Feb. 4, 1947. F. J. WRIGHT 2,415,326

HYDRAULIC APPARATUS

Filed April 9, 1943 2 Sheets-Sheet 1

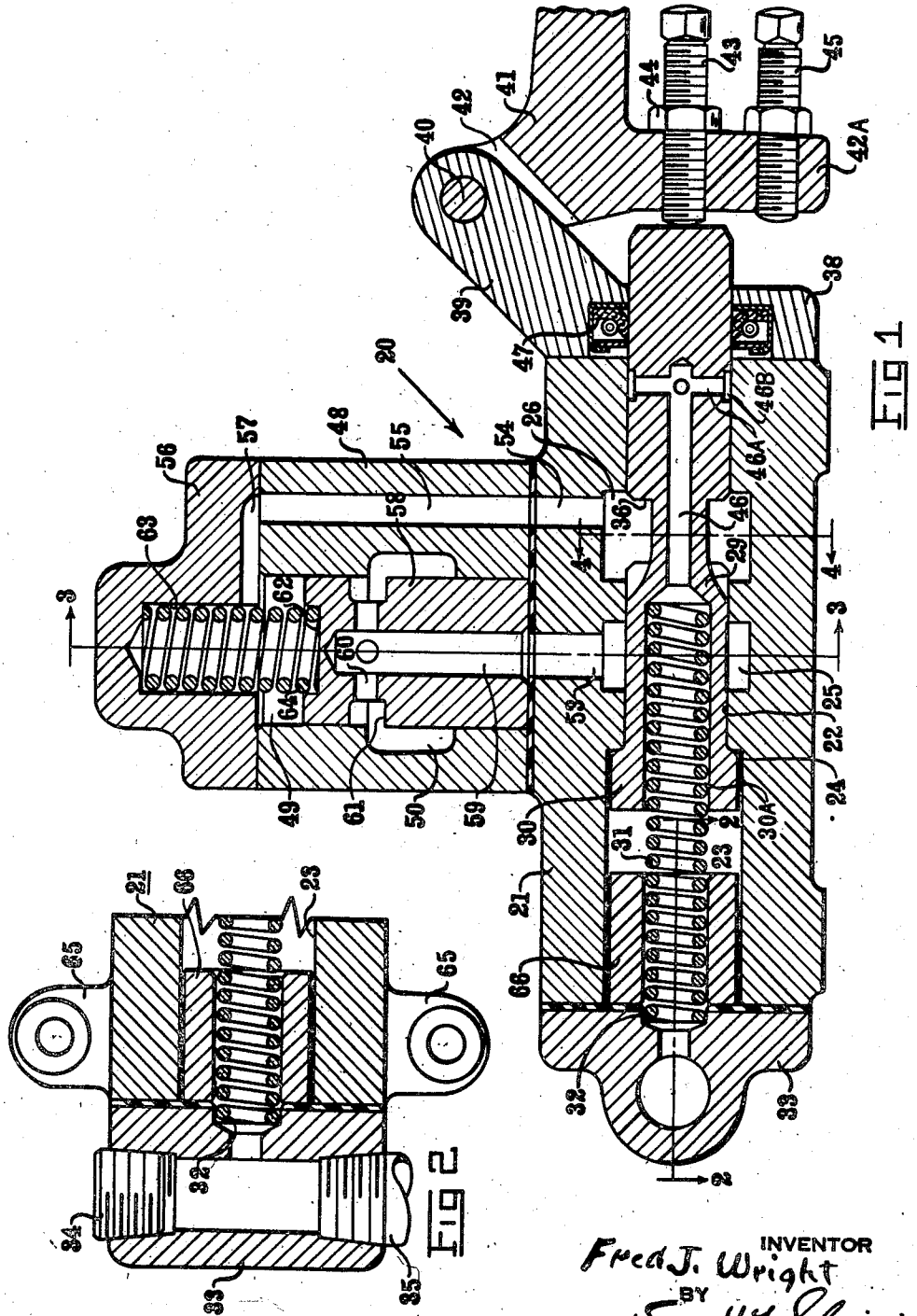


Fig 1

Fig 2

Fred J. Wright INVENTOR

BY

Warren H. F. Schmieding

ATTORNEY

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HYDRAULIC APPARATUS

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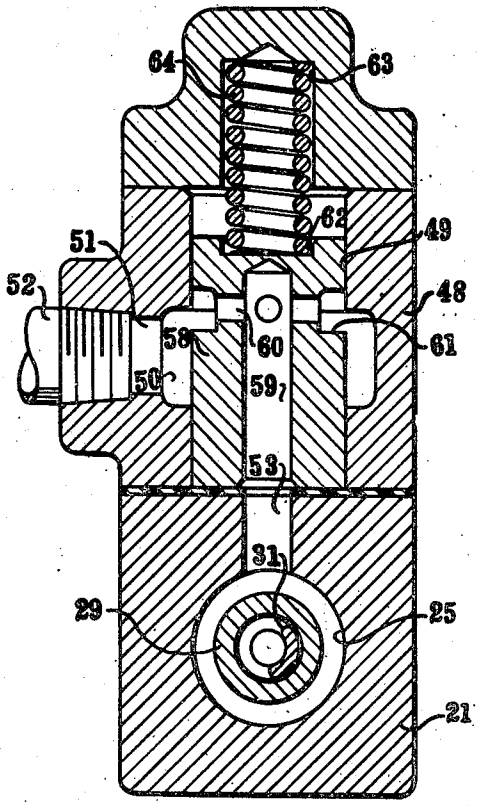


Fig 3

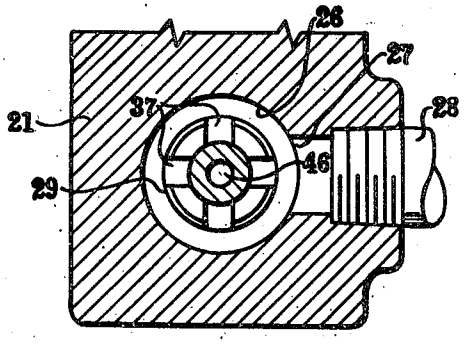


Fig 4

INVENTOR
Fred J. Wright
BY
Warren H. F. Schmieding
ATTORNEY

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UNITED STATES PATENT OFFICE

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HYDRAULIC APPARATUS

Fred J. Wright, Columbus, Ohio, assignor to The Denison Engineering Company, Columbus, Ohio, a corporation of Ohio

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6 Claims. (Cl. 137—153)

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This invention relates to apparatus employed in the field of hydraulics and is particularly directed to valve devices for controlling the flow of fluid under pump pressure in hydraulic systems.

At the present time, a great amount of machinery is operated by power which is transmitted from a prime mover to the driven member by hydraulic means. One form of hydraulic motion transmitting means includes a hydraulic circuit in which is arranged a power driven pump and a fluid motor connected by fluid conductors. The motor is associated with and operates a machine for performing some useful work. During the operation of the machine the flow of fluid under pressure must be so controlled that sufficient power will be transmitted to the fluid motor to drive the machine while under a load, then, when the load is removed, the supply of power must be diminished, otherwise, the fluid motor and machine will run at high speed with consequent danger of injury thereto. Since ordinary valve devices will not adequately control such systems without constant attention, it is an object of this invention to provide a valve mechanism which will automatically control fluid flow to the motor in such manner as to avoid the objection mentioned above.

It is another object of the invention to provide a throttle valve which can be set to open under manual actuation, to a predetermined extent to admit a certain volume of fluid at a certain pressure and which is equipped with a supplemental valve operated by fluid pressure to automatically control the fluid flow in response to fluctuations in pressure caused by changing conditions of operation of the fluid motor and machine actuated thereby.

A further object is to provide a valve mechanism for controlling the flow of fluid under pressure to a fluid motor, the mechanism including a throttle valve which is manually operated to initially admit fluid to the motor and a second valve which automatically reduces the volume of fluid admitted to the motor when it tends to race due to its load being reduced or eliminated.

