United States Patent

Ostwald et al.

[15] **3,678,954**

[45] **July 25, 1972**

[54] CONTROL VALVE

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[22] Filed: **Sept. 9, 1970**

[21] Appl. No.: **70,804**

[30] **Foreign Application Priority Data**

Sept. 9, 1969 Germany ..... P 19 45 578.8

[52] **U.S. Cl.** ..... **137/106**, 137/112, 137/119, 137/636 H

[51] **Int. Cl.** **F15b 15/06**

[58] **Field of Search** 137/636.4, 102, 107, 119, 115, 137/105, 109, 112, 106

[56] **References Cited**

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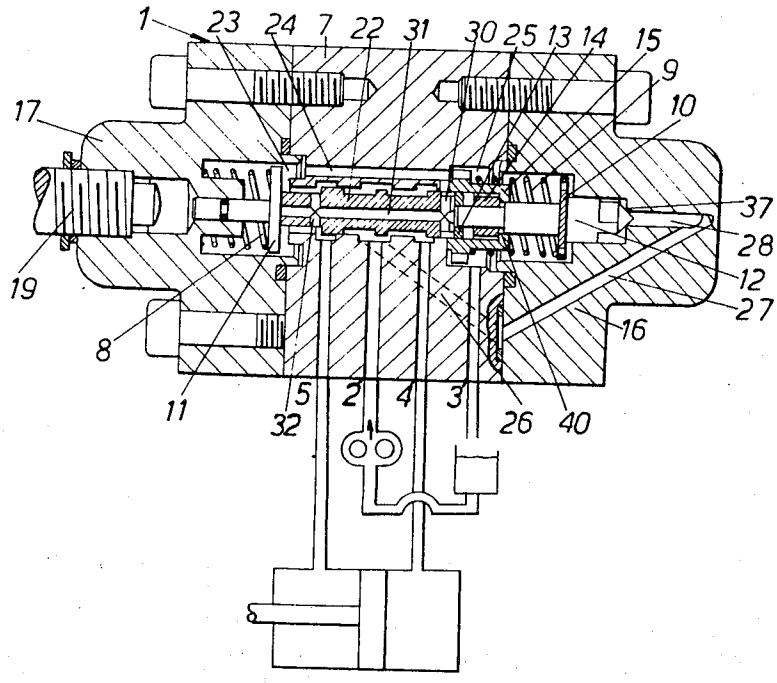
[57] **ABSTRACT**

A hydraulic control valve assembly having a valve slide and positioning device for successively positioning the valve against spaced abutments by means of an actuator piston.

