

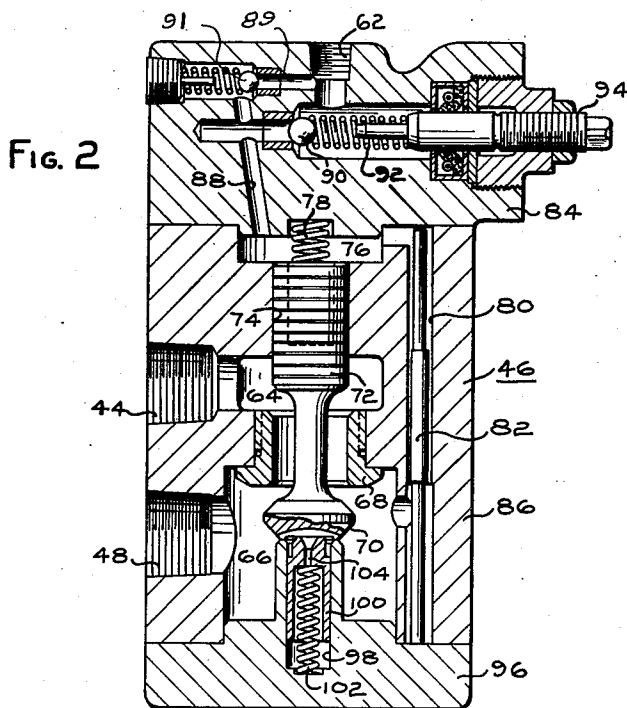
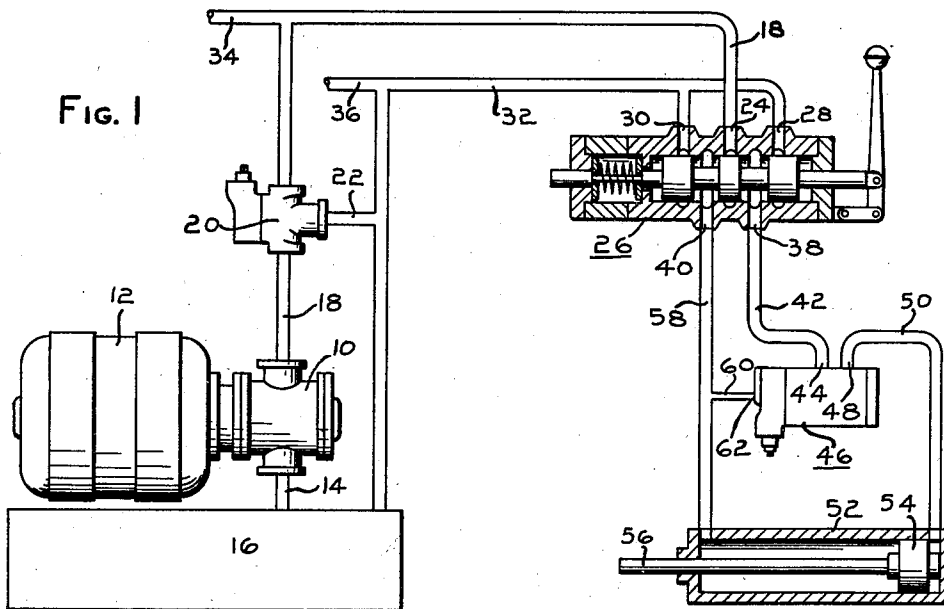
Feb. 2, 1943.

C. V. LOSEY ET AL

2,310,100

POWER TRANSMISSION

Filed Feb. 12, 1940



INVENTORS
CLIFFORD V. LOSEY &
RUDOLF E. ESCH
BY *Ralph L. Tinsdale*
ATTORNEY

UNITED STATES PATENT OFFICE

2,310,100

POWER TRANSMISSION

Clifford V. Losey, Detroit, Mich., and Rudolf E. Esch, Cleveland, Ohio, assignors to Vickers Incorporated, Detroit, Mich., a corporation of Michigan

Application February 12, 1940, Serial No. 318,570

6 Claims. (Cl. 121—38)

This invention relates to power transmissions, particularly to those of the type comprising two or more fluid pressure energy translating devices, one of which may function as a pump and another as a fluid motor.

The invention is particularly concerned with a power transmission system of this character incorporating an improved reducing valve and circuit for operating the same. In the patent to Harrington, 2,184,670, issued December 26, 1939, there is disclosed a reducing valve having a pressure control chamber by which the valve action is regulated and which permits the use of a relatively light spring for biasing the valve. Valves of this character have gone into extensive use and have been found admirably suitable for their intended purpose in a great many installations. It has been found, however, that in certain installations, where the fluid motor or other load device which is connected to the outlet port of the valve is of such character that it, in itself, maintains a back pressure in the valve outlet chamber, some difficulty is occasionally experienced. This difficulty consists in a delayed opening of the reducing valve when flow therethrough is reversed by connecting the normal inlet chamber of the valve to exhaust.

