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HYDRAULIC SYSTEMS

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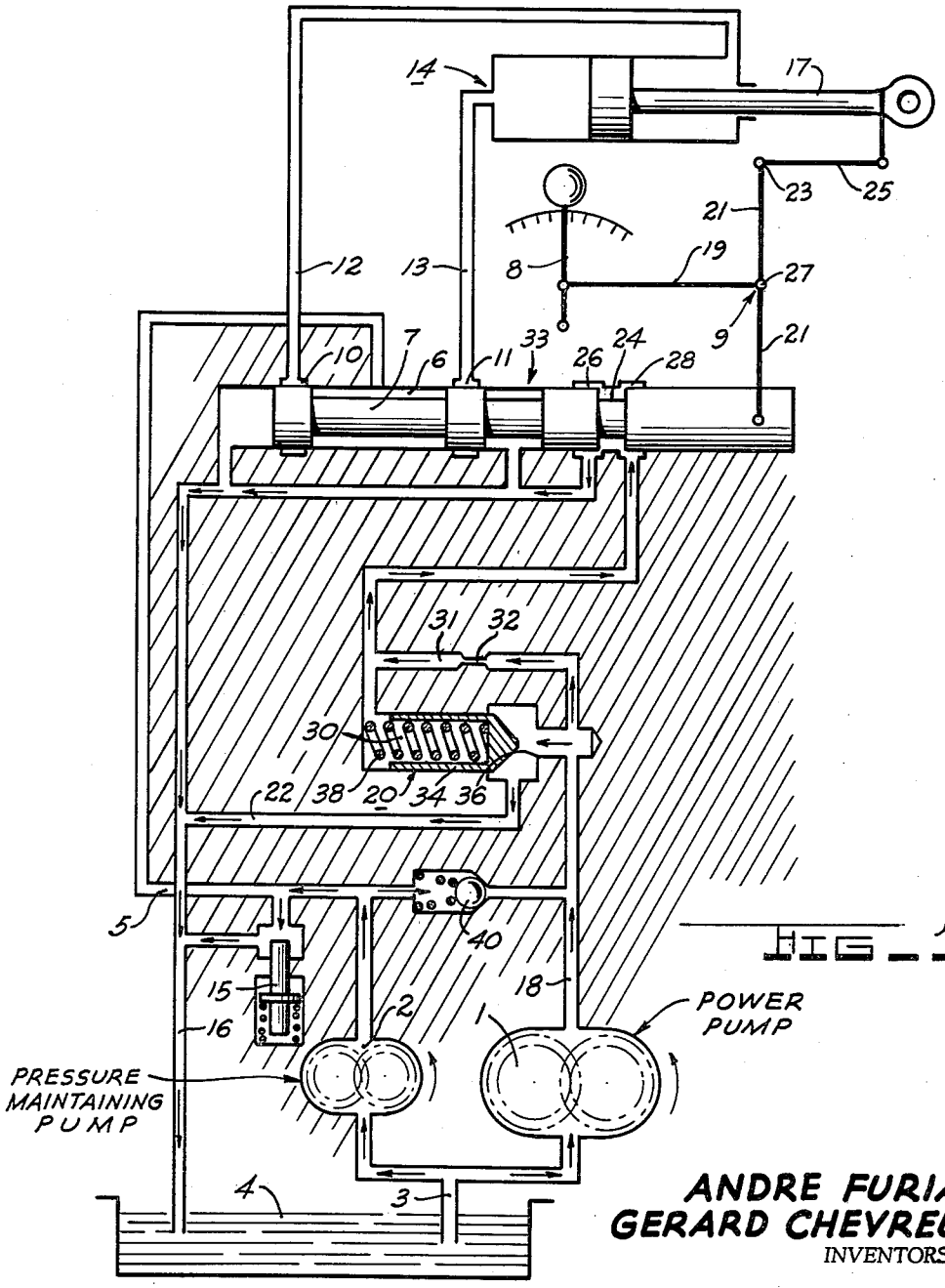


