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HYDRAULIC MOTOR AND SYSTEM

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Fig. 1.

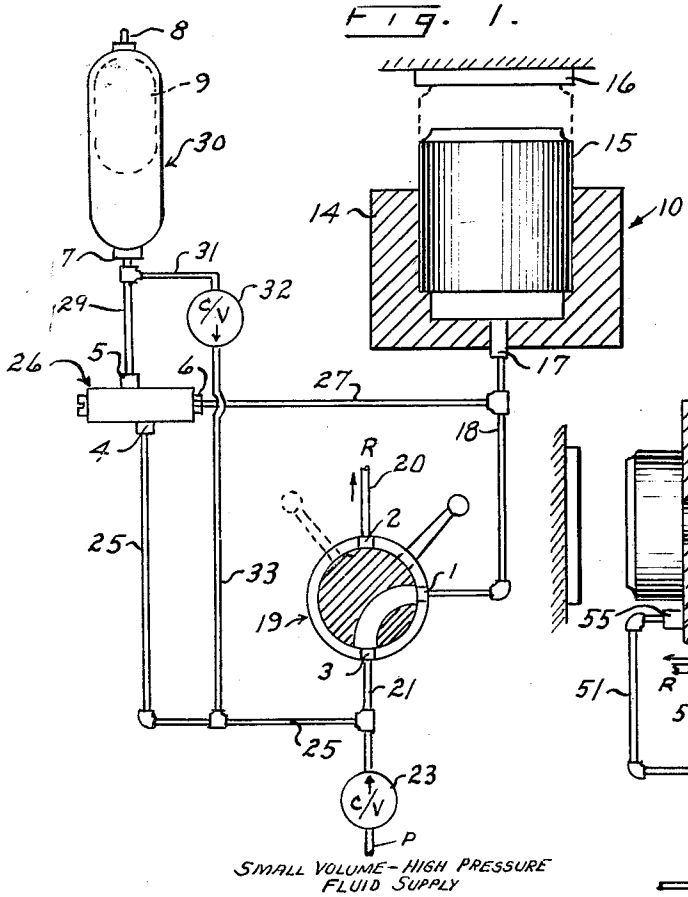


Fig. 3.

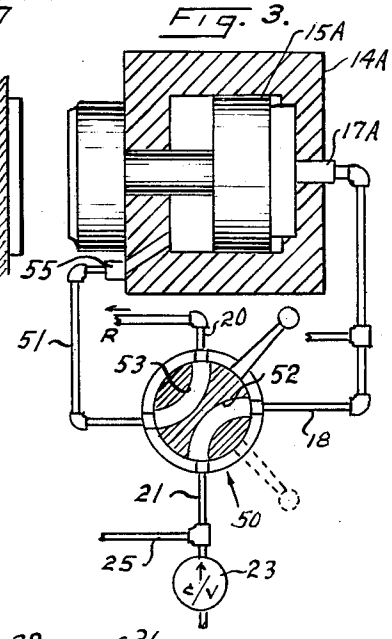
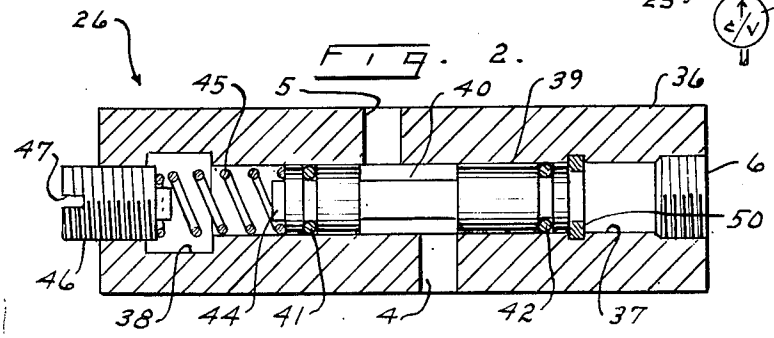


Fig. 2.



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HYDRAULIC MOTOR AND SYSTEM

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4 Claims. (Cl. 60—51)

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This invention relates to fluid operated power motors and their operating system and more particularly to the operation of a single fluid motor that is connected to a common fluid pressure supply in combination with a plurality of similar motors.

This application is related to my co-pending application Serial No. 728,516 filed February 14, 1947, now Patent No. 2,487,126, dated November 8, 1949.

In the past where a plurality of fluid motors have been connected to a common fluid pressure supply, to operate one fluid motor there is ample fluid pressure available. Where a plurality of fluid motors are operated simultaneously from a common pressure source, especially when many power strokes are produced simultaneously this might produce an undesirable condition in which the actual power supplied would be below the predetermined pressure required for the operation of each motor.

