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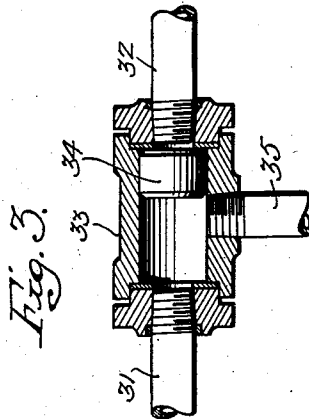
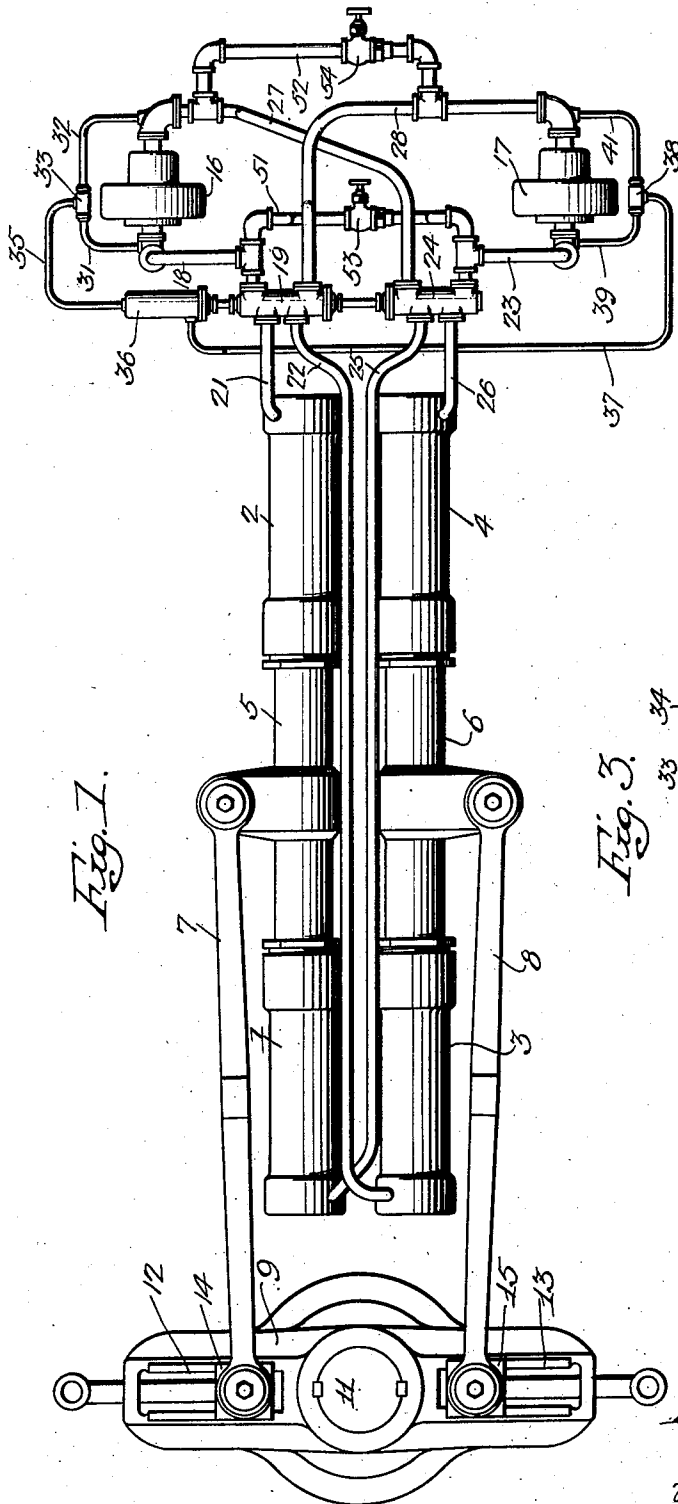
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1,955,922