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

Fig. 1 is a vertical longitudinal sectional view taken through a control valve formed in accordance with the present invention;

Fig. 2 is a detail horizontal sectional view taken through the valve on the plane indicated by the line 2—2 of Fig. 1;

Fig. 3 is a vertical transverse sectional view taken on the plane indicated on the line 3—3 of Fig. 1; and

Fig. 4 is a similar view on the plane indicated by the line 4—4 of Fig. 1.

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Referring more particularly to the drawings, the numeral 20 indicates the control valve in its entirety. In the form of the invention illustrated, the valve includes a body 21, which may be formed from a metallic casting or other suitable material and is provided with a longitudinally extending bore 22. One end of the body is counterbored as at 23 to provide a shoulder 24 intermediate the ends of the body. The bore 22 communicates with a pair of spaced chambers 25 and 26, the latter of which is in open communication, as shown in Fig. 4, with an outlet port 27. A fluid conductor 28 extends from this port to a fluid motor or other type of mechanism, the operation of which is to be governed.

The bore 22 is provided for the reception of a barrel type valve member 29 which closely fits the bore and is slidable therein. The barrel has a head 30 at one end which provides a shoulder for engagement with the shoulder 24 to limit the longitudinal movement of the barrel in one direction in response to the force of a spring 31 which has one end disposed in a recess 30A formed in the barrel and the other in a socket 32 formed in a head 33 secured to the end of the body 21. This head has a T-shaped fluid passage formed therein which communicates with the bore in the body and is threaded at each end of the cross bar of the T for the reception of a plug 34 and the threaded end of a conduit 35. The spring 31 serves to resiliently hold the barrel with the head thereon in engagement with the shoulder 24. At this time, an annular groove 36 provided in the barrel registers with the chamber 26 which communicates with the outlet port. The barrel has a plurality of slots 37 formed therein which communicate with the annular groove and provide for various degrees of communication between chambers 25 and 26 upon movement of the barrel in opposition to the spring 31. To effect this movement, the front end of the body is provided with a packing head 38 which has a lateral projection 39 provided thereon. This projection receives a pivot 40 which serves to connect a lever 41 thereto for swinging movement, which lever has bosses 42 projecting from one side for the reception of the pivot 40. Another boss 42A projects from the opposite side of

the lever and is in registration with the barrel; this boss is provided with a threaded opening in which a set screw 43 is positioned. A jam nut 44 serves to maintain the set screw in positions of adjustment wherein the end thereof engages the outer end of the barrel 29. As the lever 41 is swung in one direction about the axis of the pivot 40, the set screw 43 will move the barrel into the body until the slots 37 enter the chamber 25. At this time, fluid may flow from the chamber 25 to the chamber 26. The volume of fluid at any given pressure which can flow from chamber 25 to the other chamber 26 will depend upon the distance the barrel is moved. When the desired volume, or the extent of movement of the barrel to secure the same, is determined, a second set screw 45 is adjusted in the boss 42 until the end engages the packing head 38. From the foregoing, it will be seen that, through the provision of the lever and set screws, the barrel can be set to establish the same size passage between the chambers 25 and 26 each time the lever is operated.

The barrel has a longitudinal passage 46 provided therein which communicates with transverse passages 46A extending to a small groove 46B provided in the barrel between the annular groove 36 and the outer end. The groove and these passages serve to catch any fluid which might flow between side wall of the bore and the barrel and conducts the same to the counterbored passage 23 in the head 30 from which it may flow to a reservoir through the conduit 35. To further avoid the escape of fluid around the barrel 29, the head 38 is provided with a packing ring 47.

