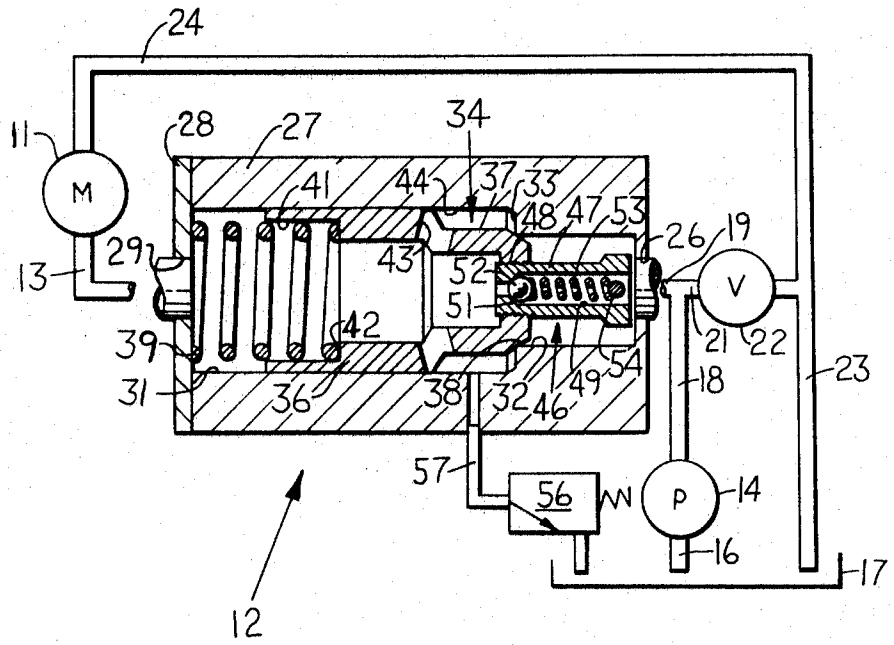
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OVERRIDABLE CHECK VALVE MECHANISM

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OVERRIDABLE CHECK VALVE MECHANISM

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ABSTRACT OF THE DISCLOSURE

A two-way check valve mechanism in the driving fluid supply line to a fluid driven motor normally blocks reversed motion of the motor from external forces applied thereto but yields to provide for the reversed motor motion in the presence of an unusually large counterforce on the motor.

This invention relates to fluid system components and more specifically to a check valve mechanism which provides for a uni-directional flow at a first range of pressures and for a flow in either direction at a higher range of pressures. The invention is particularly adapted for blocking reversed motion of a fluid driven motor when a relatively small countertorque is externally applied thereto while providing for reversed motion when the countertorque exceeds a predetermined magnitude.

Fluid pressure operated motors are used to power a variety of devices under conditions where it is desirable to prevent reversed motion of the motor. This may be accomplished in some instances by providing a simple check valve between the motor and the source of driving fluid therefor. However there are other circumstances under which it is desirable that the motor be capable of such reversed movement upon the application of an unusually large external force to the mechanism operated by the motor and this is not compatible with the use of a conventional check valve.

An example of a system in which these conditions obtain is the drive mechanism for the elevator of a self loading earthmoving scraper. Such scrapers. have a load carrying bowl with a cutting edge which guides soil upwardly into the bowl as the scraper moves forward. To assist the movement of soil into the bowl and to retain the load in the bowl at the open forward face, a chain and flight elevator is situated above the cutting edge. The elevator may be driven by a hydraulic motor operated from a remotely situated source of high pressure fluid. Under normal circumstances, it is desirable that the elevator move in one direction inasmuch as reversed motion can result in the loss of material from the bowl. As the weight of the material carried in the bowl applies a downward force to the elevator when it is stopped such loss can easily occur if no reverse motion blocking means is present in the system.

Although the blocking of reversed motion of the elevator as discussed above is desirable under normal conditions, an absolute blocking of such motion creates further problems. Large rocks or other objects can become lodged between one of the elevator flights and the scraper cutting edge and the removal of such obstructions becomes unduly complicated if reversed elevator motion is impossible. Under such circumtsances, removal of the obstruction may only be possible by jacking up the entire elevator assembly. Removal is much more readily accomplished if it is possible to force the elevator in a reverse direction a small distance by prying, jacking, or other means. However this requires that the motor which drives the elevator turn in a reversed direction.

It is possible to provide for forced reversed motion of the elevator and motor by utilizing a vent valve in the system between the check valve and the motor. By

opening the vent, fluid may be released from the intake side of the motor allowing the motor to be turned backwardly. However such a valve must be operated manually and frequently cannot be located at a position readily accessible to the scraper operator without undesirable structural complications.