FIG_1

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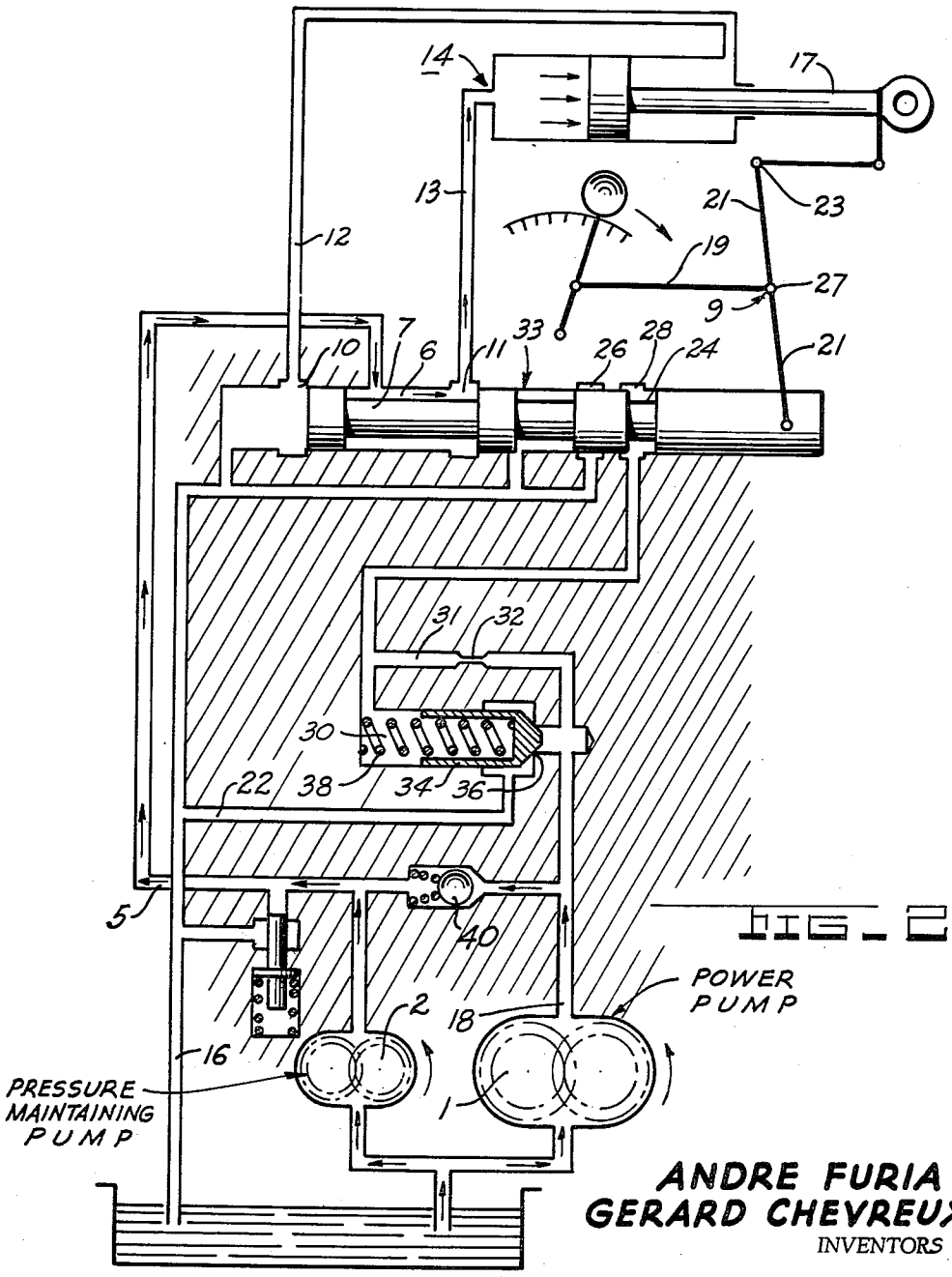


FIG. 2

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HYDRAULIC SYSTEMS

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2 Claims. (Cl. 60—52)

The invention relates to hydraulic systems and more particularly to improvements in hydraulic systems suitable for use on tractors for operating "mounted" agricultural implements though this use is in no manner limitative.

