

- [54] **AUTOMATIC SEQUENTIAL
OPERATED VALVE**
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- [58] Field of Search.....**137/106, 624.27, 624.18;
91/356**

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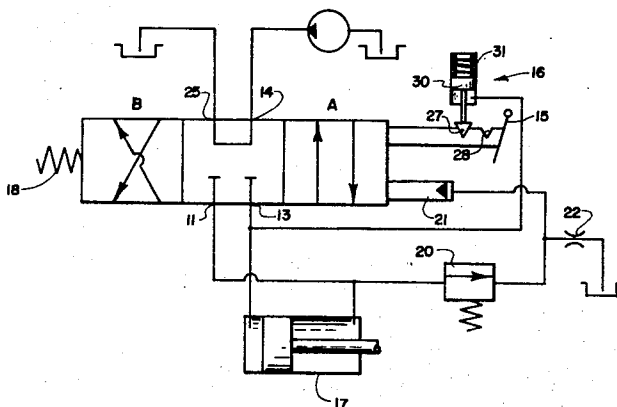
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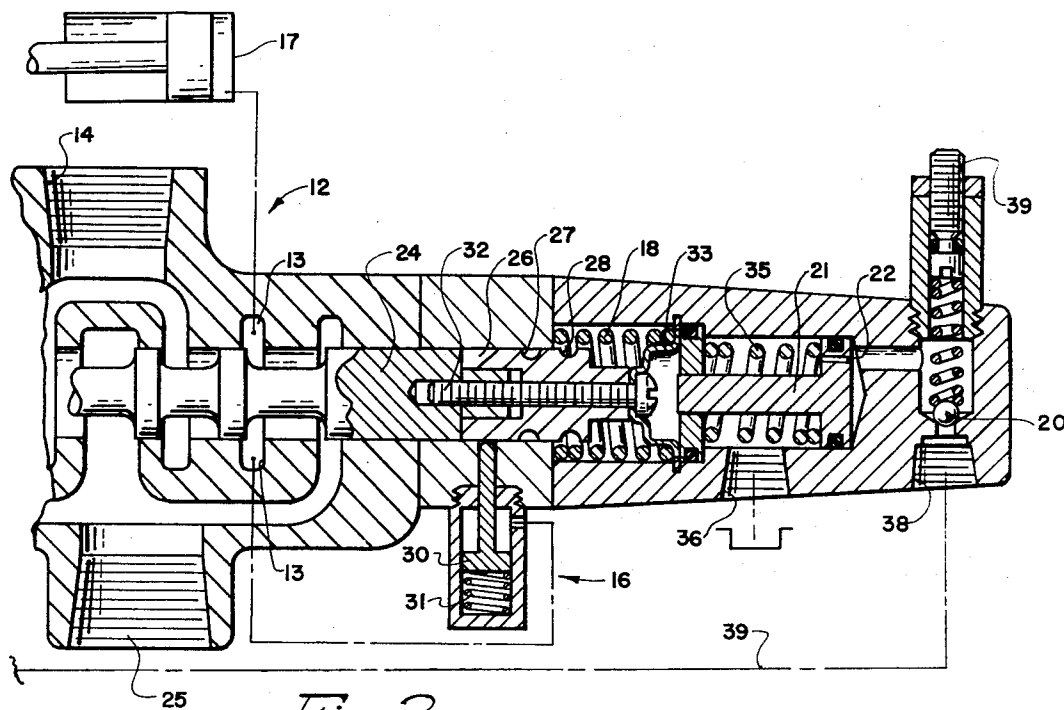
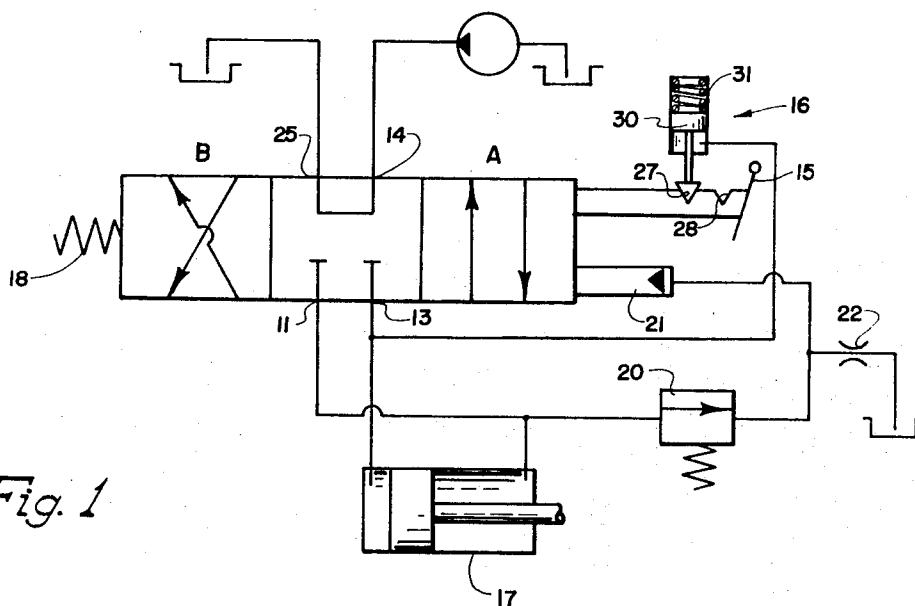
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[57] **ABSTRACT**

