

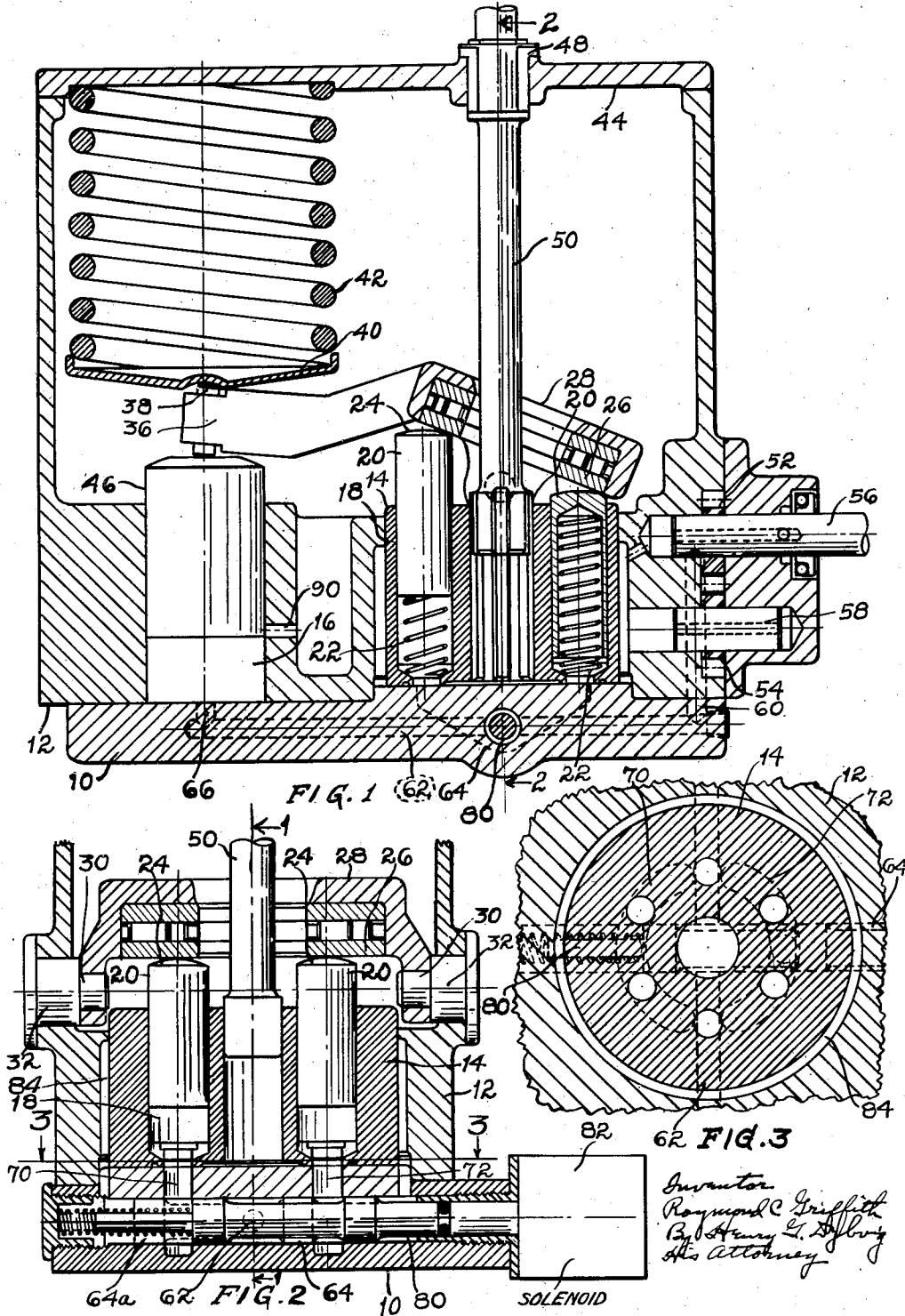
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HYDRAULIC MOTOR OF THE WOBBLE PLATE TYPE

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HYDRAULIC MOTOR OF THE WOBBLE
PLATE TYPE

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1 Claim. (Cl. 121—62)

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This invention relates to a hydraulic motor and more particularly to a hydraulic motor of the wobble plate type wherein the wobble plate is adjusted automatically in response to changed conditions.

An object of this invention is to provide a hydraulic motor of the wobble plate type, wherein the wobble plate is automatically adjusted in response to changes of load so as to increase the torque developed by the motor whenever the load increases and to decrease the torque developed by the motor whenever the load decreases.

Another object of this invention is to provide a hydraulic motor that may be reversed, which hydraulic motor stores energy during the period of time that the rotation of the motor is coming to a stop, which stored energy is released to the motor immediately after it has reversed.

Another object of this invention is to provide a substantially constant power output motor.