It is an object of this invention to utilize a fluid storage accumulator in combination with each motor where a plurality of fluid motors are connected to a common fluid pressure operating supply to insure adequate operating pressure for each power stroke of the motor.

A further object of this invention is to provide a fluid storage means in combination with a hydraulic motor where a plurality of fluid motors are connected to a common fluid pressure supply and in which a manual control valve is provided to connect both the fluid storage means and the common pressure supply to the motor for each power stroke.

Another object of this invention is to provide an individual hydraulic system for each hydraulic motor where a plurality of fluid motors are connected to a common fluid pressure supply which includes a fluid pressure storage means connected to said motor by means of a manually operated valve and in which a normally open sequence operated valve is interposed between the storage means and motor, said sequence valve being closed by a predetermined maximum pressure to prevent charging fluid into the fluid storage means during the operating stroke of the motor.

A further object of this invention is to provide means to utilize a small volume high pressure fluid pump in combination with a plurality of accumulators and check valves to store sufficient hydraulic fluid under pressure in each accumulator and retain said pressure by means of a check valve said accumulator being utilized to produce the work positioning stroke of the hydraulic cylinder and when the hydraulic cylinder has been positioned in its working position, the high pressure fluid flow from said pump may be utilized to produce the power stroke of said cylinder, the small volume high pressure fluid pump producing a static force maintaining a working pressure on the hydraulic cylinder.

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Another object of this invention is to provide a single small volume high pressure fluid pump connected to the individual hydraulic system of each of a plurality of motors in which a check valve is interposed between the supply system and the individual system of the press to permit flow from the supply system to the individual system but not vice versa and in which a fluid storage means in each individual system is normally charged to a predetermined pressure and in which a manually operated valve is utilized to connect the storage means to the motor to permit a large volume flow of fluid for positioning the work cylinder of the motor and subsequently the high pressure flow from the pump for the power stroke of said motor and subsequently by means of said valve means to close said power supply to said motor and allow said motor to dump the fluid and return the work positioning cylinder to its initial position and at the same time permit said pump to charge the storage means to a predetermined pressure.

Other objects of this invention will be apparent by referring to the detailed description of this device and its operation, as well as the accompanying drawing in which:

Fig. 1 is a diagrammatic layout of a fluid press and its individual hydraulic system that may be connected to a common fluid pressure supply,

Fig. 2 is a cross sectional view of the pilot operated valve, and

Fig. 3 is an alternate diagrammatic layout of a fluid cylinder and operating valve.

Referring to Fig. 1 there is illustrated a power press 10 with a hydraulic cylinder 14. The hydraulic cylinder 14 is provided with a piston 15 that in a work position bears against a platen or plate 16 of the press. The hydraulic cylinder 14 through a port 17 is connected by means of a line 18 to a rotary selector valve 19, the selector valve 19 being provided with three ports 1, 2, and 3, port 1 being connected to the line 18, port 2 being connected to a return line 20 and port 3 being connected to a pressure supply line 21, the supply line 21 being in turn connected to a check valve 23 and the opposite end of the check valve in turn being connected to the main pressure line P. The line 21 by means of a T con-

nection is also connected through a line 25 to one port of a pilot operated valve 26. The pilot operated valve 26 is provided with three ports 4, 5, and 6, line 25 being connected to port 4 of the valve. Port 6 of the valve is connected by means of line 27 to the line 18 through a T connection. Port 5 of the pilot valve 26 is connected by means of a line 29 to a fluid storage accumulator 30, the accumulator 30 being a hollow shell structure with an oil port 7 at one end thereof and an air port 8 being connected to a bladder 9 mounted within the accumulator shell. An auxiliary line 31 is connected below the oil port 7 to the line 29 and in turn connected to a check valve 32. The opposite end of the check valve is connected by means of a line 33 to the line 25. The selector valve 19 may be positioned in either of two positions. In the position illustrated, the valve 19 will provide a communicating passage between line 21 and line 18 while the valve 19 in its other position (illustrated in dotted lines) will provide communication between line 18 and line 20. Thus, the valve 19 in one position permits charging the hydraulic press for a positioning stroke and power stroke while the valve 19 in the other position permits the hydraulic press to discharge and allow the hydraulic piston to be restored to an open position (as illustrated in this figure the cylinder 15 will assume an open position by gravity).