An automatic four-way valve hydraulically operated for extending and retracting a refuse compaction cylinder, which senses a pressure build-up as the trash is compacted, releasing a pressure responsive detent allowing a spring to drive the valve spool of the primary valve to the return position, allowing the cylinder to retract until it reaches the end of its stroke whereupon a pressure build-up causes a pilot cylinder to move the valve spool to the neutral open center position.

8 Claims, 2 Drawing Figures





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AUTOMATIC SEQUENTIAL OPERATED VALVE

SUMMARY OF THE INVENTION

The compaction of refuse is normally accomplished by one or a pair of cylinders which move the refuse from the receiving hopper and force it into a compacted state which is more easily transported and disposed of. A simplified valving arrangement for controlling compaction cylinders would be a manually controlled four-way directional valve having an open center neutral position. The disadvantage with this type of control is that the operator must standby and hold the valve handle until the refuse is fully compacted and then shift the valve handle to the reverse position, holding it there until the cylinder is completely retracted. This necessitates an operator standing at the valve all during the compaction cycle.

Improved automated systems have been developed whereby the operator only needs to initially move the valve handle to the cylinder extended position whereupon the other valve movements in the compaction cycle are automatically accomplished by some form of mechanical actuator. For example, as the compacting blade reaches its fully compacted position it trips a lever arm, which in turn forces the valve spool to the reverse position. As the compaction cylinder reaches the fully retracted position, another lever arm is contacted forcing the valve spool back to the neutral position. Mechanical actuators of this type require a fairly complicated linkage system which requires a substantial amount of maintenance to properly operate. Due to the lack of trained or experienced personnel in servicing mobile compaction equipment, manufacturers have been striving to improve the reliability of their equipment and make it as trouble-free and easily maintainable as possible. With these purposes in mind, the valve of the present invention was designed which utilizes a completely hydraulic servo control system without mechanical limits or mechanical actuators. With the actuation function of the primary valve being hydraulic, there is no need for mechanical adjustment or danger of obstruction or malfunction due to stray refuse fouling the mechanical mechanism. While there are other hydraulic automatic cycling control circuits on the market, they involve very complex and intricate hydraulic circuitry.

The present invention is a much simplified single spool package type unit incorporating all of the control circuitry in one unit. Previously it has not been thought practical to actuate a four-way three position valve with internal pilot pressure because of the pressure loss when the valve is shifted to the neutral open center position. The simplified valve design of the present invention utilizes internal pilot pressure combined with a compressive spring to move the spool across the neutral position to the reverse flow position. When the cylinder fully retracts, a pressure build-up causes a relief valve to open and a pilot piston to drive the valve spool back to the neutral position. All of the various automatic control components are combined into one valve body with the primary valve, which eliminates numerous connections, hoses and tubing. The usage of the packaging concept with the simplified circuitry of the present invention allows for a considerable reduction in assembly time, component weight and overall size of the system. For ease in maintenance, the overall

circuit can be easily repaired by a person with minimal skills replacing the overall valve package.

It is therefore the principal object of the present invention to provide a directional valve having a simplified all hydraulic automatic cycling control circuit.

Another object of the present invention is to provide an automatic control for a four-way three position directional valve which utilizes internal pilot pressure to actuate the valve.

A further object of the present invention is to provide in the refuse handling field, an automatic hydraulic control system combined in a single valve body.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims:

FIG. 1 is a schematic diagram of the hydraulic control circuit of the present invention; and

FIG. 2 is a longitudinal sectional view of the automatic valve control means attached to a conventional valve having a portion thereof broken away.

Referring now to the drawings, and more specifically to FIG. 1, an automatic valve cycling control system is generally identified by reference numeral 10. The directional control valve 12 which operates a conventional compaction cylinder 17, is a four-way three position conventional spool valve having a first working position A which extends the cylinder, a second working position B retracting the cylinder, and an open center neutral position with fluid locked in the motor ports 11 and 13. The valve is manually controlled by push-pull handle 15 which overrides compression spring 18 and detent 16. The spring 18 urges the valve into the B position. Holding the valve in either the neutral A position is a pressure responsive detent 16. When pressure builds above a certain level in port 11, relief valve 20 opens, extending pilot piston 21 to move the valve spool back to the neutral position overriding compression spring 18. The pressure behind pilot piston 21 bleeds off through orifice 22, allowing pilot piston 21 to retract due to the action of spring 35, as shown in detail in FIG. 2.