Another object of this invention is to provide a fluid pressure responsive device for controlling the angular relation of a wobble plate with respect to the pistons, to thereby control the torque developed by the motor in proportion to the load.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawing, Figure 1 is a cross sectional view of the motor to show the arrangement of the wobble plate and the adjusting mechanism thereof taken substantially on the line 1—1 of Figure 2.

Figure 2 is another cross sectional view showing the valve control mechanism used in reversing the motor, taken substantially on the line 2—2 of Figure 1.

Figure 3 is a fragmentary view of the base, taken substantially on the line 3—3 of Figure 2.

The device disclosed herein is provided with an energy storage cylinder provided with a piston operating against a spring, such that as the pressure in the fluid line increases, the piston is actuated against the spring to increase the angle of the wobble plate, thereby increasing the torque delivered by the motor. The energy storing cylinder cooperates with the wobble plate to maintain the rotor at a substantially constant power output, even though the load changes from no load to full load.

Referring to the drawing, a fluid passage base 10, also forming a valve support, is fixedly at-

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tached to one end of a housing 12 having rotatably mounted therein a piston-carrying rotor 14 and a cylindrical cavity 16. The rotor 14 is provided with a plurality of cylindrical recesses 18.

Each cylindrical recess 18 has mounted therein a piston 20 urged upwardly by a suitable spring 22. The upper ends of the pistons 20 are curved at 24 and engage a race 26 of a bearing mounted in a wobble plate 28. The wobble plate 28, as best seen in Figure 2, is pivotally mounted at 30 on pintles 32 mounted in the sides of the housing 12. The wobble plate 28 is provided with a shank or lever 36 provided with a transverse pin 38, the upper end of which is seated against a disc-shaped member 40 urged downwardly by a spring 42, having the upper end seated in a suitable recess in a capping member 44 of the housing 12. The lower end of the pin 38 is seated on top of a piston 46 mounted in the cylindrical cavity 16.

A drive shaft 50 has one end splined in the rotor 14 and journaled in a suitable bearing 48 in the capping member 44 of the housing 12. The rotor is hydraulically driven, as is well known to those skilled in the art of the wobble plate type of motor. The hydraulic fluid is supplied from a suitable source through a gear pump including the gears 52 and 54. The gear 52 is driven through a shaft 56 from a suitable source of power, which gear 52 in turn drives the gear 54 mounted upon the stubshaft 58. The fluid is discharged through a suitable passage or conduit 60 shown in dotted lines in Figure 1, communicating with a passage or conduit 62 also shown in dotted lines, intersecting a transverse passage or conduit 64 and a vertical passage or conduit 66 communicating with the cylindrical cavity 16.

The base 10 is provided with a pair of semi-circular recesses 70 and 72. The recess 70 communicates with the end 64a of the passage 64 and the recess 72 communicates with the passage 64, as clearly shown in Figure 2. The semi-circular recess 70 registers with half of the cylindrical cavities in the rotor 14 and the semi-circular recess 72 communicates with the other half of the cylindrical cavities in the rotor 14.

A valve member 80, controlled by an electric magnet or solenoid 82, when in the full line position shown in Figure 2, causes the fluid to circulate from the passage 62 through a portion of the passage 64 through the semi-circular recess 72 to one-half of the cylindrical cavities in the rotor 14, so as to exert pressure on the pistons in the cylindrical cavities of one-half of the rotor. As the pistons exert a pressure upwardly against

the wobble plate 28, the pistons rotate the rotor. When this takes place, the fluid in the other half of the pistons is exhausted through the semi-circular recess 70 through the end portion 64a of the passage beyond the electromagnetic valve 80, where the fluid is discharged around the rotor through the cavity 84, where it returns to the gear pump. This causes the rotor 14 and the shaft 50 to rotate in one direction. By operating the electric magnet 82 from the full line position shown in Figure 2 to the dotted position shown in the same figure, the hydraulic fluid is supplied under pressure to the semi-circular recess 70 and the recess 72 functions as an exhaust. This causes the rotor to reverse.

The operation of this hydraulic motor, with the exception of the reversing mechanism, is similar to conventional hydraulic motors of the multiple piston type. If the rotor is operating at a high speed, it can readily be seen that a reversal of the flow of the fluid through the rotor by actuating the electromagnetic valve 80 would cause a terrific jar and pounding in the motor. Furthermore, if the wobble plate remains at the same angular position, the speed of the rotor will be influenced by the load.

In order to overcome some of these objections, a speed control mechanism has been provided. In addition to the control of the speed, this mechanism functions as a cushioning member for absorbing the shock when reversing the motor and it also functions to store up energy caused by the reversal of the motor, which energy is liberated as soon as the rotor reverses its direction to rapidly accelerate the operation of the rotor.