In order to increase the useful life of the power pump embodied in the hydraulic systems of the above type, it has been common practice not to maintain the pump under full pressure for the long time durations when the lift system remains in standby condition. But such a result has been attained only through costly and intricate systems or at the cost of a precision loss in the control of the implements.

It is an object of the invention to provide a hydraulic system wherein the power pump is connected to the return reservoir and operates idle as long as the system remains in standby condition.

It is an important object of the invention to provide a hydraulic system wherein a power pump is communicated direct to a discharge reservoir by a valve piloted by the manually actuated distributor valve when the latter is in its neutral position and wherein the communication is cut-off by the piloted valve when the distributor or control valve is moved from its neutral position.

It is another object of the invention to provide an hydraulic system wherein a low rate of flow under high pressure is maintained by a low-discharge pump when the system is in standby condition and wherein a sufficient rate of flow is provided by a power pump complementing the low-discharge pump when the system is actuated.

It is an overall object of the invention to provide a hydraulic lift device which is rugged in structure, reliable in operation, and simple in construction.

Other objects and advantages of the invention will appear on reading the following description which refers to the accompanying drawings which form a part of the specification and show a preferred embodiment of the invention which should be regarded as illustrative and not limitative of the invention.

In the drawings:

FIGURE 1 is a schematic view of a double acting hydraulic lift system, the distributor valve being shown in neutral position.

FIGURE 2 is a view similar to FIGURE 1, the distributor valve being shown in "raising" position.

Referring to the drawings, there is provided a hydraulic lift system comprising two pumps 1, 2 (optionally located in the same housing) supplied with hydraulic fluid by a reservoir or sump 4 connected to the common inlet 3 of the two pumps. The power pump 1 delivers a high rate of flow under a pressure which can increase up to the working pressure, but which is normally maintained at a low value by a valve communicating the pump to the return reservoir as long as the system is in standby condition. The pressure-maintaining pump 2 delivers in a pressure line 5 a rate of flow sufficient to compensate for leaks and normally maintaining the system at a pressure slightly above the working pressure and determined by the relief valve 15 connected between the pressure line 5 and a return line 16. The pressure line 5 opens in an annular chamber 6 of a distributor or control valve 33. The spool member 7 is formed with lands which overlap counterbores 10, 11 in the valve bore when the valve is in neutral position, as shown on FIGURE 1,

and separate the annular chamber 6 and lateral chambers connected to a return line 16. When the spool member 7 is moved away from its neutral position, the lands uncover the counterbores 10, 11 respectively communicated by cylinder lines 12, 13 with opposite chambers of a lift cylinder 14, as shown on FIGURE 2. The lift cylinder 14 has a piston or working member 17 which may be operatively connected to a body member to be lifted or lowered.

The distributor or control valve is manually controlled by means of a lever 8 connected to the spool member 7 of the valve through a conventional follow-up linkage 9. Upon movement of lever 8 in either direction, the spool member 7 will move from neutral to operating position in the same direction with the linkages 19 and 21 pivoting together about connection 23. When the pressure moves the piston or working member 17, linkages 25 and 21 together pivot about connection 27 thereby restoring the spool member 7 to neutral position and closing off the lift cylinder from communication with the pumps and reservoir after a certain amount of work has been performed by movement of member 17, which amount has been preset by the position of manual lever 8.

The rate of flow of pump 2 acting alone would provide a too slow actuation of the power cylinder, but this rate of flow is sufficient to maintain chamber 6 pressurized as long as the distributor valve 33 is in neutral position (FIGURE 1); in standby condition, the system then remains under pressure and ready to operate innstantaneously. The power pump, which delivers a rate of flow sufficient to actuate the cylinder at a proper speed, feeds a discharge line 18 which is normally communicated by a piloted valve 20 with a return passage 22 connected to the return line 16 and then to the reservoir.

Operation of the piloted valve is controlled by an end portion of spool member 7 formed with a groove 24. When in neutral position, the groove places in communication a pair of counterbores 26, 28 formed in the distributor valve housing and respectively connected with the return line 16 and with a rear chamber 30 of piloted valve 20. Counterbore 28 is also communicated with the working pump discharge line 18 by a by-pass 31 having a restriction 32.