AUTOMATIC CHANGE-OVER SYSTEM FOR HYDRAULIC APPARATUS

Filed March 20, 1931

3 Sheets-Sheet 1



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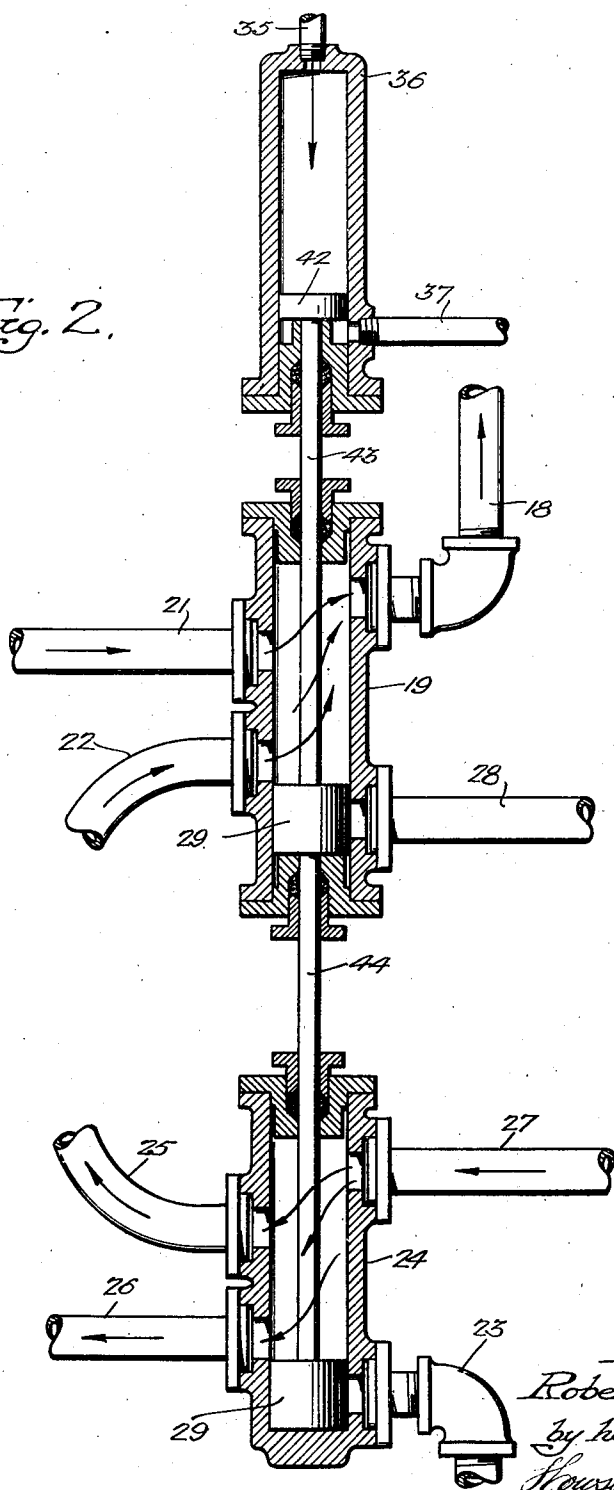
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3 Sheets-Sheet 2

Fig. 2.



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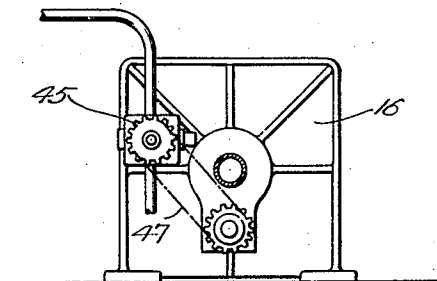
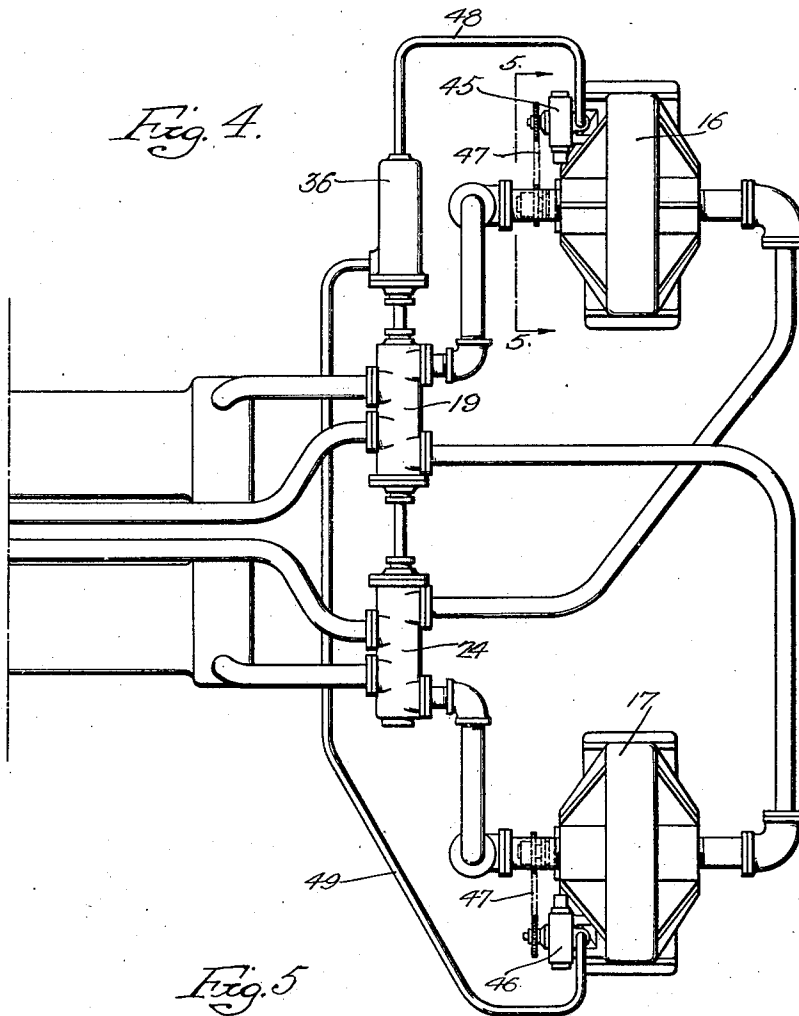
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AUTOMATIC CHANGE-OVER SYSTEM FOR HYDRAULIC APPARATUS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

