THREE AXES HYDRAULIC REMOTE CONTROL VALVE

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ABSTRACT
A hydraulic control valve for controlling a number of hydraulically operated units, the valve including a number of pairs of pressure control valves, a single joy stick mounted on the control valve for pivotal movement about two horizontal axes and a vertical axis, the pivotal movement of the joy stick about the two horizontal axes being used to control two pairs of control valves and the pivotal movement of the joy stick about the vertical axis being used to control the third pair of one-way bypass control valves, the pivotal motion of the joy stick about the vertical axis being transferred to the third pair of valves through a compression spring which also provides a return bias for the joy stick.

8 Claims, 5 Drawing Figures
THREE AXES HYDRAULIC REMOTE CONTROL VALVE

SUMMARY OF THE INVENTION

The control valve of the present invention provides for the remote control of a plurality of hydraulically operated units through a single joy stick. This type of a control is designed for use where a large number of units must be operated simultaneously by a single operator. The control valve of the present invention provides for the control of three pairs of pressure control valve assemblies by pivoting the joy stick on three different axes. Two pair of the pressure control valves are controlled by pivoting the joy stick about the vertical axis. Since the joy stick must be free to pivot about the two horizontal axes, the connection between the joy stick and the third pair of control valves must be accomplished through a flexible cable. This is accomplished by using a compression spring to transfer the rotary motion of the joy stick to the third pair of bypass valves. The compression spring also provides a return bias for the joy stick so that it returns to a neutral position when the operator releases the joy stick.

Other objects and advantages of the present invention will become apparent from the following drawings in which:

Fig. 1 is a side view in section of the control valve of the present invention;

Fig. 2 is a section view taken on line 2—2 of Fig. 1 showing the connection of the joy stick to the control assembly for the third pair of bypass valves;

Fig. 3 is a top view of the control valve;

Fig. 4 is a view taken on line 4—4 of Fig. 1 showing the drive assembly for the third pair of valve assemblies; and

Fig. 5 is an enlarged side view of the driven sheave for the third pair of valves.

DESCRIPTION OF THE INVENTION

The hydraulic control valve 10 of this invention provides for the control of a plurality of hydraulically operated units by means of a single joy stick 12 which is used to control a number of pairs of pressure control valve assemblies 14a, 14b; 16a, 16b and 18a, 18b. The joy stick 12 is pivotable about two horizontal axes AA and BB to control two pairs of the pressure control valve assemblies 14a, 14b and 16a, 16b. The joy stick 12 is also pivotable about a vertical axis CC to control the other pair of one-way bypass valve assemblies 18a, 18b. The control valve 10, therefore, capable of controlling three pair of one-way bypass valve assemblies by means of the single joy stick 12.

More particularly, the control valve 10 includes a housing or body 26 and a cover 27. Six fluid flow passages or bores 28 are provided in the bottom 30 of the housing 26. A rectangular recess 32 is provided in the top 34 of the housing 26. The bores 28 are connected to the recess 32 by small bores 36 and are provided at the open end with threaded counterbores 44.

Fluid communication between the bores 28 and a reservoir or tank 29 is provided by means of a tank port or passage 38 connected to the bores 28 by transverse passages 40. Fluid communication between the counterbores 44 and a source of hydraulic pressure 45 is provided by a fluid inlet port or passage 42 which is connected to the bores 28 by transverse passages 46. The passages 40 and 46 are closed by threaded plugs 41.

Fluid flow through each of the recesses 28 is controlled by means of the pressure control valve assemblies 14, 16 and 18. Each of the valve assemblies is identical and includes a valve seat 50 which is threadedly received in the counterbore 44 and includes an axial passage 52 having a threaded section 54 at the outer end. The valve seat 50 is sealed within recesses 28 and counterbore 44 by means of O-ring seals 56. Fluid communication between the axial passage 52 and the counterbore 44 is provided by means of a small pressure reducing orifice 58.

Fluid flow through the passage 52 is controlled by means of a poppet valve member 60 positioned within the recesses 28 and biased into engagement with the open end of passage 52 by means of spring 62. The bias of the spring 62 provides a sufficient force to hold the valve member 60 in the open end of passage 52 at the required pressure, but allows fluid to bypass from the counterbore 44 through the small orifice 58 and passage 52 into the recess 28 and out through the tank passage 38.

Means are provided for increasing the force of the compression spring 62 in order to increase the pressure in passage 52. Such means is in the form of an actuating member 64 having a stem 66 and a spring seat 68. The stem 66 extends upwardly through the bore 36 into the cover 27. The spring seat 68 is seated on the inner end of the recess 28. The stem 66 is sealed in the bore 36 by means of an O-ring 70. The actuating members 64 are biased to the neutral position by means of a compression spring 65 provided between the valve seat 50 and the spring seat 68.

The valve assemblies increase pressure by means of the joy stick 12 which is pivotally mounted in the cover or frame 27. The cover 27 is secured to the housing 26 by screws 72 to enclose the recess 32. A ball seat 82 is provided in a chamber 73 in the cover 27. The chamber 73 is connected to the recess 32 through a bore 75 in the ball seat 82.

The joy stick 12 is supported for pivotal movement in the ball seat 82 by means of a ball 80. The ball 80 includes an axial bore 84 having a reduced diameter section 86 at one end and a tapered counterbore 88 at the other end.