It is an object of the present invention to provide an improved valve of the character described together with an improved control circuit therefor which will insure that the valve will open wide immediately upon the inlet chamber being connected to exhaust.

It is also an object to provide an improved valve of the character described which avoids certain chattering difficulties occasionally experienced in certain unusual installations where the resonant characteristics of the circuit are apparently such as to cause occasional chattering with a valve of the type disclosed in the aforesaid Harrington patent.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred form of the present invention is clearly shown.

In the drawing:

Figure 1 is a diagrammatic view of a hydraulic circuit incorporating a preferred form of the present invention.

Figure 2 is a longitudinal sectional view of the improved reducing valve incorporated in the circuit of Figure 1.

Referring now to Figure 1, there is shown a pump 10 driven by a suitable prime mover, such

as an electric motor 12, and having a suction conduit 14 for withdrawing oil from a tank 16. A delivery conduit 18 extends through a relief valve 20 of conventional construction for bypassing the pump delivery to tank through a conduit 22 whenever a predetermined pressure is exceeded in the delivery conduit 18.

The conduit 18 extends to the pressure port 24 of a conventional four-way directional control valve 26. The latter has tank ports 28 and 30 which are connected by a return line 32 to the tank 16. The delivery conduit 18 and the return conduit 32 may have branches 34 and 36 extending to other control valves for directing the pump delivery at times to other fluid consuming devices which normally impose a high pressure on the delivery conduit 18.

The valve 26 has cylinder ports 38 and 40. A conduit 42 extends from the port 38 to the inlet port 44 of a pressure-reducing valve 46. The outlet port 48 thereof extends by a conduit 50 to one end of a cylinder 52 having a piston 54 slidable therein. The rod 56 of the piston may be connected to any suitable device, such as a machine tool slide, which it is desired to actuate hydraulically in a reciprocating movement. A conduit 58 extends from the cylinder port 40 to the opposite end of cylinder 52 and has a branch 60 extending to the drain port 62 of the valve 46.

Referring now to Figure 2, the valve 46 is there shown in cross section and may be similar to the valve disclosed in the Harrington patent with the additional provision of chatter-preventing means later to be described. Briefly, the valve comprises an inlet chamber 64 which communicates with the port 44 and an outlet chamber 66 which communicates with the port 48. A valve seat 68 forms a passage between the two chambers and is controlled by a poppet valve 70 having a piston 72 of the same diameter as the effective seating diameter of the valve 70. The piston 72 slides in a bore 74 and is exposed to the pressure in a control chamber 76. A light spring 78 biases the valve 70 downwardly in Figure 2.

A passage 80 extends from the outlet chamber 66 to the control chamber 76 and has a pin 82 therein of slightly less diameter than the passage 80 to form a restriction within the passage. The upper cap 84 which is secured to the body 86 has a passage 88 therein extending from the control chamber 76 to a spring-loaded pilot relief valve 90, the spring 92 of which may be adjusted by means of an adjusting screw 94. The outlet side of the valve 90 connects with the drain port

62. A passage 89 connects between passage 88 and the drain port 62 and has a check valve 91 therein which opens freely to flow from port 62 to passage 88.

The lower end cap 96 has formed therein a cylindrical bore 98 in which a piston 100 is slidably mounted. The piston is adapted to abut the lower end of valve 70 and for this purpose is biased upwardly by a spring 102 exerting a lighter force than that of spring 78. A restricted passage 104 extends through the piston 100 to communicate between the cylinder 98 and the outlet chamber 66. The bore 104 is of such resistance that oil can flow into or out of the cylinder 98 only at a reduced rate thus restricting the speed of movement of piston 100 equally in both directions.

In operation, with the motor 12 working and driving the pump 10, oil is withdrawn from the tank 16 through suction conduit 14 and delivered through delivery conduit 18 and branch 34 to the work circuit which is connected thereto causing a pressure to be built up therein.

When it is desired to operate the piston 54 at a lower pressure than that maintained in conduit 18, the spool of valve 25 may be shifted to the left connecting port 24 to port 38 and port 40 to port 30. Pressure fluid is, therefore, permitted to flow through conduit 42, valve 46 and conduit 50 to the righthand end of cylinder 52 projecting the piston 54 to the left. The oil discharged from the lefthand end of cylinder 52 returns to tank through conduit 58, valve 26 and conduit 32. During this flow the reducing valve 46 operates to prevent pressure in conduit 50 from building up beyond the value determined by the setting of spring 92, its action in this respect being identical to that described in the Harrington patent.