1,955,922

AUTOMATIC CHANGE-OVER SYSTEM FOR
HYDRAULIC APPARATUSRobert C. Lamond, Philadelphia, Pa., assignor
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Application March 20, 1931, Serial No. 524,153

6 Claims. (Cl. 60—52)

This invention relates to improvements in hydraulic systems employing a plurality of pumps to supply the fluid pressure to a motor or other actuated mechanism, said pumps being adapted for selective operation and one constituting a reserve for the other.

A principal object of the invention is to provide a novel and improved automatic change-over system whereby operation may be shifted from one of said pumps to another without preparatory adjustment of valves or other control elements.

Another object is to include in said system means whereby the pumps may be used simultaneously or jointly.

My invention has a particularly useful application to hydraulic steering gears, and a further object of the invention, therefore, is to provide a steering gear of the stated character, including one or more reserve pump units, in which the change-over operation to a reserve unit may be accomplished with relatively great rapidity and with a minimum of operations.

The invention further resides in certain structural and mechanical details hereinafter set forth and illustrated in the attached drawings, in which:

Figure 1 is a plan view of a hydraulic steering gear made in accordance with my invention;

Figs. 2 and 3 are fragmentary sectional views illustrating details of my apparatus;

Fig. 4 is a fragmentary plan view of a portion of a steering gear illustrating a modification within the scope of my invention, and

Fig. 5 is a section on the line 5—5, Fig. 4.

With reference to the drawings, 1—2—3—4 designate two pairs of aligned cylinders which with the associated plungers, 5 and 6 respectively, constitute a reciprocating double-acting fluid motor, this motor being operatively connected through the medium of rods 7 and 8, connected respectively to the intermediate portions of the plungers 5 and 6, to a yoke 9 upon a rudder post 11. As illustrated in Fig. 1, the yoke 9 has at opposite sides of the post 11 longitudinal guideways, 12 and 13, for reception of sliding blocks 14 and 15 to which the said rods 7 and 8 are respectively connected. Fluid under pressure is supplied to the cylinders 1—2—3—4 for actuating the plungers 5 and 6 from either one of a pair of pumps 16 and 17, which preferably are of the reversible discharge type illustrated in U. S. Patent No. 1,077,979. These pumps are adapted to operate separately, the one constituting a reserve for the other. The plungers 5 and 6 are adapted to operate simultaneously in opposite

directions, and for this purpose, provision is made for connecting the cylinders to the pumps so that reversal in the direction of the pump discharge will result in the aforesaid opposite reciprocation of the plungers.

As illustrated in Fig. 1, a pipe 18 extending from one of the ports of the pump 16 is connected through a valve 19 with pipes 21 and 22 extending respectively to the outer ends of the cylinders 2 and 3; while the corresponding port of the pump 17 is connected through a pipe 23 and valve 24 with pipes 25 and 26 extending respectively to the outer ends of the cylinder 1 and the cylinder 4. The other port of the pump 16 is connected through a pipe 27 with the valve 24, while a pipe 28 similarly connects the valve 19 with the corresponding port of the pump 17.