One side of the body 21 has a raised pad for the reception of a block 48 which constitutes a lateral extension of the body 20 when it is secured thereto. This block includes a guide bore 49, the intermediate portion of which is enlarged to form a chamber 50. This chamber communicates with the inlet port 51 (see Fig. 3) of the valve and the port 51 is connected by a fluid line 52 extending from a source of fluid under pressure. The source of fluid may be a pressure tank, pump, or any other means of fluid supply. The side of the body 21 to which the block 48 is attached is provided with a relatively short passage 53 by which the bore 49 is connected with the chamber 25 in the main valve body. A second short passage 54 in the body 20 extends from the chamber 26 and communicates with a passage 55 extending through the block 48 in spaced parallel relation to the bore 49. The open upper end of a bore 49 is closed by a cap 56 which is suitably secured to the upper end of the block 48 and this cap has a groove 57 formed therein which establishes communication between passage 55 and the upper end of the bore 49. The purpose of this communication will be set forth hereafter.

A spool 58 is disposed for sliding movement in the bore 49 and this spool 58 has a central passage 59 extending thereinto from the bottom. The upper portion of this passage 59 is connected by transverse ports 60 with an annular groove 61 provided in the outer surface of the spool 58 adjacent to the upper end. The upper face of the spool 58 has a pocket 62 formed therein in registration with a similar pocket 63 formed in the cap 56. These pockets receive the ends of a coil spring 64 which normally serves to yieldably urge the spool toward the lower end of the bore 49. When the spool is in this lower position, fluid may flow without restriction from the fluid line 52, through the inlet 51 and chamber 50, to the passage 59 and through the passage 53 into the chamber 25. In the event the barrel 29 is in the position shown in Fig. 1 where communication between chambers 25 and 26 is interrupted, the fluid pressure on the underside of spool 58 at the upper end of the passage 59 and on the bottom of the spool 58 serves to move the same against the force exerted by the spring 64 until the lower edge of the groove 61 reaches the upper edge of the chamber 50 at which time the flow of fluid into the passage 59 will be precluded.

In the use of the valve, the lever 41 is depressed until it reaches the predetermined stopping point. This operation will place the slots 37 in such a position as to permit fluid to flow under pressure from the chamber 25 to the chamber 26 and through the outlet port to the conduit 28 which will carry it to the fluid motor. When this fluid flows from the chamber 25, pressure therein and below the spool 58 will be lowered and the spring 64 as well as the weight of spool 58 will move the spool downward to admit more fluid. Continued fluid flow will operate the motor and its work will be performed. If the load on the motor should be diminished or eliminated, there would be a tendency for the motor to run at high speed. At this time, however, the pressure in the line 28 leading to the motor will drop, due to the load being removed and this reduction in pressure will be transmitted through the passages 54 and 55 and groove 57 to the upper end of the bore 49. A differential in pressure between the upper and lower ends of the spool member will then exist. When this differential becomes sufficient to overcome the force of spring 64 and the weight of spool 58, the the latter will move in opposition to the spring to diminish the flow of fluid into the valve body chamber 25 as before described. This fluid control will take place automatically without any attention on the part of the operator and with the lever 41 retained in position to provide for the predetermined maximum opening of the barrel valve 29.

It will be seen that a valve mechanism has been provided which will automatically control the operation of a fluid motor and prevent injury thereto due to high speed which might occur in the absence of such a valve. No attention by the operator is necessary since the flow is controlled by fluctuations in pressure in the line leading to the motor. Thus, when the load is restored or a new load applied to the fluid motor or the mechanism operated thereby, pressure in the fluid line 28 will increase and this increased pressure will be transmitted through the passages 54, 55 and groove 57 to the upper end of the bore 49. As the combined forces exerted by this pressure, the weight of the spool 58 and the spring 64 exceed the upward pressure exerted on the spool by the fluid therebeneath, the spool will move downward to increase the flow of fluid from chamber 50 to chamber 25. This increased flow will supply the power needed by the motor to counteract the additional load and the motor will therefore operate at a substantially constant rate regardless of the load imposed thereon.

The valve unit may be secured to any suitable support by passing bolts or screws through apertured lugs 65 which project from the sides of the valve body 21.

To prevent undue movement of the barrel in

the bore 22, a stop member 66 is positioned in the counterbore 23. This member comprises a cylindrical body of a diameter suitable for insertion in the counterbore 23 and having a hole extending therethrough. The valve mechanism shown and described serves as a safety device and may be employed in many capacities other than the one set forth herein.

