

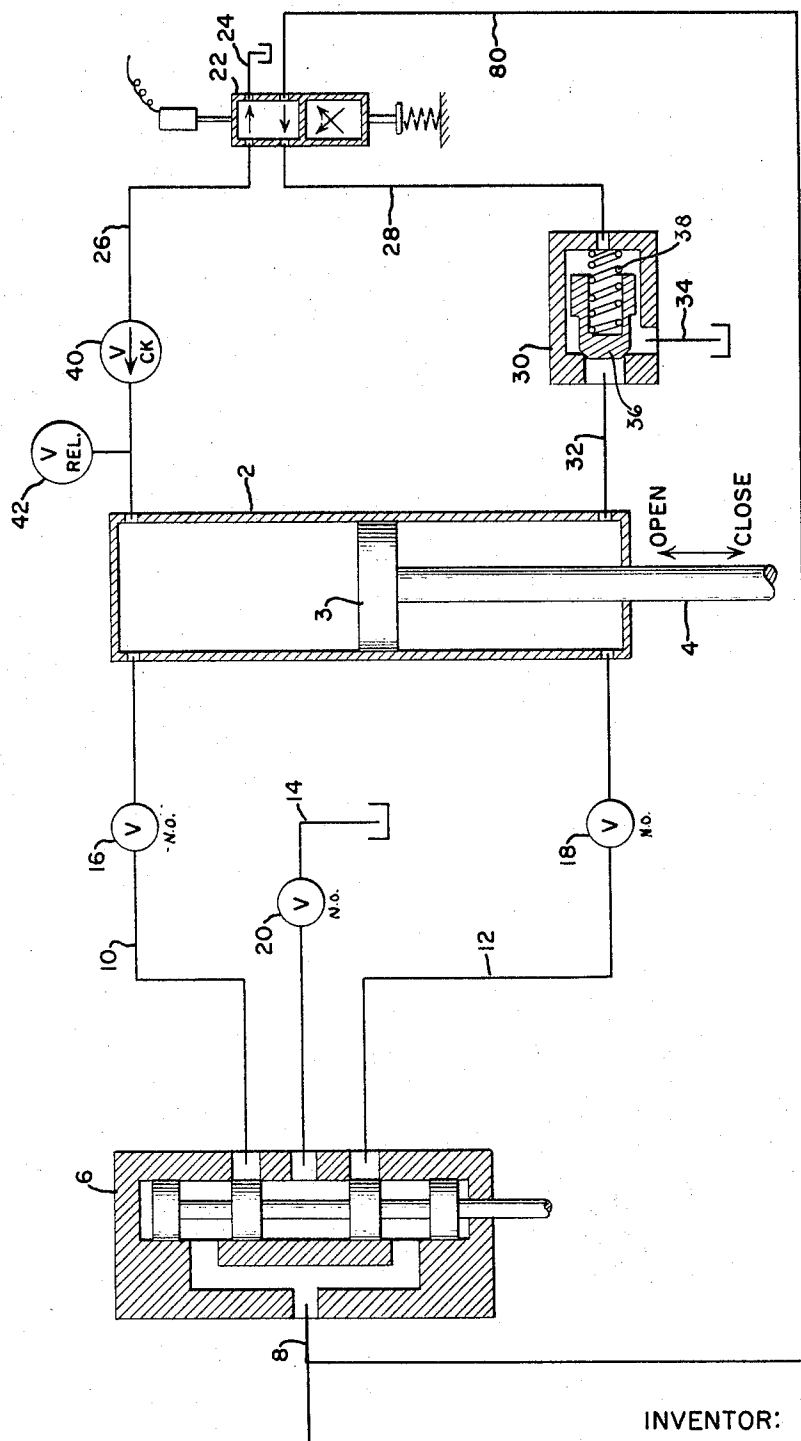
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VALVE GEAR LOCKING AND EMERGENCY CLOSING SYSTEM

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VALVE GEAR LOCKING AND EMERGENCY CLOSING SYSTEM

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ABSTRACT OF THE DISCLOSURE

A hydraulic valve operator having separate and distinct parallel hydraulic circuits, one circuit being controlled by a servovalve and the other circuit controlled by a speed responsive solenoid.

Background of the invention

This invention relates generally to valve operators and, more particularly, to hydraulic valve actuating systems having a dual control to provide for improved reliability.