The present invention is a simple and compact valve mechanism which may be disposed between a motor and source of high pressure driving fluid to impart the desirable capabilities discussed above to the motor. In particular, the valve provides a two way check valve action which blocks reverse motor motion when the counterforce thereon does not exceed a predetermined limit while providing for such motion upon the application of a larger counterforce to the motor.

Accordingly it is an object of this invention to provide a compact and simple valve mechanism having a check valve action within a limited range of fluid pressures and providing for a two-way fluid flow at pressure above said range.

It is another object of this invention to provide means for blocking reverse motion of a fluid driven motor under normal conditions while providing for such motion upon the application of a greater than normal external force to the motor.

It is still another object of the invention to provide reverse motion limiting mechanism for the drive system of a fluid motor operated self loading scraper elevator which facilitates the removal of obstructions lodged in said elevator.

The invention, together with further objects and advantages thereof, will best be understood by reference to the following specification in conjunction with the accompanying drawing which is an axial section view of a valve mechanism embodying the invention with the associated fluid driven motor, driving fluid supply, and control elements therefor being shown schematically.

Referring now to the drawing there is shown a rotary hydraulic motor **11** which may be of conventional construction and which may be utilized to operate any of a variety of mechanisms known to the art. Motor **11** may, for example, be operatively coupled to the elevator of a self-loading scraper as hereinbefore discussed. Blocking of reversed motion of motor **11** when the motor is stopped, and in the absence of a very strong counterforce thereon, is provided for in the present invention by a compact and simple valve mechanism **12** connected into the inlet conduit **13** through which high pressure driving fluid is supplied to the motor **11**.

To drive the motor, **11**, a pump **14** has an intake **16** communicated with a reservoir **17** containing a suitable hydraulic fluid such as oil. The outlet conduit **18** of pump **14** is forked with a first branch **19** being coupled to the motor intake conduit **13** through the check valve mechanism **12**. The second branch **21** of the pump outlet **18** provides a return line to reservoir **17** through a motor control valve **22** and return conduit **23**. The motor outlet **24** also communicates with conduit **23** to return the driving fluid to reservoir **17** for recirculation by pump **14**.

Motor **11** is activated by closing control valve **22** inasmuch as pump **14** then supplies fluid under pressure to the motor intake **13** through check valve mechanism **12**. Opening of the control valve **22** stops operation of the motor **11** as the pressurized fluid from pump **14** is then returned directly to reservoir **17** through the control valve and conduit **23** thereby bypassing the motor. A pronounced advantage of this type of drive system is that the pump **14** may be situated remotely from the motor **11** and the control valve **22** may be at still a third location which is convenient to an operator, the intercon-

nections between the several components being very simple in that only conduits are required.

Under normal conditions valve mechanism **12**, functions to prevent the movement of fluid from motor **11** back toward reservoir **17** through the motor intake conduit **13** when the motor is stopped. This normally prevents reverse motion such as might occur if an external torque is applied to the motor at such time and no flow blocking mechanism is present in the system. However the check valve mechanism **12** further functions to allow such a reverse flow if the counter torque applied to motor **11** exceeds a predetermined magnitude.

Valve mechanism **12** has a housing **27** with an inlet **26** at one end to which pump outlet conduit branch **21** connects. Motor intake conduit **13** connects with an outlet passage **29** in an end closure **28** at the opposite end of the housing **27**. The flow passage through housing **27** has a first section **31** adjacent the outlet **29** and a second shorter section **32** of reduced diameter adjacent the inlet **26**, with a step **33** defining the transition between the two sections.

To provide the valve action, a piston **34** is disposed coaxially within the larger diameter bore section **31** and is slidable therein in an axial direction. Piston **34** has a base portion **36** with a diameter conforming to that of bore section **31** and has a head portion **37** with a diameter slightly greater than that of the smaller section **32** of the bore. A bevel **38** at the end of piston head **37** seats against step **33** to close the fluid passage through the valve mechanism and a compression spring **39** within bore section **31** urges the piston toward the closed position. Spring **39** extends into the large diameter portion of a bore **41** in piston **34** and bears against a step **42** therein.

To provide for fluid flow through the piston **34** when the piston head **37** is retracted from step **33** bores **43** communicate the region **44** around the head section of the piston with the interior bore **41** thereof.

The structure of valve mechanism **12** as described to this point constitutes a check valve limiting fluid flow between pump **14** and motor **11** to a single direction. Fluid from pump **14** enters the valve housing bore section **32** through conduit **19** and reacts against piston head **37**. The resulting force retracts the piston head **37** from step **33** allowing the fluid to flow through region **44** and bores **43** and **41** to the motor intake conduit **13**. However fluid attempting to flow in the reverse direction reacts against the opposite side of piston **34** and, together with spring **39**, seats the piston head **37** against step **33** thereby blocking fluid flow in the direction of pump **14**. As the motor **11** cannot turn in a reverse direction without pumping fluid into intake conduit **13**, the above described check valve action prevents reverse turning of the motor by relatively small torque forces which may be applied thereto.

