axial displacement by means of a washer 95, secured to the end of the shaft by means of screws 96. The motor is mounted on a bracket 97, as by means of bolts 98, and nuts 99, and the bracket is rigidly secured to the housing 1 by means of cap screws 100.

The pump, as thus described, and with the various parts thereof in the positions as shown in the drawings, is filled with oil to a level such as to be clearly visible through the gauge 90, it being noted that the piston 33 is in its uppermost position, so that the oil inlet hole 33a is in registration with the hole 16 and the oil in the

pump therefore has access through the groove 15 and through these holes to the space below the piston, and fills this space as well as the bores 13 and 14, the oil outlet opening 7 and a conduit (not shown), connected to this latter opening and supplying oil to the opposed cylinders of a clutch such as described in my aforesaid patent.

It will also be noted that the ball 75 is disposed in the V-notch 57 in the periphery of the flange 55 of the brake hub, so that the indicator rod 76 is in a lowered position, which can be readily seen by the operator. At the same time, the indicator rods 88 are in their lowermost position, as can be readily seen by looking at the exposed upper ends of these rods. Moreover, the stop piece 68 is in engagement with the stop block 51, as shown in Fig. 4, and the micro-switch 43 has been deenergized due to the fact that the plunger 44 of such switch has fallen upon the flat surface 32 of the cam 31, thereby stopping the motor 94.

The motor 94 is then energized so as to cause the shaft 22 to rotate in a counterclockwise direction as viewed in Fig. 2, so that the cam 26 causes the cam roller 40 and the piston 33 to be depressed against the action of the spring 36. The downward movement of the piston 33 seals access to the oil inlet hole 33a from the hole 16, so that thereafter the oil below the piston is forced through the oil outlet opening 7 and through the conduit previously referred to and to the opposed cylinders of the clutch as described in my aforesaid patent so as to energize the clutch.

To avoid excessive oil pressure in the line to the clutch, the oil pressure, after building up to a predetermined point, is relieved by upward movement of the pistons 77 against the springs 83, such movement being indicated by the position of the upper ends of the rods 88.

After the shaft 22 has rotated about 180 degrees, the motor 94 is automatically deenergized due to the fact that the plunger 44 of the micro-switch 42 has fallen on the flat spot on the cam 30. At the same time, and to avoid overriding of the motor shaft, the stop piece 68 is brought into engagement with the opposite end of the stop block 51, so that a decelerated action results from the relative movement of the brake hub and brake disc acting through the brake lining interposed therebetween, the studs 59 riding in the slots 67 during such braking movement. At the end of this movement, the ball 75 drops into the notch 58, so that the rod 76 is again in a lowered position to indicate to the operator the end of the movement.

Due to the aforesaid movement of the cam shaft 22, the micro-switch 43 is, of course, again energized, so as to be in a position to be deenergized at the conclusion of the reverse movement of the cam shaft.

On the reverse movement of the cam shaft, oil will be drawn back into the bore 10, and when the piston 33 has returned to its initial position, seepage of oil back through the hole 33a will relieve any excess pressure on the pistons 77 and allow these to return to their normal position.

It is thus seen that I have provided a pump which effectively accomplishes the objects and has inherent therein the advantages which have hereinbefore been stated and referred to.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the structure herein disclosed, provided the means

stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In combination, a hydraulic pump having a shaft mounted therein, a reciprocating piston, a cam on the shaft for driving the piston, a motor for rotating said shaft in both directions through a predetermined arc of less than one revolution, means for braking the movement of said shaft at the ends of its movements to thereby brake said motor, switch means conditioning the motor for reversal thereof and cam means on the shaft for operating the switch means.

2. In combination, a hydraulic pump having a shaft mounted therein, a piston, a cam on the shaft for operating the piston, a motor for rotating said shaft in both directions through a predetermined arc of less than one revolution, means for braking the movement of said shaft at the ends of its movements to thereby brake said motor, and means for visually indicating the extreme limits of movement of the shaft, a pair of switch mechanisms and cam means on the shaft for alternately operating the switches to deenergize the motor and to condition the motor for reversal.

3. In combination, a hydraulic pump having a shaft therein, a piston, a cam on the shaft for operating the piston, a motor for rotating said shaft in both directions through a predetermined arc of less than one revolution, means responsive to the movements of said shaft for deenergizing the motor at the predetermined limits of movement of the shaft.

4. In combination, a hydraulic pump having a shaft therein, a piston, a cam on the shaft for operating the piston, a motor for rotating said shaft in both directions through a predetermined arc of less than one revolution, means responsive to the movements of said shaft for deenergizing the motor at the extreme limits of movement of the shaft, said means comprising a pair of independently actuated micro-switches and a brake mechanism acting on the shaft and carried solely by the shaft.

5. In combination, a hydraulic pump having a housing structure, a shaft therein, a piston actuated by the shaft, a motor for rotating said shaft in both directions through a predetermined arc of less than one revolution, means responsive to the movements of said shaft for deenergizing the motor at the extreme limits of movement of the shaft, said means comprising a pair of independently actuated micro-switches, cams on said shaft for energizing and deenergizing said switches and a brake mechanism carried by the shaft and reacting against said housing structure during the terminal movements of the shaft.

6. In apparatus of the character described, the combination of a rotary electric torque motor, a non-rotating unicycle pump driven by the motor comprising a cylinder housing structure, a reversible shaft operable through less than one revolution in either direction and carried by the housing, a piston, a cam on the shaft for effecting a compression stroke of the piston during a part revolution of the shaft in one direction only, spring means for urging the piston against the cam during a reverse movement of the shaft and cam and a permanently closed brake mechanism mounted on the shaft and freely carried thereby during the major arcuate movements of the shaft and including means reacting against the hous-

ing during the terminal movements of the shaft for causing the braking means to overcome the inertia of the motor and shaft.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,141,230	Burke	June 1, 1915
1,647,032	Birkigt	Oct. 25, 1927
1,871,989	Heitger	Aug. 16, 1932
1,917,690	Beeh	July 11, 1933
1,922,121	Brown	Aug. 15, 1933
1,951,215	Sidney	Mar. 13, 1934
2,016,621	Bernard	Oct. 8, 1935
2,232,983	Wahlmark	Feb. 25, 1941
2,250,007	Campion	July 22, 1941
2,269,097	Garday	Jan. 6, 1942
2,277,134	Nelson	Mar. 24, 1942
2,390,762	Woelfer	Dec. 11, 1945