It is often desirable in the turbine art to employ control valves having a provision for locking the same open and out of service. While out of service, maintenance or other operations may be performed on the valves or on their control systems. While such a control valve or set of valves and their associated controls are rendered inactive in this manner, it is also desirable that the turbine overspeed mechanism still be capable of closing the valves in the event of an emergency overspeed.

The present invention provides a means to lock the turbine control valves open so that maintenance may be performed while at the same time a backup hydraulic circuit enables the valves to close as a response to any overspeed condition.

It is accordingly an object of the present invention to provide a means to hydraulically lock a valve operating mechanism in an open or intermediate position with provision for closing in the event of an overspeed.

Other objects, advantages, and features of the present invention will become clear from the following description of an embodiment thereof when taken in connection with the accompanying drawing.

Summary of the invention

Briefly, the present invention is practiced in one form by a double acting hydraulic valve operator controlled by a servovalve in a primary hydraulic circuit. In a parallel secondary hydraulic circuit, normally inactive, a solenoid valve is operative in response to an overspeed signal to direct hydraulic fluid to the valve operating cylinder to close the same. Thus, the primary of these two parallel hydraulic circuits may be disconnected for maintenance while the secondary circuit controls the valve operator.

Drawings

In the drawing, the single figure is a representation of a valve operating cylinder and its parallel control hydraulic circuits according to the present invention.

The system shown in the drawing includes a double acting cylinder or valve operator 2 having a piston 3 and piston rod 4 movable therein. Piston rod 4 is operatively connected by mechanical means to the stem of a steam control valve (not shown). At this point it should be understood that valve operator 2 and its associated turbine control valve are but one of a plurality of control valves in a set. In the uppermost position of rod 4, the steam valve is in its fully open position, and at the lowermost position of rod 4, the associated steam valve is closed.

The movement of piston 3 and rod 4 is controlled by a servovalve 6 which is connected to a source of hydraulic fluid 8, and is in turn connected through hydraulic lines 10 and 12 to the double acting cylinder 2. A drain line 14 also extends from servovalve 6. Lines 10, 12 and 14 include normally open valves 16, 18 and 20 respectively. Hydraulic line 10 connects the servovalve 6 to one end of the double acting cylinder 2, and hydraulic line 12 connects servovalve 6 with the opposite end of double acting cylinder 2. In normal operation, the servovalve controls the up and down movement of piston 3 within double acting cylinder 2, the position of rod 4 being fed back to the servovalve, by means known to the art and not shown, to complete the control loop.

A second hydraulic circuit, parallel to the first, includes a solenoid-operated four-way valve 22 which also communicates with the source of hydraulic pressure 8 through line 80. Solenoid valve 22 is connected to a drain line 24, a hydraulic pressure line 26 leading to one end of cylinder 2, and a hydraulic pressure line 28 to one side of a dump valve 30. Dump valve 30 in turn communicates with one end of cylinder 2 through hydraulic line 32 and with a drain through line 34. Hydraulic line 26 includes a one-way check valve 40 which permits hydraulic fluid to flow only in the direction toward the cylinder 2. Line 26 also includes a relief valve 42.

Dump valve 30 includes a seating member 36 which is biased by a spring 38 in a direction such as to close communication between hydraulic line 32 and drain line 34. Seating member 36 is also effectively a piston which is biased in the closing direction by pressure from line 28.

Operation

During normal operation of the steam turbine associated with this system, valves 16, 18 and 20 and valves in supply line 8 are open, and system hydraulic pressure is supplied to the servovalve 6 and therethrough to the valve operating cylinder 2. In addition, through the parallel hydraulic circuit, hydraulic fluid is directed through the solenoid operated four-way valve 22 to the dump valve 30, keeping it in a closed position. In this position (shown in the drawing) of solenoid-operated valve 22, hydraulic line 26 is vented to the drain 24, with check valve 40 preventing escape of hydraulic fluid through line 26. In normal operation then, the valve operating cylinder 2 is controlled by servovalve 6, and hydraulic fluid is prevented from escaping through the secondary or parallel hydraulic circuit by means of check valve 40 and dump valve 30 being kept closed.