The joy stick 12 includes a drive pin 74 and a handle 78. A flange 77 is provided on the drive pin 74 at a spaced distance from the lower end of the pin. The drive pin is positioned in the bore 84 in the ball 80 and extends outwardly through a reduced diameter section 86. The pin 74 is retained within the bore 84 by means of a retaining ring 90 with the flange 77 seated against the reduced diameter section 86. The handle 78 is threadedly received on the end of the drive pin 74. The joy stick 12 can be enclosed within a boot 85, if desired.

Pivotal movement of the joy stick 12 is transferred to the control valve 14 and 16 by means of a plate 92 mounted on the ball 80. The plate 92 is positioned to engage the upper end of the stem 66 for the actuating members 64. The plate 92 includes a central opening 94 having a diameter slightly smaller than the diameter of the ball 80. The plate 92 is positioned on the ball 80 with the opening 94 seated on the outside surface of the ball and retained thereon by a retaining ring 96.
should be noted that on pivotal movement of the ball 80 on the axis AA, the bias on one or the other of the valves 14a and 14b will be increased in the closed direction and pivotal movement of the plate 92 on the axis BB, the bias on one or the other of the valves 16a or 16b will be increased in the closed direction.

The fluid pressure of the control valves 18a and 18b is increased by means of a drive unit 98 (FIGS. 4 and 5) provided within the recess 32. The drive unit 98 includes a drive sheave 100 and a driven sheave 102. The drive sheave 100 is mounted for pivotal movement on a shaft 104 which is seated in a recess 105 in the housing 26 and extends upwardly into bore 75 in the cover 27. The shaft 104 is connected to the drive pin 74 by means of a flexible member 108 in the form of a compression spring 108. The compression spring 108 also acts as a means for biasing the joy stick 12 to the neutral position.

The driven sheave 102 (FIG. 5) is mounted for pivotal movement on a screw 110 which is threadedly received in a threaded bore 112 in the cover 27. The motion of the driven sheave 102 is transferred to the control valves 18a or 18b by means of an arm 114 which is secured to the driven sheave 102 by screws 115. The arm 114 includes a bevelled surface 116 and 118 on each of the ends of the arm. In this regard, when the driven sheave 102 is rotated clockwise in FIG. 4, the bevelled surface 118 on the arm 114 will engage the end of the stem 66 for the valve assembly 18a pushing the stem 66 into the housing. When the driven sheave 102 is rotated in the opposite direction, the bevelled surface 116 in the other end of the arm 114 will push the stem 66 for valve 18b into the housing 26.

The rotary motion of the joy stick 12 about the vertical axis CC is transferred from the drive sheave 100 to the driven sheave 102 by means of wires or flexible cables 120. Each of the wires 120 has one end secured to a cap screw 122 on the drive sheave 100 and the other end wrapped around the outside surface of the driven sheave 102 and connected to a cap screw 124. Rotary motion of the drive sheave 100 is limited by means of a pin 126 mounted in the top 135 of the housing and extending upwardly into a notch 128 in the drive sheave 100.

In operation, hydraulic fluid is pumped to the control valve at a rate of 10 gallons per minute and flows through the restricted orifice 58 to the passage 52 at the rate of 0.5 gallons per minute. The valve members 60 because of the small bias of the springs 62 will allow the fluid to flow past the valve members 60 and back to tank 29 through recess 28, passage 40 and tank port 38. When the joy stick is pivoted on any one of the three axes, one or more of the actuating members 64 will be moved toward the valve member 60 increasing the bias of the springs 62. The flow of fluid past the valve member 60 having the increased bias will be restricted increasing the pressure of the fluid in passage 52. This increased pressure will be applied to the hydraulic unit connected to the corresponding valve assembly.

I claim:

1. A hydraulic control valve for controlling a number of hydraulically operated devices, said valve comprising:

   a housing having a number of fluid flow passages in fluid communication with the hydraulic devices,

   a valve assembly including a valve member and a spring biased said valve member toward said valve seat to restrict the flow of fluid through said passage to said reservoir passage, means mounted on said housing for selectively increasing the bias of one or the other of said springs for each pair of valve members to reduce fluid flow through said passage to said reservoir passage and increase the pressure of the fluid to said devices, said means for increasing the bias force being pivotal about two axes lying in a common plane for controlling two pairs of said valve members and being pivotable about a longitudinal axis for controlling said third pair of valve members,

   a flexible member connected to said biasing means for transferring the pivotal motion of said
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biasing means to said third pair of valve members.

6. The valve according to claim 5 including drive
means connected to said flexible member for transfig-
ing the pivotal movement of the biasing means about
its longitudinal axis to the third pair of valve members.

7. The valve according to claim 5 wherein said flex-
ible member comprises a compression spring, said com-
pression spring being operable to bias the biasing
means to a neutral position.

8. A hydraulic control valve comprising a housing,
three pair of one-way bypass fluid flow valve assem-
bles in said housing, said assemblies being adapted
to be connected to operate hydraulically actuated
devices,
a fluid inlet passage connected to each of said assem-
bles,
a fluid return passage connected to each of said as-
sembles for conducting fluid bypassed through the
valve assembly to a reservoir,
and means for selectively closing one or more of said
bypass valve assemblies to increase fluid pressure
to the devices being operated, said means including
a joy stick mounted for pivotal movement about a
first axis for controlling one pair of said assemblies
and pivotable about a second axis to control a sec-
ond pair of said assemblies, said joy stick being ro-
tatable about a longitudinal axis,
drive means for controlling the third pair of bypass
valve assemblies,
and a flexible member connecting said joy stick to
tsaid drive means whereby said drive means re-
sponds to the rotary motion of said joy stick.

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