The speed control mechanism and load control mechanism includes the shank 36 that oscillates the wobble plate 28, the disc-shaped member 40, the spring 42 and the piston 46. The fluid under pressure passes through the passage 62 and the passage 66 into the cylindrical cavity 16. As the load increases on the rotor 14, the pressure builds up in the hydraulic system, so as to raise the piston 46 and thereby increase the angle of the wobble plate 28, so that the rotor develops more torque and tends to decelerate. The piston 46 is then shown in the near "up" position. If the piston is raised higher, the fluid escapes through a vent 90, thereby limiting the upward movement of the piston 46. When the load on the rotor decreases, the pressure in the hydraulic system decreases, permitting the piston 46 to move downwardly, thereby decreasing the angle of the wobble plate 28 so as to increase the speed of the rotor, as is well known to those skilled in the art.

When the electromagnet 82 moves from one position to another so as to actuate the valve member 80 from one position to another, the pressure in the hydraulic system increases very rapidly, thereby causing the piston 46 to raise. As the piston 46 is raised, the angle of the wobble plate 28 is increased, thereby increasing the torque generated by the pistons. This will result in a very rapid acceleration of the rotor when it is reversed. As the pressure in the system decreases, resulting from the acceleration of the rotor, the spring 42 forces the piston downwardly and as the piston and the spring advance downwardly, the angle of the wobble plate 28 is decreased, thereby increasing the speed of the rotor. The arrangement of the spring 42 and the piston 46 is such that when the proper speed is attained, the spring and the piston function as a power

control to maintain the rotor at a substantially constant power, irrespective of the load.

An electromagnet has been shown here as illustrative of a valve control mechanism for actuating the valve. This valve may be actuated in any other suitable manner, either driven directly or indirectly from the prime mover or from any other source of power, or it may be manually controlled. For some usages of the motor the valve may be actuated periodically from one position to another, so as to cause the motor to reverse cyclically, for example, if the motor is used in actuating a washing machine where it is desirable to reverse the direction of movement, a suitable control mechanism may be provided for the valve actuating mechanism such that the motor reverses periodically.

Whenever this motor is used as a reversible motor, as for example, when it is used as a washing machine motor, and whenever the motor is reversed for any other reason, the inertia of the movable parts connected to the rotor of the motor tends to continue the rotation of the rotor. Whenever the valve 80 is reversed and the motor is in rotation, the rotor functions as a hydraulic pump from the time the valve is reversed until the rotor stops. The only place that the hydraulic fluid can escape is to the power control piston 46. As soon as the rotor comes to a stop, it ceases to pump fluid and instead, receives fluid. Immediately after the rotor has come to a stop, fluid is supplied to the rotor from the gear pump and also from the piston 46 actuated by the spring 42, which has stored up energy and now delivers this energy to the rotor. Thus, it can be seen that the rotor will have a tremendous amount of power delivered to it, causing the rotor to accelerate at a very rapid rate. This is very desirable when the motor is used as a washing machine motor. When it is used as a washing machine motor, power is delivered to the rotor from two sources, the gear pump and the piston 46. As soon as the pressure decreases, the angle of the wobble plate is decreased, thereby further tending to accelerate the motor.

Instead of the cylinder 16 and the piston 46 acting against the spring 42, any other pressure responsive device could be used, as for example, a bellows moving in response to changes in pressure.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claim.

Having thus described my invention, I claim:

In a reversible hydraulic motor of the wobble plate type, said motor including a frame having a cylindrical cavity, a rotor assembly mounted in the cylindrical cavity, said rotor assembly including a plurality of pistons, an adjustably mounted wobble plate pivotally mounted in said frame, said wobble plate being provided with a laterally disposed arm, said frame member being provided with a second cylindrical cavity extending parallel to the first cylindrical cavity but arranged in offset relation therefrom, a piston mounted in the second cylindrical cavity, a passage member having a passage for supplying fluid to the pistons in the rotor, said passage member being attached to the frame member,

said passage member having a passage communicating with the said second cylindrical cavity, a capping member for the frame member, said capping member being provided with a bearing, a rotor shaft attached to the rotor journaled in said bearing, said capping member having a cylindrical recess, a compression spring having one end seated in said cylindrical recess, and a disc-like member being provided with a cylindrical recess in which the other end of the compression spring is seated, said disc-like member engaging one side of the arm of the wobble plate, the opposite side of the arm resting upon said piston, said compression spring biasing said arm of the wobble plate so that the wobble plate approaches a plane substantially normal to the axis of rotation of the rotor, said piston in the cylinder actuating said arm against the compression spring so as to cause the wobble plate to form an inclined angle with respect to the axis of rotation of the rotor as the pressure in the system increases due to an increase in load, the compression spring tending to urge the piston into the cylindrical cavity whenever the pressure in the hydraulic system decreases.

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