If it is desired to block or lock the steam valves in an open position, this can be done by raising the piston to its uppermost or any intermediate position and then closing valves 16 and 18. Thus it will be apparent that the flow of hydraulic fluid is shut off and the piston 3 is immovable. This is because valves 16 and 18 and check valve 40 as well as dump valve 30 and piston seals on piston 3 are all of the zero leakage type. In this condition, elements of the primary hydraulic circuit as, for example, the servovalve 6, now being out of service, can be removed for service or adjustment, etc. by appropriate closing of other incidental valves not shown. If, in this locked condition, there is an overspeed of the associated turbine, an overspeed signal to the solenoid valve 22 operates the valve so that hydraulic fluid from source line 8 and line 80 is directed through line 26 and check valve 40 to drive the piston 3 downward to close the steam valves. In addition, solenoid valve 22 connects hydraulic line 28 to the drain line 24 so that the seating member 36 in dump valve 30 is permitted to shift, opening the dump valve 30 and draining the hydraulic line 32 through drain line 34. Thus, this parallel or secondary hydraulic system functions to

close the steam valves when they are in a locked position with reference to the primary hydraulic system.

If, during normal operation, there is a servovalve malfunction which causes a turbine overspeed, the parallel or secondary hydraulic circuit works in exactly the same way to close the steam valves by means of hydraulic valve operator 2. In this case, the flow pattern is slightly different in that, when the overspeed signal trips the solenoid, the pressurized fluid from the solenoid valve 22 and from line 26 forces the piston downward to close the valves, and in addition some of the fluid is forced through line 10 back toward the servovalve which is in a drain position with respect to line 10. However, the restricted flow through the servovalve 6 from line 10 to drain line 14, because of the orificing within the valve 6, and the relatively larger area of solenoid valve 22, is such that the net result is still a pressure buildup on top of the piston 3 to drive the piston downward to close the steam valves. That is to say, that the drain through servovalve 6 and line 14 is a relatively low volume drain, while the draining through hydraulic line 32 and dump valve 30 is a relatively high volume drain with a resultant net pressure increase on the top side of piston 3 and a decrease on the bottom side of piston 3, with a consequent downward stroke and closing of the valves.

It will be apparent that a valve locking and overspeed protection system has been described herein which permits isolation of the valve's control servo system while still providing overspeed protection.

It may occur to others of ordinary skill in the art to make modifications of the present invention which will remain within the concept and scope thereof and will not constitute a departure therefrom. Accordingly, it is intended that the invention be not limited by the details in which it has been described but that it encompass all within the purview of the following claims.

What is claimed is:

1. A reciprocating fluid motor having a first expansible chamber to provide a first output stroke and a second expansible chamber to provide a second output stroke, said fluid motor being operatively connected to a first independent fluid control circuit and a second parallel independent fluid control circuit, said first circuit including a servovalve communicating with a source of fluid pressure and with said first expansible chamber controlling fluid flow thereto, said second circuit including a secondary valve communicating with said source of fluid pressure and with said first expansible chamber, said secondary valve being normally closed between said fluid pressure source and said first expansible chamber, and being responsive to a selected signal

to open and permit fluid flow from said fluid pressure source to said first expansible chamber.

2. The combination according to claim 1 in which said fluid motor is double acting, said servovalve further communicating with said second expansible chamber controlling fluid flow thereto, said secondary valve being a four-way valve and further communicating with a dump valve, said dump valve communicating with said second expansible chamber, said four-way secondary valve in normal position directing fluid pressure to said dump valve holding the same closed.

3. The reciprocating fluid motor according to claim 2 in combination with a turbine steam valve operatively connected to said fluid motor, said first output stroke effective to close said steam valve and said second output-stroke effective to open said steam valve, and said signal being responsive to an overspeed condition of said turbine.

4. A valve operating system including
 - a double acting hydraulic cylinder operatively connected to a valve stem,
 - a first hydraulic circuit and a second parallel hydraulic circuit communicating with a common fluid reservoir and operatively connected to said double acting hydraulic cylinder,
 - said first circuit including a servovalve communicating with said fluid reservoir and with each end of said hydraulic cylinder controlling the same and an isolation valve in each line between said hydraulic cylinder and said servovalve,
 - said second circuit including a four way valve communicating with said fluid reservoir, a check valve and a dump valve, said check valve disposed to permit passage of hydraulic fluid from said four way valve to one end of said hydraulic cylinder,
 - said dump valve disposed to receive fluid flow from the opposite end of said hydraulic cylinder,
 - said dump valve further disposed in communication with said four way valve and biased closed by fluid pressure therefore,
 - said four way valve being responsive to a signal to shift position venting the biasing pressure to said dump valve and directing pressure through said check valve to said cylinder.

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