The piloted valve 20 comprises a valve head 34 sealingly slidable in a bore and having a front end adapted to come into sealing abutment against a seat 36, thereby closing communication between discharge line 18 and return passage 22. A light spring 38 located in the rear chamber 30 of the valve biases the valve head 34 toward its seat.

It should be noted that one or a plurality of manually actuated, open center valves may be provided for actuating auxiliary hydraulic systems: such open center valves of any well known construction will be located on line 18 upstream of the piloted valve 20 so that they maintain free communication as long as all the open center valves are in neutral position; when one of these distributors is actuated the pressure of the fluid delivered by the pump 1 increases obviously up to the value necessary to operate the corresponding auxiliary circuit.

When the pumps are at rest, the piloted valve 20 is closed by spring 38, and there is no pressure in the hydraulic system. If for instance the distributor valve 33 is in neutral position, as shown on FIGURE 1, the counterbores 26 and 28 are in communication. When the pumps begin to operate, a restricted communication is established between pump 1 and return line 16 through working pump discharge line 18, by-pass 31, counterbore 28, groove 24 and counterbore 26. The pressure loss along this path is mainly localized at the restriction 32 and results in a pressure differential between the opposed

end faces of the valve head 34, the pressure in the rear chamber 30 being the lower one. The pressure differential overcomes the force of spring 38 and lifts valve head 34 off its seat, thereby opening free communication between discharge line 18 and return passage 22 connected to return line 16. The pressure loss of the fluid flow across piloted valve 20 remains exceedingly small, as it has just to overcome the force of spring 38 to keep valve head 34 clear from its seat and the pressure level in chamber 30; which is exceedingly low as the cross area of passage between the counterbores 28 and 26 is much larger than that of restriction 32. The almost complete fluid flow then leaves the discharge line through the piloted valve 20. In short, in standby condition, pump 1 delivers flow at a minimum pressure level. But the system is maintained ready to operate by the pressure maintaining pump 2 which delivers flow under the pressure for which the relief valve is set to open, which pressure maintains closed a one-way check valve 40 which then cuts off the distributor valve circuit from the circuit of pump 1.

Passage from "idle" or "standby" condition to "working" condition occurs automatically when the distributor valve is moved from its neutral position. Figure 2 shows the spool member of the distributor valve displaced toward the "raising" position. The left-hand portion of the spool member operates as a conventional distributor member to communicate the annular chamber of the distributor valve with cylinder line 13 and to communicate return line 16 with cylinder line 12, respectively. On the right-hand portion of the spool member, groove 24 ceases to overlap counterbores 28 and 26. The flow through restriction 32 being cut off, the pressures acting on both sides of valve head 34 become equal and spring 38 moves valve head 34 toward its seat 36. As soon as initial closure takes place, the spring force is complemented by the differential pressure acting on the valve head since the pressure of pump 1 then prevails on the full rear area of the valve head while the peripheral portion of the front end face of the valve head is subjected to pressure in the return passage 22. As soon as piloted valve 20 is closed, the pressure delivered by pump 1 in discharge line 18 may increase up to the working pressure. On the contrary, the pressure delivered by pump 2 has decreased to the working pressure and the one-way check valve 40 opens, resulting in pump 1 feeding the pressure line 5 in parallel with the pressure maintaining pump 2.

As soon as the follow-up linkage 9 has restored the spool member into its neutral position, almost simultaneously the power cylinder chambers are respectively separated from lines 5 and 16 and counterbores 26 and 28 are placed again in communication. The working pump 1 then forces fluid flow through the by-pass 31 thereby creating a pressure loss between the opposed end faces of valve head 34, while the pressure in rear chamber 30 so decreases as to permit the pressure of pump 1 exerted on the central portion of the valve head 34 to lift the latter from its seat. The hydraulic system is then switched into standby condition.