6 Claims, 2 Drawing Figures



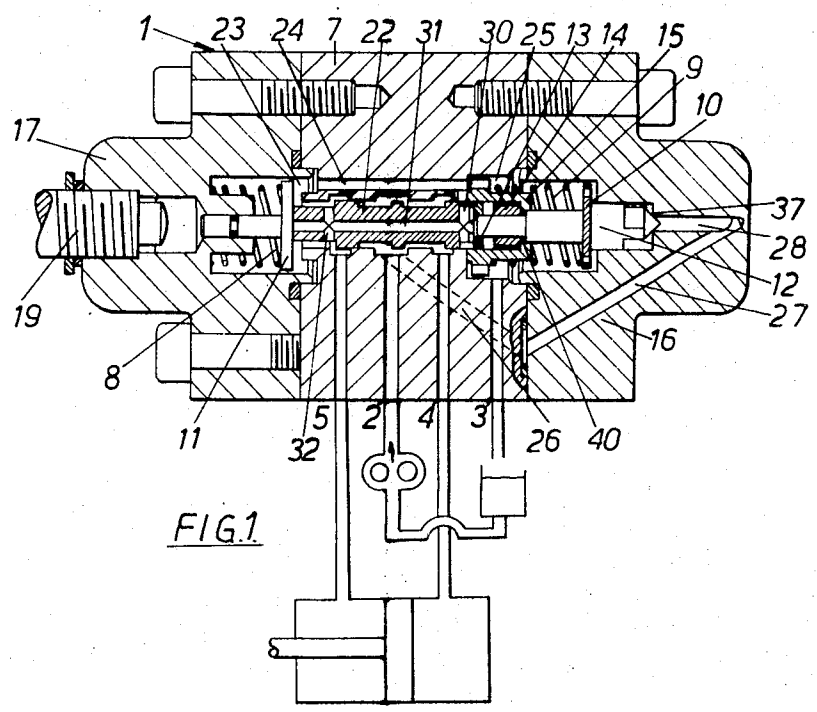


FIG.1

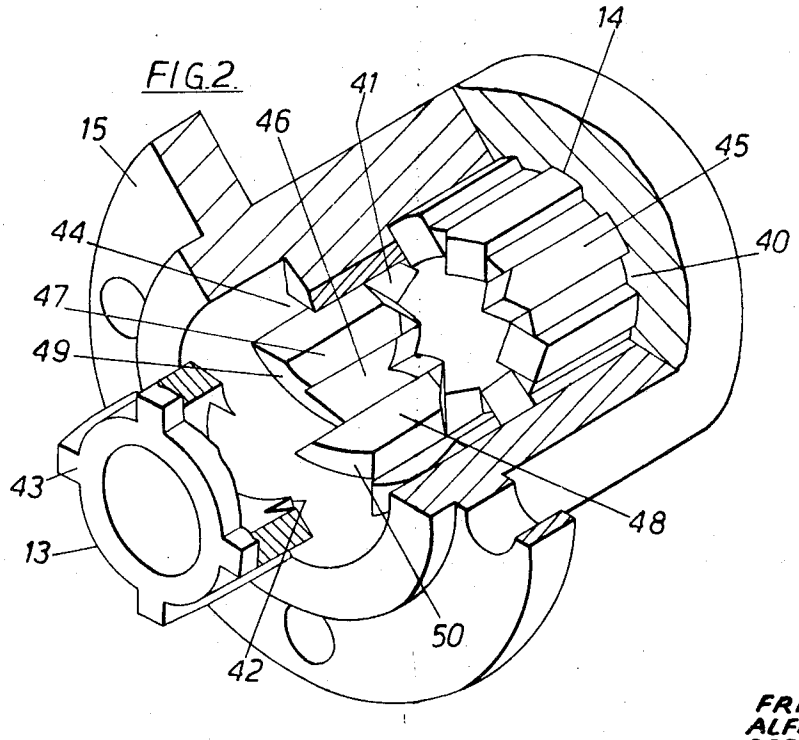


FIG.2

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CONTROL VALVE

BACKGROUND OF THE INVENTION

This invention relates to hydraulic control valves and more particularly to a two-positioned hydraulic control valve for controlling the flow of hydraulic fluid to a hydraulic load.

Control valves which are actuated by means of hydraulically operated limit switches and an additional pressure valve are known as are control valves with electrically operating limit switches acting upon control solenoid valves.

These known devices are intricate, expensive and bulky. In addition, when installed in a hydraulic system the system must be protected by means of a pressure-limiting valve which adds to the cost.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a device which alternately connects a hydraulic energy source with various consumer lines depending on the pressure of the source.

It is a further object of this invention to provide a device of this type which is reliable, compact and inexpensive to manufacture.

This invention achieves these objects by providing a hydraulic control valve which is movable between fixed axial positions by means of a device having axially spaced abutments and means for moving the device between successive abutments after each movement of an actuating member in response to a signal such as increased supply pressure.

In a preferred embodiment of the invention the control slide — after overcoming the pressure exerted on the actuating rod — moves the actuating rod so as to activate an electric switch. Preferably the actuating member which displaces the control slide is a stepped piston having its smaller end subject to supply pressure and a larger area which is open to supply pressure only after the initial movement of the actuator in response to the supply pressure on the smaller area.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-section of a control valve assembly embodying the present invention; and

FIG. 2 is a partial sectional perspective view of the valve positioning member of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings there is shown a control valve assembly 1 having a pump connection 2, a reservoir connection 3 and consumer or load connections 4 and 5. A control slide 22 in the form of a spool valve is movable between the position shown in the drawings, in which the pump connection leads to load line 4 while the reservoir is connected to the load line 5, and a second position in which the connections are reversed so that the pump connection leads to the consumer line 5 while the reservoir is connected to the consumer line 4. In the position shown the connection between the consumer line 5 and the reservoir line 3 is made via control slide 22, chamber 23 in the housing cover 17 and the longitudinal bore 24 in the housing 7 leading to the chamber 25. The pump connection 2 leads to the bore 28 in the housing cover 16 via the bores 26 and 27. An actuating member 12, the end of which forms a valve closing the bore 28 at the seat 37, is positioned at the right end of the control slide as seen in FIG. 1. The actuating member 12 is held in the position shown in which the bore 28 is closed by means of the compression spring 9 acting between a guide sleeve 15 in the housing 7 and the perforated abutment disc 10 on the actuating member 12.

