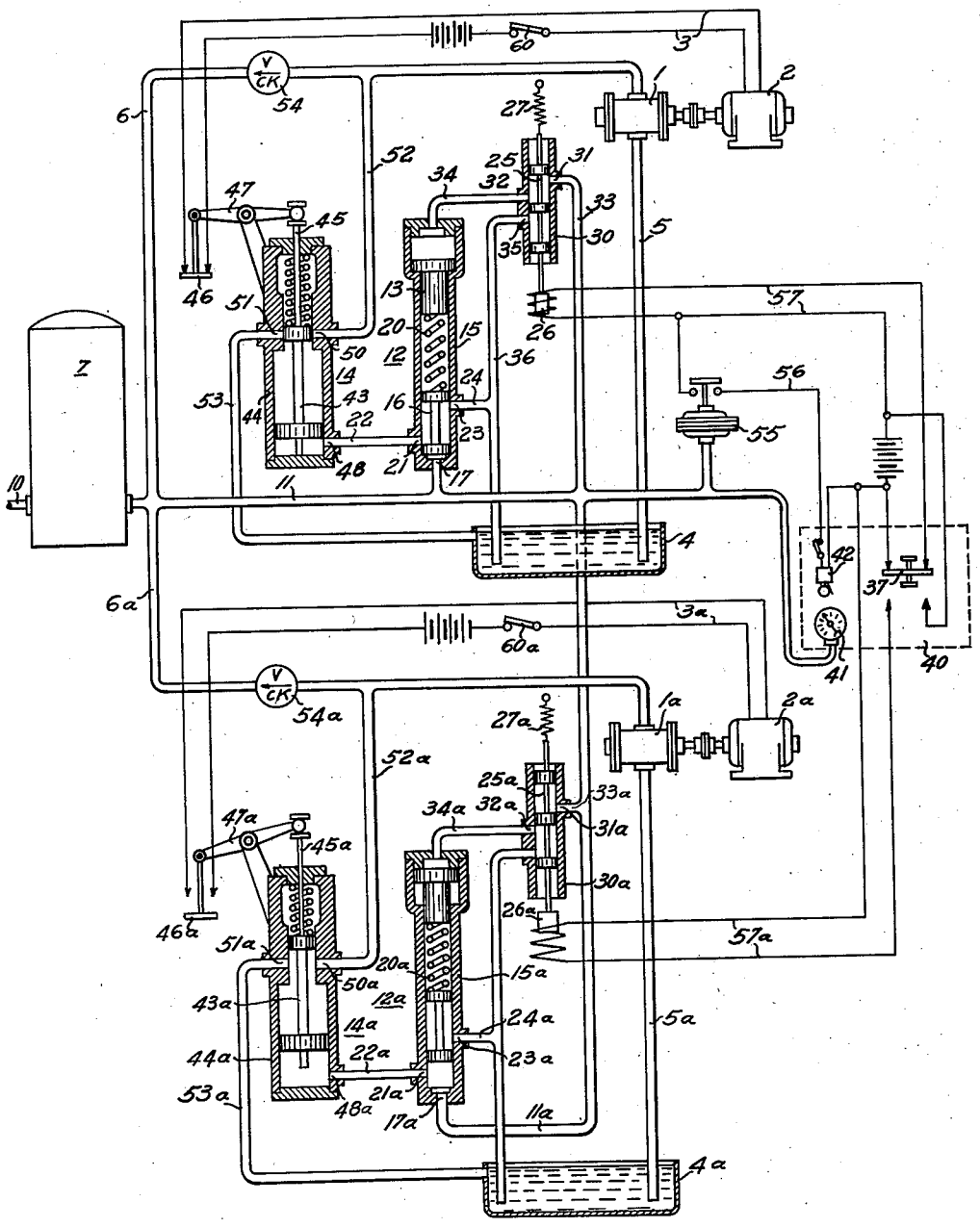
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FLUID PRESSURE CONTROL APPARATUS

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FLUID PRESSURE CONTROL APPARATUS

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1

The present invention relates to oil pumping units for supplying oil under pressure to hydraulic turbine governors or other apparatus using fluid under pressure and particularly to means for shifting the pressure operating range of an individual pumping unit, and the principal object of the invention is the provision of new and improved apparatus of these types.

Where two oil pumping units are used on modern hydraulic turbine governor systems, the equipment is usually arranged so that the pumps are started and stopped separately by their respective pump control means. Such means are herein characterized by a limit switch placed in each pump motor starter control circuit and an unloader valve which mechanically operates such switch. The arrangement is such that the motor will stop when such unloader valve opens and start when the unloader valve starts to close.

When this system is used, it is customary to arrange controls on the pilot valves, which admit receiver pressure to their respective unloading valves when such pressure attains a predetermined value, such that the operating range of each unloader valve may be separately shifted. Thus, one pump will operate automatically at the normal pressure range and the other pump will operate automatically at a lower or "standby" range.

An object of this invention is to provide means remotely controllable whereby the pressures at which a pilot valve is to be actuated may be remotely selected, so that in the case of a turbine governor, for example, the governor may be located at a low level, or, in general, at some remote place.