FIG. 2 is the actual structural drawing of the control system 10 diagrammatically illustrated in FIG. 1. Since directional control valve 12 is not a part of the present invention, portions of the valve have been broken away to conserve space. Valve spool 24 is shown in the cylinder retract position B, with fluid flowing from the cap end of cylinder 17 through port 13 out return port 25. Attached to the end of valve spool 24 is an extension member 26, having a detent 27 for the neutral position and a detent 28 for the cylinder extend position A. The end of detent piston 30 is normally biased by spring 31 towards a detent. When pressure builds above a certain level on the rod side of piston 30, spring 31 is overcome, releasing the detent and allowing compression spring 18 to move the valve spool 24 to the right. Attached to the end of extension 26, by means of a screw 32, is a spring retaining cap 33. In contact with the end of cap 33 is a pilot piston 21, normally spring biased to a retracted position by compression spring 35. Orifice 22 in piston 21 allows fluid behind the piston 21 to bleed out through exhaust port 36. The valve motor port 11 of FIG. 1, not seen in FIG. 2, con-

nects with pilot port 38. A ball type pressure relief valve 37 allows fluid above a set pressure to flow behind and extend pilot piston 21. The pressure at which valve 37 opens can be adjusted by screw 39.

OPERATION

When the refuse compaction system 10 is not in use, the valve is positioned in its open center neutral position, as seen in FIG. 1. The valve spool is held in this neutral position by detent 16 engaging groove 27. To initiate the compaction cycle, the operator moves the valve handle 15 to position A, the cylinder extend position, whereupon the spring biased detent 16 engages notch 28. As the compaction cylinder 17 approaches the end of its stroke, a compaction blade connected thereto (not shown in the drawing), compacts the refuse causing the working pressure in motor port 13 to rise. Once a preset level is exceeded, pressure on the rod side of piston 30 overcomes the biasing force of spring 31, releasing the detent 16. As the detent 16 releases, the compressive force of spring 18 drives the valve spool across the neutral position to the piston retract position B. The compaction cylinder 17 then begins to retract due to working pressure supplied to motor port 11. As the compaction cylinder approaches its fully retracted position, the working pressure in port 11 increases to a level whereby pressure relief valve 20 opens, allowing fluid to extend pilot piston 21 which drives the valve spool back to the neutral position. Since a portion of the primary valve 12, in FIG. 2, is broken away, the working port 11 just mentioned is not shown in this figure. Hydraulic line 39, of FIG. 2, would connect working port 11 to pressure relief valve 20 through port 38. After the valve spool has been driven by pilot piston 21 to the neutral position, detent groove 27 is engaged and the pressures in the working lines drop to zero. The fluid behind pilot piston 21 bleeds off through drain port 36, through orifice 22, as compression spring 35 returns pilot piston 21 to its retracted position whereby the system is ready for another cycle.

Having described the invention with sufficient clarity to enable those familiar with this art to construct and use its general principles, I claim:

1. In a four-way directional valve for use with refuse compactors having a valve body containing a valve spool bore including two working ports, supply and return ports, a valve spool contained therein defining a first working position, a reverse flow second working position and middle open center neutral position, the improvement comprising an automatic valve cycling control system including:

a pressure responsive detent means for holding the

valve spool in the first working position which releases when the working pressure reaches a preset level;

spring means urging the valve spool into the second working position whereby as the pressure detent means releases the valve spool is forced across the neutral position to the second working position; and

a pilot cylinder means responsive to a preset working pressure in the second working position which overcomes the spring means and forces the valve spool to the neutral position.

2. In a directional valve as set forth in claim 1, wherein the pilot cylinder means includes a pressure relief valve which opens at a set pressure allowing flow to the pilot cylinder.

3. In a directional valve as set forth in claim 1, wherein the pilot cylinder means includes a pressure relief valve which opens at a set pressure allowing flow to the pilot cylinder, a second spring means urging the pilot cylinder to retract from its extended position and orifice means behind the pilot cylinder venting the fluid to atmosphere, thereby allowing the pilot cylinder to retract from its extended position.

4. In a directional control valve as set forth in claim 1, wherein the pressure responsive detent means holds the valve spool in the neutral position.

5. In a directional control valve as set forth in claim 1, wherein the pressure responsive detent means also holds the valve spool in the neutral position, the spring means having sufficient force once the pressure responsive detent releases from the first working position to force the valve spool across the detented neutral position to the second working position.

6. In a directional control valve as set forth in claim 1, wherein the pressure responsive detent means also holds the valve spool in the neutral position, the spring means having sufficient force once the pressure responsive detent releases from the first working position to force the valve spool across the detented neutral position to the second working position, further including a manual valve spool operator which can override either the detent or spring means.

7. In a directional valve as set forth in claim 1, wherein all of the components of the valve cycling control system are integral in the valve body forming a single package unit.

8. In a directional valve as set forth in claim 1, wherein the pilot cylinder means includes a pilot piston having an orifice therein venting to atmosphere and a compression spring for retracting the pilot piston once extended.

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