When the pump pressure supplied to the end of the actuating member 12 via the bore 28 exceeds the loading of the compression spring 9 the actuating member 12 is lifted from its seat 37 to allow the pump pressure to be applied to the larger piston surface of the actuating member. The sudden change in force which is created moves the actuating member 12 rapidly to the left against the compression spring 9 thus displacing the sleeves 13 and 14 from their rest position against the shoulder 40 of the guide sleeve 15. In addition the actuating member 12 displaces the control slide 22 to the left against the compression spring 8 which bears on the actuating rod 11.

As will be explained hereinbelow the mechanism shown in FIG. 2 causes the sleeve 13 to change its abutment position to hold the valve in a new control position in which the supply connection 2 leads to the consumer connection 5 and the reservoir is connected to the consumer connection 4 via the bores 30, 31, 32 and the chamber 23.

When the control slide 22 moves to the left, as described above, the actuating rod 11 contacts the actuating button 19 of a microswitch whereby an electric motor is actuated to disconnect the supply pressure at the connection 2.

Reference is now made to FIG. 2 for a description of the operation of the device which provides the two-position abutments for the control slide 22. The mechanism shown is somewhat similar to the two-position device which has been so successfully adapted to use in snap-action ball-point pens. In the device shown guides 44 and 46 of different radius are alternately provided in the cylinder bore of the guide sleeve 15. The sleeve 14 having external teeth 45 is slidable in the guides up to the abutment shoulder 40 of the guide sleeve 15. The end of the sleeve 14 remote from the abutment shoulder 40 is provided with teeth pointing in an axial direction. The sleeve 13 which is rotatable and axially slidable has external teeth 45 and wedge-shaped ends 42 which rests against the flanks 41 of the teeth disposed in the deeper of the two guides 44. The front surfaces of the keys formed by the guides 44 and 46 are provided with inclined surfaces or chamfers 49 and 50 on the ends remote from the shoulder 40. When the sleeve 14 abuts against the shoulder 40 and the sleeve 15 rests with its ends 42 against the teeth flanks 41, the first control position of the control slide 22 results. If the sleeve 14 is moved from the abutment 40 by the actuating member 12 the sleeve 13 will slide in the guides 44 until the teeth flanks 41 contact the chamfers 49. At this point the compressive force exerted in the sleeve 13 by the restoring device, which is contrary to the force of the actuating member, will cause the sleeve 13 to move in an axial and rotary direction along the chamfers 49 until it rests against the abutment formed by the guide 46 and the key 48. This second abutment position provides the second position of the control slide 22. In this manner the control slide 22 is easily movable between two fixed abutment positions.

An advantage of this invention is that the compression spring 8 and the actuating rod operate as a change-over valve and restoring device with respect to the control slide and in addition represent a pressure limiting valve for the hydraulic system.

While we have described above the principles of our invention in connection with specific apparatus it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention as set forth in the accompanying claims.

We claim as our invention:

1. A hydraulic valve having a control slide, characterized in that the control slide is caused to rest Alternately against abutments by a positioning device and in opposition to the force of a restoring device, said abutments being disposed in axial direction at a certain distance and separate from one another, and said positioning device, when actuated, being moved from the respective abutment to the next abutment by means of an actuating piston which is applied with and from a pressure source; and further characterized in that a guiding sleeve has been provided with at least two guides arranged in the inside bore of said guiding sleeve, said guides being of different radius and accommodating the positioning device, the positioning device consisting of two sleeves which are provided with and external toothing and a toothing on the front surface.

2. The valve according to claim 2, further characterized in that keys separating the guides have chamfered surfaces on their respective faces.

3. The valve of claim 3, characterized in that the sleeve with its front surface remote from the toothing, rests against a shoulder on the guiding sleeve, and the other sleeve is axially slidable towards the guiding sleeve and providing a front surface which is fitted with wedge-shaped ends, said front surface resting against the teeth flanks of the sleeve.

4. The valve of claim 4, characterized in that the sleeve provides a front surface with wedge-shaped ends which rests against the chamfer of the guide.

5. The valve of claim 5, further characterized in that an actuating rod is displaced by the control slide after the compressive force exerted on the actuating rod has been overcome, whereafter said rod actuates the button of an electric switch.

6. The valve of claim 6, characterized in that the actuating piston for the displacement of the control slide is designed as a stepped piston on its end which is applied with pump pressure.

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