The construction of the valves 19 and 24 is illustrated in Fig. 2. Each of the valves contains a plunger 29 which operates in a cylinder with which the respective associated pipes communicate. When the pistons 29 occupy positions in the housings, as illustrated in Fig. 2, they respectively close the valves ports to the pipes 23 and 28, the pipes 21 and 22 of the valve 19 being left in communication with the pipe 18, while the pipes 25 and 26 of the valve 24 are left in communication with the pipe 27. Assuming the pump 16 to be in operation and the pump 17 inoperative, it will be apparent that in one direction of pump discharge the pipes 21 and 22 will be connected through the pipe 18 with the pump suction, while the pipes 25 and 26 through the pipe 27 will be connected with the discharge. The direction of flow may, for example, be as indicated by arrows in Fig. 2, and it will be apparent that the cylinders 1 and 4 will then be under pressure and the cylinders 2 and 3 under suction, this resulting in a movement of the plunger 6 to the left, see Fig. 1, and a simultaneous movement of the plunger 5 in the opposite direction. Reversal of the direction of discharge in the pump 16 must necessarily result in a reversal of the movements of the plungers 5 and 6.

With the plungers 29 at the opposite ends of their cylinders, the valve ports communicating with the pipes 18 and 27 are closed, while the ports to the pipes 23 and 28 are open, and operation of the motor must then necessarily be through the medium of the pump 17 to which, through the aforesaid pipes 21, 22, 25 and 26, the valves 19 and 24, and the pipes 23 and 28 the cylinders are directly connected for operation as described above. In this case also,

reversal of the direction of discharge of the pump results in a reciprocation, always in opposite directions, of the plungers 5 and 6.

Heretofore in apparatus of the general type described above, a distributing valve was employed requiring manual adjustment when the operation was to be shifted from one pump to the other. In many instances, it is required that the change-over from one pump to another be extremely rapid, and the necessity for adjustment of the distributing valve both complicated and delayed the change-over operation. In accordance with the present invention, I provide means whereby this change-over is accomplished automatically by the act of setting the reserve pump in operation.

In the embodiment of my invention illustrated in Figs. 1 to 3, inclusive, I provide supplemental pipes 31 and 32 communicating respectively with the ports of the pump 16 and with opposite ends of a cylinder 33 containing a shuttle valve 34, see Fig. 3. Since one of the pipes 31 and 32 will always be connected with the discharge port of the pump and the other with the suction port the valve 34 will necessarily assume a position in the cylinder 33 in which the pressure side of the pump, regardless of the direction of discharge, is connected, through a pipe 35 extending from the mid section of the cylinder 33, with an end of a pressure cylinder 36, see Figs. 1 and 2. The opposite end of this cylinder 36 is connected through a pipe 37 with a valve casing 38 corresponding to the valve 33 and connected in similar manner through pipes 39 and 41 with the two ports of the pump 17, thus providing that the discharge pressure of the latter pump, when operated, will be applied continuously to the associated end of the cylinder 36. Within the pressure cylinder 36 is a piston 42, to which is connected a rod 43 extending to the plunger 29 of the valve 19, and a second rod 44 connects the plungers 29 together. Assuming operation of the pump 16, pressure is applied through the pipe 35 to the end of the cylinder 36 as indicated by the arrow in Fig. 2, thereby forcing the piston 42 to the opposite end of the cylinder and adjusting the plungers 29 to the positions in which they are shown in Fig. 2. It will be noted that in these positions, the ports connecting the valves 19 and 24 with the pipes 23 and 28 are closed. In event that the pump 16 goes out of operation and the pump 17 is thrown in, pressure is applied through the pipe 37 to the cylinder 36, which results in a movement of the piston 42 to the opposite end of its cylinder, and adjustment of the plungers 29 of the valves 19 and 24 to the opposite ends of the valve chambers, in which positions they close the ports communicating with the pipes 18 and 27, while establishing communication between the pipes 23 and 28 and the pipes 21, 22, 25 and 26. It will be apparent that the apparatus as described operates automatically with the change-over operation from one pump to the other, to connect the cylinders 1, 2, 3 and 4 with the operating pump to afford an actuation of the plungers 5 and 6 as previously set forth.