Another object is to provide a pumping unit having means, remotely controllable, for shifting the pressure range at which such unit operates.

Another object is to provide new and improved dual pumping systems, in which one of the pumping units operates at a normal pressure range while the other unit operates at a lower or "standby" pressure range, such that upon failure of the former unit the latter unit will automatically maintain the receiver pressure within the lower range until shifted to the higher or normal range by manual remote control means.

Other objects will appear hereinafter as the description of the invention proceeds.

The novel features of the invention and how the objects are attained will appear more fully from this specification and the accompanying drawing showing one embodiment of the invention and forming a part of this application, and all of these novel features are intended to be pointed out in the claims.

2

Referring to the drawing, a schematic elevation partly in section of two identical oil pumping units, is shown, having a common receiver and controllable from a common control panel which may be remotely placed from the units.

A description of the oil pumping unit shown in the upper part of the drawing will serve for both, it being noted that the parts of the pumping unit shown in the lower part of the drawing corresponding to parts of the upper unit have been given the same reference numerals but with the suffix *a*.

The fluid pumping means is herein characterized by oil pump 1 and driving means for the fluid pumping means herein characterized by electric motor 2 and circuit 3. The pumping means delivers fluid from sump 4 through conduits 5 and 6, to the receiver 7 which supplies a hydraulic turbine governor system (not shown) or any other system with fluid under pressure, through pipe 10. Receiver pressure is communicated through conduit 11 to the pilot means, herein characterized by pilot valve assembly 12, the actuation pressure of which is determined by remotely controllable adjusting means, herein characterized by biasing piston 13. Upon actuation of the pilot means, receiver pressure actuates pump control means, herein characterized by the unloading valve assembly 14 which functions to prevent further discharge to the receiver 7 by the pumping means and initiates such discharge to the receiver 7 upon the reversed actuation of the pilot means.

The pilot means comprises the pilot valve assembly 12 having a pilot valve casing 15 fitted with a differential two-spooled pilot valve 16 responsive to receiver pressure through a port 17 against the force of biasing means herein characterized by resilient means 20. A port 21 is connected to the unloading assembly 14 through a conduit 22 and a port 23 permits trapped fluid to exhaust to the sump 4 through a conduit 24.

The adjusting means, comprising the biasing piston 13 reciprocable in the upper part of the valve casing for varying the force exerted by the resilient means 20, is remotely controllable. The upper part of the pilot valve casing 15 is bored somewhat larger than the lower part and receives the biasing piston 13 which comprises a head fitting in the larger bore and a stem fitting in the smaller bore. The characteristics of the resilient means 20 and the length of the larger bore are proportioned with respect to the area

of the port 17 such that the pilot valve 16 will respond to two predetermined receiver pressures depending on whether the biasing piston 13 is in a raised or lowered position. The area of the smaller bore, in which the pilot valve 16 is fitted, with respect to the area of the port 17 determines the pressure range between opening and closing of the valve. The purpose of utilizing differential bores in the pilot valve casing 15 is to permit the option of using receiver pressure rather than fluid pressure from an outside source to force the biasing piston 13 to its lower position.

The remote control means shown herein comprises a three-spooled control valve 25 having an extended stem secured to a solenoid core 26 at the lower end and a spring 27 for moving the valve to its deenergized position at the upper end. Such valve 25 is fitted into a control valve casing 30 having ports 31 and 32 which are in communication to allow receiver pressure to force the biasing piston 13 to its lower position, when the solenoid 26 is energized, through the conduits 33 and 34; and a port 35 which is in communication with the port 32 when the solenoid 26 is deenergized to allow the biasing piston 13 to raise and exhaust the fluid to the sump 4 through the conduits 34 and 36. The solenoids 26 and 26a are alternately energizable by a double throw switch 37 mounted on a control panel 40 located remotely from the control valves 25 and 25a. The control panel 40 may also have mounted thereon a pressure gauge 41 to indicate receiver pressure, and a receiver pressure responsive electric bell 42 which may be adjusted to sound an alarm when the receiver pressure drops to predetermined value.

The pump control means comprises an unloading valve assembly 14 having a two-spool unloading valve 43 fitted into the unloading valve casing 44 and a port 48 which admits receiver pressure from the pilot valve assembly 12. A stem 45 extending from the unloading valve 43 is operably connected to a switch 46 in the pump motor control circuit 3 by means of a lever 47 such that upon the unloading valve 43 lifting, the circuit will be broken stopping the motor 2 and pump 1. The raised position of the unloading valve 43 allows ports 50 and 51 to communicate which permits the pump 1 to unload by draining the trapped fluid to the sump 4 through the conduits 53 and 53. A check valve 54 in the conduit 6 prevents loss of receiver pressure when the pump 1 is not operating.

While two sumps 4, 4a have been shown, for the sake of clarity, it will be obvious that only a single sump is required.