Considering now mechanism which provides for overriding of the check valve action when a countertorque above a specific level is applied to the motor **11**, a ball check valve assembly **46** is carried on the head **37** of the piston **34**. Check valve assembly **46** has a tubular body **47** one end of which is threaded into a bore **48** in the end of the piston head **37**. Valve body **47** projects axially from the piston head **37** and has an axial passage **49** which is of reduced diameter at the end adjacent piston **34**, with the stepped portion of the passage forming an annnular seat **51** for a ball valve element **52**. A compression spring **53** is disposed coaxially within the valve body **47** with one end bearing against the ball **52** and the other end abutted against a transverse pin **54**. Spring **53** thus urges the ball **52** towards seat **51** at which position the flow passage through the check valve **46** is closed.

During operation of motor **11**, the check valve assembly **46** remains closed, and is in effect bypassed by the fluid passage at step **33**. However movement of piston head **37** against step **33** to block a reverse flow and lock motor **11** results in a fluid pressure being applied to the ball **52** in a direction tending to open the check valve assembly **46** and the valve mechanism **12** is effective to block reverse motion of the motor only while check valve assembly remains closed. Thus spring **53** is selected to exert a force against ball **52** which holds the ball against seat **51** in the presence of a fluid pressure thereon corresponding to the maximum countertorque which motor **11** is to sustain without yielding and undergoing reversed motion. When a countertorque exceeding this valve is applied to the motor **11** ball **52** lifts from seat **51** against the action of spring **53** allowing fluid to flow towards control valve **22** and reservoir **17**. The control valve **22** is open at the time, to stop the flow of driving fluid to motor **11** as hereinbefore described, and thus such fluid may exhaust to the reservoir. Accordingly the motor **11** yields to the high countertorque and undergoes reversed motion.

Pressurized fluid systems of this class usually have an over-pressure relief valve which opens to relieve any undesirably high pressure which may develop in the system. In the present invention such a pressure relief valve **56** may advantageously be connected into the system by an inlet conduit **57** communicated with the region **44** of the valve body **27**, the relief valve outlet being communicated with reservoir **17**. It will be observed that the relief valve **56** is also capable of opening if sufficient back pressure is developed by reverse motion of motor **11**. However, the relief valve **56** is not capable of duplicating the action of the check valve assembly **46** since to properly perform its relief function, it must be set to open at a higher pressure than that which opens the check valve assembly **46**. Further, relief valve **56** remains coupled to the system under all conditions whereas, as discussed above, check valve assembly **46** is effectively bypassed at such times as pump **14** is driving motor **11** forwardly in the normal manner.

It will be apparent that many modifications are possible within the scope of the invention and it is not intended to limit the invention except as defined in the following claims.

What is claimed is:

1. In combination with a fluid driven motor having a driving fluid inlet and a source of driving fluid therefor wherein said motor may be subjected to an external force tending to produce reversed motion thereof, a means for blocking said reversed motor motion when said external force is below a predetermined magnitude comprising, a first check valve defining a first uni-directional flow passage from said source to said motor intake, a second check valve defining a second oppositely directed unidirectional flow passage communicated with said motor inlet, and biasing means holding said second check valve closed when the fluid pressure at said motor inlet is below a value corresponding to said predetermined magnitude of external force acting on said motor.

2. Means for blocking reversed motion of a fluid driven motor as defined in claim **1** wherein said second flow passage is of substantially reduced cross section relative to said first flow passage.

3. Means for blocking reversed motion of a fluid driven motor as defined in claim **1** wherein said first and second check valves are contained within a common housing having a single fluid inlet communicated with said source and a single fluid outlet communicated with said motor inlet.

4. Means for blocking reversed motion of a fluid driven motor as defined in claim **1** wherein said first check valve is comprised of a valve housing having said first fluid passage extending therethrough, said first fluid passage having a step therein defining a valve seat, a piston disposed within said first passage within said valve housing and being slidable therein, said piston having a

head portion seatable against said valve seat to close said first flow passage, and wherein said second check valve is carried by said piston and moves therewith.

5. Means for blocking reversed motion of a fluid driven motor as defined in claim **4** wherein said first flow passage extends longitudinally within said piston, and wherein said second check valve is comprised of a tubular body transpierced through said head of said piston and having a stepped bore defining said second flow passage and having a movable valve member seatable in said stepped bore to close said second passage, and wherein said biasing means comprises a resilient element within said tubular body bearing against said movable valve member.

6. Means for blocking reversed motion of a fluid driven motor as defined in claim **4** and comprising the further combination of an over-pressure relief valve, said relief valve being communicated with said first flow passage at said valve housing, said relief valve being biased to open when the fluid pressure in said first passage substantially exceeds said fluid pressure required to open said second check valve.

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