Referring to Fig. 2 there is illustrated the pilot valve 26 which is generally barrel shaped. The valve 26 is comprised of a body member 36 with a central bore 37, the bore 37 being provided with an enlarged end bore 38. A pair of ports 4 and 5 are provided through the body 36 and are positioned in a staggered relationship to each other connecting the exterior of the body 36 with the central bore 37. A plunger 39 is provided to fit the bore 37. The plunger 39 is provided with a central section 40 of smaller radius than the bore 37 to thus provide a cutout portion in the center of plunger 39, both ends of the plunger 39 fitting snugly with the bore 37. The end of the plunger 39 may be provided with seals 41 and 42. One end of the plunger 39 is provided with a spring seat 44 and a spring 45 is mounted thereon. The opposite end of the spring 45 abuts against a plug 46, the plug 46 being threadably secured in the body 36 as illustrated. The plug 46 is provided with a cutout portion 47 to permit adjusting the position of plug 46 and thus in turn adjusting the compression of spring 45. In the bore 37 at the opposite end thereof there is provided a lock ring groove 50 and when the plunger 39 has been mounted within the bore 37, a circular snap ring 50 is compressed and passed through bore 37 and allowed to snap into the groove 50 to form a stop for the plunger 39. The bore 37 at the lock ring end is threaded to form the port 6. Thus, it is apparent that the valve 26 in its normal position permits a fluid flow between port 4 and port 5 but when port 6 is connected to a fluid line and sufficient fluid back pressure is exerted through port 6, the plunger 39 will be forced to the left (as illustrated in Fig. 2) until port 4 is sealed off by the plunger to thus prevent the flow of fluid between ports 4 and 5. When the back pressure through port 6 is released, the plunger 39 will be returned to the position illustrated in Fig. 2 by means of the resilient spring 45. It is also apparent that spring 45 may be calculated for a definite pressure value on plunger 39 and it may be easily adjusted by means of plug 46 to obtain an exact pressure value in port 6 to cause the valve to close port 4.

Referring to Fig. 1 we may follow the general operation of the single press 10 illustrated although we must assume that this press is only one of a plurality of presses in which each individual hydraulic system as illustrated in Fig. 1 will be connected to a single pressure source P. The press 10 has been illustrated as a gravity return although any press may be similarly connected and as in our prior application changes may be readily made to provide a pressure return to obtain a similar result. With the system as described above we may assume a predetermined fluid pressure is provided on the main supply line P and referring to my related application mentioned above we may further assume that this is a high pressure supplied from a small low volume pump. Thus the fluid pressure from P will pass through the check valve 23 being charged into the press system as illustrated in Fig. 1. The fluid pressure from check valve 23 is charged into the line 21 and with the valve 19 in the position illustrated in dotted lines, line 21 will be closed by the valve 19. Therefore, the fluid pressure from line 21 will pass through line 25 to the port 4 through the normally opened sequence valve 26 out port 5 through the line 29 and be charged through port 7 into the accumulator 30 and will continue to fill and charge the accumulator 30 pressing the air bladder 9 and deforming the bladder 9 depending upon the air pressure charged in the bladder 9 until the accumulator 30 is fully charged at a predetermined pressure which is equivalent to the pressure supply P. With the accumulator 30 fully charged, we are ready to operate the hydraulic press 10. It may be assumed that with a large piston 15 it is necessary to have a large fluid volume flow at a low pressure quickly to position the piston 15 into a work position, thus moving valve 19 to the position illustrated in Fig. 1. Since we cannot obtain a large volume flow from the supply system P, we do obtain the large fluid volume flow that is necessary from the accumulator 30 through line 31 through check valve 32 through line 33 through line 25 through line 21 through port 3 of valve 19 out port 1 through line 18 into the port 17 of the press charging the press cylinder and forcing it into its work position. Thus with the piston 15 in its working position, we no longer need a large volume flow of fluid and the high pressure low volume flow that is continually available at P will be charged into this supply line 21 and 18. The pressure developed on a non-compressible fluid produces the power stroke on the piston 15. When the pressure in line 18 has increased to a predetermined pressure setting in the sequence valve 26, the fluid pressure through line 27 through port 6 closes the sequence valve 26 to close the port 4 of the valve and thus prevent the high pressure charged from the pump to back up into the accumulator. Due to the check valve 32, the fluid pressure cannot back up through line 33 into the accumulator. Thus the high pressure is exerted only on the piston 15 of the press 10 to produce the power stroke. It is apparent that having completed the power stroke of the press that valve 19 may be moved to the dotted position illustrated and thus the accumulator 30 will again be charged as described and at the same time with valve 19 in a discharge position for the press, the piston 15 will drop by gravity forcing the fluid in the piston chamber out through port 17 at a low pressure through line 18 through port 1 of the valve

19 out port 2 through line 20 to the return line and back to the reservoir (not illustrated).