The operation of the described embodiment of the invention is as follows:

Assume that the pilot valve assemblies 15 and 15a of the respective units have been designed such that when the respective biasing piston 13 or 13a is in its lower position, the normal pressure range of the respective unit will be 275–300 p. s. i. and that when the respective piston is in its upper position the "standby" range of the respective unit will be 250–275 p. s. i. Assume that the pressure responsive device 55 is adjusted to close the bell circuit 56 when the receiver pressure is less than 270 p. s. i.

Before the pumping units are put into operation, the double-throw switch 37 is in a neutral position, the switch 57 in the bell circuit is open, the hand operated switches 60 and 60a in the respective motor control circuits 3 and 3a are open and as there is no pressure in the receiver 7 the switches 46 and 46a operated by the respective unloader valves 43 and 43a are closed.

Assuming that the upper unit on the drawing is to operate in the normal range, the switches 60 and 60a are closed which respectively causes both pumps 1 and 1a to operate, and the double-throw switch 37 is thrown to close the upper solenoid circuit 57 causing the upper control valve 25 to move to its lower position allowing receiver pressure to be communicated to the large bore of the upper pilot valve casing 15. As the receiver pressure increases the upper biasing piston 13 will be forced to its lower position.

When the receiver pressure reaches 275 p. s. i., the lower pilot valve 16a will respond causing the unloader valve 43a to unload and stop the pump 1a. At this pressure the bell circuit switch 57 may be closed. The upper pumping unit will then function to maintain the receiver pressure between 275–300 p. s. i. The parts are then in the position shown in the drawing.

If the upper pumping unit should fail, the receiver pressure will drop and upon reaching 270 p. s. i. the bell 42 will ring warning the operator of the failure at which time he can close the lower solenoid circuit 57a by means of the double-throw switch 37 so as to shift the range of the lower unit from the "standby" range (250–275 p. s. i.) to the normal range (275–300 p. s. i.). If for any reason the operator does not so shift the lower unit, it will automatically begin to pump fluid when the receiver pressure drops below 250 p. s. i. and will continue to operate in the "standby" range indefinitely.

The pressures herein referred to have been given by way of illustration and not limitation, it being obvious that other pressures may be used.

From the foregoing it will be apparent to those skilled in the art that the illustrated embodiment of the invention provides a new and improved control for pressure responsive devices and accordingly accomplishes the objects of the invention. On the other hand, it will also be obvious to those skilled in the art that the illustrated embodiment of the invention may be variously changed and modified without departing from the spirit of the invention and accordingly the disclosure herein is illustrative only, and the invention is not limited thereto.

It is claimed and desired to secure by Letters Patent:

1. A dual pumping system wherein two pumping units supply fluid under pressure to a common conduit and each pumping unit comprises; fluid pumping means, pilot valve means responsive to the pumping means discharge pressure, biasing means resisting actuation of said pilot valve means, adjusting means having a first position whereby a predetermined resistance is imparted to said biasing means and a second position whereby a relatively greater resistance is imparted to said biasing means, and pump control means actuable upon actuation of said pilot valve means for preventing discharge of said pumping means into said common conduit; the combination with said pumping units of means remotely controllable for selectively moving the adjusting means of either of said pumping units to said first position or to said second position.

2. A dual pumping system wherein two pumping units supply fluid under pressure to a common conduit and each pumping unit comprises; fluid pumping means, pilot valve means responsive to the pumping means discharge pressure, resilient means resisting actuation of said pilot

valve means, adjusting means having a first position whereby a predetermined resistance is imparted to said resilient means and a second position whereby a relatively greater resistance is imparted to said resilient means, and pump control means actuable upon actuation of said pilot valve means for preventing discharge of said pumping means into said common conduit; the combination with said pumping units of means remotely controllable for selectively moving the adjusting means of either of said pumping units to said first position and concurrently the adjusting means of the other of said pumping units to said second position.

3. A dual pumping system wherein two pumping units supply fluid under pressure to a common conduit and each pumping unit comprises; fluid pumping means, pilot valve means responsive to the pumping means discharge pressure, resilient means resisting actuation of said pilot valve means, adjusting means having a standby position whereby a predetermined resistance is imparted to said resilient means and a normal operating position whereby a relatively greater resistance is imparted to said resilient means, and pump control means actuable upon actuation of pilot valve means for preventing discharge of said pumping means into said common conduit; the combination with said pumping units of means remotely controllable for selectively moving the adjusting means of either of said pumping units to said standby position and concurrently the adjusting means of the other of said pumping units to said normal operating position.

4. A dual pumping system wherein two pumping units supply fluid under pressure to a common conduit and each pumping unit comprises; fluid pumping means, pilot valve means responsive to the pumping means discharge pressure, resilient means resisting actuation of said pilot valve means, a cylinder and a biasing piston movable in said cylinder to vary the resistance of said resilient means, said piston having a standby position whereby a predetermined resistance is imparted to said resilient means and a normal operating position whereby a relatively greater resistance is imparted to said resilient means, and pump control means actuable upon actuation of said pilot valve means for preventing discharge of said pumping means into said common conduit; the combination with said pumping units of control valve means remotely controllable for supplying fluid under pressure to said cylinder for moving the biasing piston of either of said pumping units to said normal operating position and concurrently the biasing piston of the other of said pumping units to said standby operating position.

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