My invention relates to starter means for hydraulic devices, and more particularly to starter means for hydraulic lifts, and included in the objects of my invention are:

First, to provide means which enables a positive displacement pump to be employed for the purpose of actuating a hydraulic lift or other hydraulic devices without encountering shock loads or excessive initial acceleration when the pump pressure is applied to the device, this being avoided by by-pass arrangement which is gradually and controllably throttled so as to avoid shock loads and enable the hydraulic device to start smoothly and easily.

Second, to provide means of this character wherein the rate of initial acceleration of the hydraulic device may be readily and easily controlled or adjusted.

Third, to provide means of this character which is particularly suited for use in conjunction with hydraulic lifts and assures smooth operation even though the load may vary over wide ranges.

Fourth, to provide means of this character which is particularly dependable in its operation.

With the above and other objects in view as may appear hereinafter, reference is made to the accompanying drawings in which:

The figure is a diagrammatic view of my starter means for hydraulic lifts, portions of the by-pass valve being shown in section.

A fluid supply system for hydraulic lifts includes a surge or reservoir tank 1 which is connected by a pipe line 2 to the intake of a pump 3, the outlet of which is connected by a suitable pipe line 4 to a hydraulic device or lift (not shown). A check valve 5 is provided in the supply line 4 so that the hydraulic lift may be raised by action of the pump, but the hydraulic fluid cannot backflow through the pump to the surge tank. In practice a separate line (not shown) by-passes the check valve so that the hydraulic lift may be controllably lowered.

In the exercise of my invention, I provide a by-pass line 6 which joins the supply line 2 and the supply line 4. Mounted in the by-pass line 6 is a by-pass valve 7. The preferred type of by-pass valve comprises a tubular valve body 8 in which is fitted a core 9. The core 9 is tubular but divided by a central bulkhead 10. Annular rows of slots 11 and 12 are provided in the walls of the core 9 at opposite sides of the bulkhead 10 so that fluid may pass around the bulkhead by flowing radially outwardly through one set of slots and radially inwardly through the other set of slots. Interposed between the core 9 and the valve body 8 is a valve tube 13 formed of rubber or similar yieldable material. The valve tube is adapted to be constricted about the bulkhead 10 to close the by-pass valve. This is accomplished by introduction of fluid into an annular pressure chamber defined by the valve tube and the confronting walls of the valve body. This chamber is intersected by a port 14 which is connected to a small control line 15. The control line returns to the valve body at the intake side thereof and communicates with a port 16. Interposed in the control line 16 is a throttle valve 17. An air chamber or cushion chamber 18 may communicate with the control line and augment in effect the volume of the pressure chamber defined between the valve tube 13 and valve body 8.

Operation of my starter device for hydraulic lifts is as follows:

When the pump 3 is idle backflow from the hydraulic lift is prevented by check valve 5. However, due to the fact that the pump 3 is not itself a check valve but instead will by-pass fluid in either direction when idle, the pressure on both sides of valve 7 corresponds to the head of fluid in the surge tank 1. This pressure is sufficiently nominal that an air space exists in the chamber 18. The cavities surrounding the valve tube 13 and that portion of line 15 which communicates with chamber 18 are full of fluid.

When the pump 3 is started, a nominal rise in pressure occurs in lines 4 and 8 downstream of the check valve 5 and causes expansion of the valve tube 13, thus opening the by-pass valve 7. The fluid in the surrounding cavity is readily displaced by reason of its substantially free communication with the chamber 18. Thus, initially, the entire output of the pump is by-passed through the valve 7.

The attendant pressure differential between the upstream side of the valve 7 at port 18 and the chamber 18 results in flow through the throttle valve 17, causing a gradual building up of back pressure in the cavity which surrounds the valve tube 13. Such pressure constricts the tube 13, throttling the by-pass valve 7. The rate at which the by-pass valve closes depends upon the setting of the throttle valve 17. The gradual rise in pressure in line 4 insures a "soft" or gradual acceleration of the hydraulic lift connected therewith. Also, by reason of the fact that the initial output of the pump is by-passed, the pump motor (not shown) is not required to start under load, but instead may reach its optimum running speed before full load is applied, that is, before the by-pass valve is re-closed.