In Fig. 3 there is illustrated a still further embodiment of this invention in which the hydraulic system illustrated in Fig. 1 is connected to a four way rotary selector valve and fluid cylinder that requires fluid pressure for operation in both directions. With a rotary valve 50 connected to line 21 and the valve 50 in turn being connected by line 18 to one side of a cylinder 14A while the opposite side of the cylinder 14A is connected by means of a line 51 to the opposite port of the valve 50. The valve 50 is a three position rotary selector valve having a neutral or intermediate position in which all ports are disconnected or shut off. The position illustrated in Fig. 3 in solid lines will provide a connecting channel 52 in the valve to connect line 21 with line 18 while another connecting channel 53 connects line 51 with the return line 20. In the third position of valve 50 illustrated in dotted lines, channel 52 will connect line 21 with line 51 while channel 53 will connect line 18 with the return line 20. The fluid cylinder 14A illustrated is similar to cylinder 14 of Fig. 1 except that it is provided with two fluid ports, port 17A at one end thereof and port 55 at the other end thereof. The operation of the fluid cylinder 14A may be readily followed by referring to Fig. 3. With the fluid under pressure supplied through line 21 and the valve 50 in the position illustrated in Fig. 3, the fluid will pass through the channel 52 through line 18 into port 17A thus forcing the piston 15A to the left (Fig. 3) and any fluid that may remain within the piston cylinder on the lefthand side of the piston will be forced out the port 55 through line 51 through the channel 53 of the valve and out the return line 20. To release the fluid pressure and restore the fluid motor to the position illustrated in Fig. 3, the operating handle of valve 50 must be moved to the dotted position illustrated. In this position the fluid pressure from line 21 will pass through channel 53 through line 51 through port 55 into the piston cylinder of the fluid motor 14A forcing the piston 15A to the right and at the same time, the fluid within the piston cylinder to the right of the piston will be forced out port 17A through line 18 through channel 53 and out the return line 20. The third or neutral position of valve 50 is utilized when the press or fluid motor 14A is at rest and while the valve 50 remains in a neutral position, the fluid from P will be charged through the check valve 23 and line 25 as already described in Fig. 1 to thus recharge the accumulator or fluid storage means 30.

Having described the apparatus and a complete sequence of operation according to Fig. 1, it is apparent that the press may be replaced by any fluid motor operated device and in combination with its hydraulic system for operation may be modified in any way as long as a sufficient volume of fluid at a given pressure is supplied to position the press or fluid cylinder and a second high pressure of small velocity is supplied for utilizing the pressing or power operation without departing from the spirit of this invention and this invention shall be limited only by the appended claims.

What is claimed is:

1. A system of the character described for operating a hydraulic motor of the type having a cylinder with an inlet and a piston slidable in said cylinder, said system comprising a small volume high pressure fluid supply, a pressure accumulator having a fluid port, a normally open pressure controlled valve having an inlet port connected to said fluid supply, an outlet port connected to the accumulator fluid port, and a second inlet port connected to the inlet of said hydraulic motor to apply pressure to said valve to close the latter when the pressure in said hydraulic motor has risen to a predetermined amount, a selector valve having an inlet port, a discharge port and a control port, means connecting the fluid supply to said selector valve inlet port, means connecting said accumulator port to said selector valve inlet port, a one way valve permitting flow only from said accumulator port to said selector valve inlet port, and means to set said selector valve to connect said control port to said discharge port, whereby said accumulator will be charged substantially to the pressure of said fluid supply, and to set said selector valve to connect said inlet port to said control port, whereby fluid both from said accumulator and said fluid supply will flow into said hydraulic motor quickly to move the piston to operating position and upon rise in pressure in said motor to the setting of said pressure controlled valve to close the latter, and upon continued flow of the high pressure low volume fluid from said fluid supply, further to move the piston.

2. The combination set forth in claim 1 in which the hydraulic motor is of the gravity return type, whereby upon setting of said selector valve to connect the control port to the discharge port, the piston will return to retracted position with resultant drop in pressure in said hydraulic motor and opening of said pressure valve and fluid will flow from the fluid supply to the accumulator to charge the latter.

3. The combination set forth in claim 1 in which said pressure valve comprises a cylindrical casing having a longitudinal bore therethrough, and a pair of radially displaced bores extending into said longitudinal bore on opposed sides thereof defining the inlet and outlet ports, one end of said longitudinal bore defining the second inlet port, a piston slidable in said longitudinal bore of reduced diameter between its ends, means to urge said piston toward said second inlet port, and means to limit the movement of said piston to retain its reduced diameter portion aligned with said first inlet and outlet ports to provide communication therethrough.

4. The combination set forth in claim 3 in which the means to urge the piston toward said second inlet port comprises a coil spring in said longitudinal bore, and means are provided to adjust the tension of said coil spring.

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