It should be noted that the pressure perturbations in the working circuit, particularly in the annular chamber of the distributor valve 6, do not trouble operation of the piloted valve 20 thereby avoiding any instability of the latter.

From the foregoing it will be apparent that we have devised a hydraulic system which may be easily constructed, which provides a smooth operation as hydraulic pressure is instantly available at all times and is trouble free and reliable as the power pump remains idle as long as the system is in standby condition.

Although the invention has been described in connection with a specific embodiment, it will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention. Particularly the cooperation of a distributor valve and of a

piloted valve as described above may be of interest in systems other than those described. Accordingly we do not intend to be limited to the specific embodiment disclosed herein primarily for purposes of illustration but instead desire protection falling within the scope of the appended claims.

What we claim is:

1. In a hydraulic system having a pressure maintaining pump, a power pump, fluid motor means, and a return reservoir; fluid conducting means including a control valve establishing communication of said fluid motor with said pressure maintaining pump output and said reservoir in open position and cutting off said communication in neutral position, means for positioning said control valve, passage means including a one-way check valve communicating said power pump output with said pressure maintaining pump output, said check valve being biased in closed position by the pressure produced by said pressure maintaining pump, said fluid conducting means to said fluid motor combining the flow from both said pumps when increased pressure from said power pump opens said check valve second passage means including a first valve means for normally discharging said power pump output to said reservoir, said first valve means comprising a valve seat communicating the power pump output to the reservoir and a valve member slidable in a bore and seatable on said seat, said valve member having one end subjected to pressure of the power pump tending to unseat said valve member and the other end subjected to a reduced pressure of said power pump tending to seat said valve member, second valve means in said second passage means for communicating said other end with the return reservoir when said second valve means is open, said power pump producing pressure on said other end of said valve member seating the same when said second valve means is closed whereby the power pump pressure is increased to open said check valve, said second valve means being operatively connected with the control valve and so constructed as to be substantially closed when the control valve is substantially open to the fluid motor with the pressure maintaining pump, means interconnecting said motor means and said positioning means for opening said second valve means and positioning said control valve in neutral position in response to predetermined movement of said motor means.

2. A hydraulic lift system comprising a pressure maintaining pump, a power pump, fluid motor means and a return reservoir; fluid conducting means including a control valve comprising a housing and a spool member slidably mounted in a bore of said housing and formed with lands positioned to register fluid motor counterbores of said bore into communication with said pressure maintaining pump output and reservoir when said spool member is in open position and to cut off said communication when said spool member is in a neutral position, means for positioning said spool member, first valve means having a valve member with front and rear faces slidable in a bore, a valve seat, said front face being seatable on said valve seat and spring means biasing said valve member toward its seat, first passage means communicating the power pump output with the front face of said valve member, second passage means communicating the front face of said valve member with the return reservoir, third passage means communicating the rear face of the valve member with the return reservoir, second valve means located in said third passage means, said second valve means comprising a pair of axially spaced counterbores of the bore of said housing, one counterbore communicating with the rear face of said valve member and the other counterbore communicating with the return reservoir, a groove formed on the terminal portion of said spool member, said groove being positioned in open position of said second valve means so as to overlap both last named counterbores when the spool member is in said neutral position and being posi-

tioned in substantially closed position of said second valve means to cut off communication of both last named counterbores when said spool member is in substantially open position, fourth passage means interconnecting said first passage and said third passage means which produces a lower pressure to the rear face of said valve member than at the front face thereof when said spool member is in neutral position whereby said valve member is lifted off its seat by the pressure differential between its front and rear faces to produce open unrestricted communication of said power pump with said return reservoir, fifth passage means communicating the power pump output with the pressure maintaining pump output, a check valve in said fifth passage means biased in closed position by pressure produced by said pressure maintaining pump

when said control valve is in neutral position and biased in open position by pressure produced by said pressure pump when the control valve is in open position, means interconnecting said motor means and said positioning means for positioning said spool member in neutral position in response to predetermined movement of said motor means thereby opening said second valve means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,468,605	Mayer	Sept. 18, 1923
1,982,711	Vickers	Dec. 4, 1934
2,319,551	Linden et al.	May 18, 1943