It will be noted that the port 62 is, under these conditions, connected to tank by the action of the four-way valve 26. Thus the small leak-off flow which takes place from outlet chamber 66 through passage 89, chamber 76, passage 88, valve 90, and port 62 maintains a balanced load on the upper end of piston 74 which load automatically varies to adjust the valve 70 to whatever position may be necessary to maintain in chamber 66 a predetermined pressure. During this action the piston 100 acts to restrict the speed of movement of valve 70 only in the downward direction since the valve 70 cannot move downwardly without also moving the piston 100 downwardly, and its speed is dependent upon the rate at which oil can discharge from cylinder 98 through passage 104. During upward movement of the valve 70 the piston 100 imposes no restriction to its speed since the valve 70 is free to lift away from the piston 100 whenever pressure conditions in chambers 66 and 76 cause such upward movement. Thus any tendency to chatter which may arise from the resonant characteristics of the circuit is effectively damped out by retarding movement of the piston 72 in one direction.

When it is desired to return the piston 54 toward the right, the spool of valve 26 may be shifted to the right thus connecting port 24 to port 40 and port 38 to port 28. Under these conditions it will be noted that pressure oil directed through conduit 58 to the lefthand end of cylinder 52 is also directed through the branch conduit 60 to the drain port 62 thus building up pressure behind the valve 90 causing the latter to close in the same manner as a check valve. Check valve 91 permits the pressure fluid to flow

freely through passages 89 and 88 to the chamber 76 thus positively pushing the piston 72 downwardly to open valve 70 immediately. Accordingly, return flow from the righthand end of cylinder 52 is permitted to flow freely through conduit 50, valve 46 and conduits 42 and 32 back to the tank.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A hydraulic power transmission system comprising in combination with a fluid motor and a source of pressure fluid, two conduits leading to opposite sides of the motor, directional control means for selectively directing pressure fluid to either conduit selectively while exhausting the other conduit, a pressure reducing valve in series in a first one of the conduits, said valve having an operating chamber for controlling the opening and closing of the valve, and means including a branch conduit connecting between the operating chamber and the second one of the conduits for fully opening the reducing valve while the second conduit is under pressure.

2. A hydraulic power transmission system comprising in combination with a fluid motor and a source of pressure fluid, two conduits leading to opposite sides of the motor, directional control means for selectively directing pressure fluid to either conduit selectively while exhausting the other conduit, a pressure reducing valve in series in a first one of the conduits, said valve having an operating chamber for controlling the opening and closing of the valve, means forming a path for a relatively small fluid flow from the outlet of the reducing valve through the operating chamber to a point outside the valve, and means for selectively conducting such flow to exhaust or inhibiting such flow.

3. A hydraulic power transmission system comprising in combination with a fluid motor and a source of pressure fluid, two conduits leading to opposite sides of the motor, directional control means for selectively directing pressure fluid to either conduit selectively while exhausting the other conduit, a pressure reducing valve in series in a first one of the conduits, said valve having an operating chamber for controlling the opening and closing of the valve, and means under the control of the directional control means for selectively connecting the operating chamber either with pressure fluid or exhaust.

4. A hydraulic power transmission system comprising in combination with a fluid motor and a source of pressure fluid, two conduits leading to opposite sides of the motor, directional control means for selectively directing pressure fluid to either conduit selectively while exhausting the other conduit, a pressure reducing valve in series in a first one of the conduits, said valve normally acting to prevent reverse flow therethrough, and pilot control means for selectively opening the valve to reverse flow.

5. A hydraulic power transmission system comprising in combination with a fluid motor and a source of pressure fluid, two conduits leading to opposite sides of the motor, directional control means for selectively directing pressure fluid to either conduit selectively while exhausting the other conduit, a pressure reducing valve in series in a first one of the conduits, pressure responsive pilot means for regulating the opening of the

valve to maintain a predetermined pressure at the outlet thereof, and fluid pressure means for selectively disabling said pilot means.

6. A hydraulic power transmission system comprising in combination with a fluid motor and a source of pressure fluid, two conduits leading to opposite sides of the motor, directional control means for selectively directing pressure fluid to either conduit selectively while exhausting the

5 other conduit, a pressure reducing valve in series in a first one of the conduits, pressure responsive pilot means for regulating the opening of the valve to maintain a predetermined pressure at the outlet thereof, and fluid pressure means under the control of the directional control means for selectively disabling said pilot means.

CLIFFORD V. LOSEY.
RUDOLF E. ESCH.