In the modification of my invention illustrated in Figs. 4 and 5, I have eliminated the shuttle valves 33 and 38 and their respective connections and utilize in their place auxiliary pumps 45 and 46 respectively operatively connected with the pumps 16 and 17. Each of the pumps 45 and 46 is operatively connected through a chain drive 47 with the rotary shaft of the associated pump

16 or 17, whereby operation of either of these last-named pumps results in operation of the auxiliary pump connected thereto. The pump 45 is connected through a pipe 48 with one end of the control cylinder 36, while the opposite end of this cylinder is connected through a pipe 49 with the pump 46. Each of the pumps 45 and 46 is connected to a suitable source of fluid supply such as the make-up tanks of the pumps 16 and 17. Assuming operation of the pump 16, the resultant simultaneous operation of the pump 45 results in application of fluid pressure to the end of the control cylinder 36 and movement of the piston 42 to the position shown in Fig. 2, the plungers 29, 29 of the valves 19 and 24 being thus moved to the positions illustrated in Fig. 2. If the pump 16 goes out of operation and the pump 17 is set in operation, pressure is applied to the opposite end of the control cylinder 36 through the pipe 49 from the auxiliary pump 46, with the result that the piston 42 and the plungers 29, 29 are shifted to the opposite ends of their respective cylinders whereby the appropriate connections between the pump 17 and the cylinders 1, 2, 3 and 4 automatically take place.

It is sometimes desirable to employ the pumps jointly in operating the motor, and provision for such joint operation is made, see Fig. 1, in the valve controlled by passes 51, 52, which respectively connect the corresponding ports of the two pumps. When the valves 53 and 54 are open, both pumps may operate for joint actuation of the motor.

There may be other embodiments and modifications without departure from my invention.

I claim:

1. An hydraulic system comprising a fluid motor, pumps operatively connected with and adapted for individual and selective operation to actuate the motor, a valve unit adapted in alternative positions to connect one of said pumps with the motor and disconnect another of said pumps, an auxiliary motor for moving said valve unit to said alternative positions, and means automatically operative through actuation of either of said pumps individually for actuating the said auxiliary motor to shift the valve unit into position to connect the actuated pump with the motor.

2. An hydraulic system comprising a fluid motor, pumps operatively connected with and adapted for individual and selective operation to actuate the motor, a valve unit controlling the said connections between the pumps and the motor and adapted in alternative positions to disconnect one of said pumps from and to connect the other of said pumps with the motor, and pressure-controlled valve-actuating means operatively associated with both of said pumps and operative by each of said pumps individually to actuate the valve unit to connect the operating pump to the motor.

3. An hydraulic system comprising a fluid motor, pumps operatively connected with and adapted for individual and selective operation to actuate the motor, a valve unit adapted in alternative positions to disconnect one and to connect another of said pumps with the motor, an auxiliary motor for actuating the said valve unit, and means for connecting said auxiliary motor with the pumps whereby operation of either of said pumps individually effects an adjustment of the valve unit connecting the operated pump with the motor,

4. An hydraulic system comprising a fluid motor, pumps operatively associated with and adapted for individual and selective operation to actuate the motor, a valve unit controlling the connection between the motor and said pumps and adapted in alternative positions to disconnect one and connect the other of said pumps with the motor, an auxiliary fluid motor for actuating the valve unit, and bypasses from each of said pumps to the auxiliary motor whereby operation of either of the pumps individually actuates the auxiliary motor to connect the operated pump with the motor.

5. An hydraulic system comprising a main fluid motor, main pumps operatively associated with and adapted for individual and selective operation to actuate the motor, valve mechanism controlling the connections between the motor and said pumps and adapted in alternative positions to connect said pumps individually with the motor, an auxiliary fluid motor for actuating the valve mechanism, and an auxiliary pump operatively connected with each of said main pumps and connected with the auxiliary motor whereby actuation of either of said main pumps results in

an actuation of the auxiliary motor adjusting the valve mechanism to connect the operated main pump with the said main motor.

6. An hydraulic system comprising a reversible fluid motor, reversible discharge pumps operatively associated with said motor and adapted for individual and selective operation to actuate the motor, valve mechanism controlling the connection between said pumps and the motor and adapted in alternative positions to individually connect the pumps with the motor, an auxiliary fluid motor for actuating the valve mechanism, and means operatively connecting each of said pumps with the auxiliary motor whereby operation of either pump individually effects an actuation of the auxiliary motor adjusting the valves to a position connecting the operated pump with the main motor, the connecting means between each of said pumps and the auxiliary motor comprising a bypass from each port of the pump, and a shuttle valve actuated by fluid pressure in said bypasses for connecting the bypasses individually with the said auxiliary motor.

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