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

I claim:

1. In a hydraulic system, control mechanism comprising in combination, a housing forming a cylinder having an inlet port intermediate the ends thereof, a piston in said cylinder, said piston being closed at one end and having a valve port in the cylindrical wall thereof cooperating with said inlet port in the cylinder for varying the flow of fluid between said ports, said piston having a passage extending from the port in the piston to the end opposite the closed end of the piston, said housing having a plurality of chambers, and passages connecting one of said chambers, with one end of the cylinder and another chamber with the other end of the cylinder, a manually actuated valve for controlling the flow of fluid between said chambers and an outlet port extending from a chamber other than that connected with the end of the passage in said piston.

2. In a hydraulic system, control mechanism comprising in combination, a housing forming a cylinder having an inlet port intermediate the ends thereof, a piston in said cylinder, said piston being closed at one end and having a valve port in the cylindrical wall thereof cooperating with the port in the cylinder for varying the flow of fluid from the inlet port, said piston having a passage leading from the inlet port in the piston to the end opposite the closed end of the piston for conducting fluid to one end of the cylinder, means normally urging the piston toward said one end of the cylinder to thereby increase the flow of fluid through the ports, said housing having a plurality of chambers, and passages connecting one of said chambers with said one end of the cylinder and the other chamber with the other end of the cylinder, and a valve for controlling the flow of fluid between said chambers, said other chamber having an outlet adapted to be connected with a work machine.

3. In a hydraulic system, a housing having transversely extending bores, one of said bores providing a cylinder having an inlet port intermediate the ends thereof, a piston in the cylinder and having a port in the cylindrical wall thereof cooperating with the cylinder port for controlling the flow of fluid between the ports, one end of the piston being closed, said piston having a passage leading from the port thereof to one end of the cylinder, a spring normally urging the piston toward said end of the cylinder to increase the flow of fluid through said ports, a valve in the other bore dividing the bore into two chambers, said housing having a passage connecting said one end of the cylinder with one of the chambers and having a passage connecting the opposite end of the cylinder with the other chamber, said other chamber having an outlet adapted to be connected with a work machine.

4. Flow control mechanism comprising a body with an elongated bore and inlet and outlet passages communicating therewith at longitudinally spaced points; a lateral projection provided on said body, said projection having a chamber connected at one end with one and at the opposite end with the other of said passages, said chamber having an inlet port intermediate the ends; a piston movably disposed in said chamber, said piston having passage means to connect the inlet port with the inlet passage in said body; means tending to urge said piston toward one end of said chamber to provide maximum flow through said inlet port; a plunger valve disposed for movement in said bore to control communication between said inlet and outlet passages; means tending to maintain said plunger in communication obstructing position; and means for manually actuating said plunger.

5. In a hydraulic system, a housing having transversely extending bores, one of said bores providing a cylinder having an inlet port intermediate the ends thereof, a piston in the cylinder and having a port in the cylindrical wall thereof cooperating with the inlet port for controlling the flow of fluid between the ports, one end of the piston being closed, said piston having a passage leading from the port thereof to one end of the cylinder, a valve in the other bore dividing the bore into two chambers, said housing having a passage connecting said one end of the cylinder with one of the chambers and having a passage connecting the opposite end of the cylinder with the other chamber, said housing having an outlet port communicating with the latter chamber, and manually operated means for actuating said valve to control fluid flow between said chambers.

6. In a hydraulic system, control mechanism comprising in combination, a housing forming a cylinder having an inlet port intermediate the ends thereof; a piston in said cylinder, said piston being closed at one end and having a passage arranged to communicate with said inlet port and with one end of the cylinder, said housing having a plurality of chambers and passages connecting one of said chambers with said one end of the cylinder and the second of said chambers with the other end of the cylinder; a manually actuated valve for controlling the flow of fluid between said chambers; and an outlet port leading from the second of said chambers.

FRED J. WRIGHT.

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