When the pump is stopped, the excess fluid is
bled through the throttle valve 17 and the pump until the initial nominal pressure conditions are re-established. In order to accomplish this as quickly as practicable, a check valve 18 may be by-pass the throttle valve 17.

It should be observed that the pump motor is controlled by suitable switches located in convenient relation to the hydraulic lift or other hydraulic device.

It should be observed that the air chamber 18 is shown diagrammatically and therefore the flexible membrane conventionally used to separate the air and liquid in an air chamber is omitted. In actual practice, such membrane is used to prevent gradual absorption of air in the liquid. However, it should be pointed out that even without the provision of the diaphragm, the system will operate for several days or several weeks, depending on the liquid used.

Having fully described my invention, it is understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. An actuating means for hydraulic lifts comprising: a positive displacement pump adapted to circulate fluid to a hydraulic device; a by-pass valve connected across said pump, said valve including a valve body, a sleeve within said body and defining therewith an annular pressure chamber, a valve core within said valve and including a bulkhead engaged by said sleeve when said sleeve is constricted by fluid pressure in said chamber thereby to close said sleeve; a cushion chamber member in communication with said pressure chamber, a flow line communicating with said pressure chamber and cushion chamber member and with the output side of said pump; and a throttle valve in said flow line, said cushion chamber member adapted to receive fluid from said pressure chamber upon initial operation of said pump to permit flow through said by-pass valve, said throttle valve adapted to cause controlled increased pressure in said cushion chamber member and pressure chamber and thereby cause said valve to reclose gradually on continued operation of said pump.

2. An actuating means for hydraulic lifts comprising: a positive displacement pump adapted to deliver fluid to a hydraulic device; a by-pass valve connected across said pump, said valve including a valve body, a sleeve within said body and defining therewith an annular pressure chamber, a valve core within said valve and including a bulkhead engaged by said sleeve when said sleeve is constricted by fluid pressure in said chamber thereby to close said valve; and means including a by-pass line to the output side of said pump, a restrictor valve in said line and a cushion chamber in communication with said pressure chamber and adapted to relieve pressure in said pressure chamber on initial starting of said pump, thereby to open said by-pass valve and thereafter receive fluid through said restrictor valve to repressurize said cushion chamber and effect gradual re-closing of said by-pass valve.

3. In a starting apparatus for hydraulic devices wherein a pump is employed to operate said hydraulic device and a check valve prevents back-flow from said device through said pump when said pump is idle, the combination of: a by-pass valve connected across said pump, said by-pass valve including a valve body defining a flow passage, a yieldable sealing member normally closing said flow passage, said sealing member and valve body defining a fluid receiving pressure chamber controlling said sealing member; and a cushion chamber member in substantially free communication with said pressure chamber and in restricted communication with the output side of said pump; said cushion chamber member adapted to receive fluid from said pressure chamber when said pump is initially operated thereby to permit opening of said sealing member and to accumulate slowly pressure from the output side of said pump to supply said pressure chamber and gradually re-close said sealing member.

4. In a starting apparatus for hydraulic devices wherein a pump is employed to operate said hydraulic device and a check valve prevents back-flow from said device through said pump when said pump is idle, the combination of: a by-pass valve connected across said pump and including a normally closed seal means adapted to open in response to fluid pressure within said by-pass valve, and a pressure responsive means for closing said seal means in opposition to pressure in said by-pass valve; a cushion chamber member in substantially free communication with said pressure responsive means, and in restricted communication with the output side of said pump; said cushion chamber adapted to receive fluid from said pressure responsive means upon initial application of pressure against said seal means thereby to open said by-pass valve on starting of said pump, said cushion chamber and pressure responsive means adapted to accumulate pressure during operation of said pump thereby to gradually re-close said by-pass valve.

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