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(54) **Multiway valve**

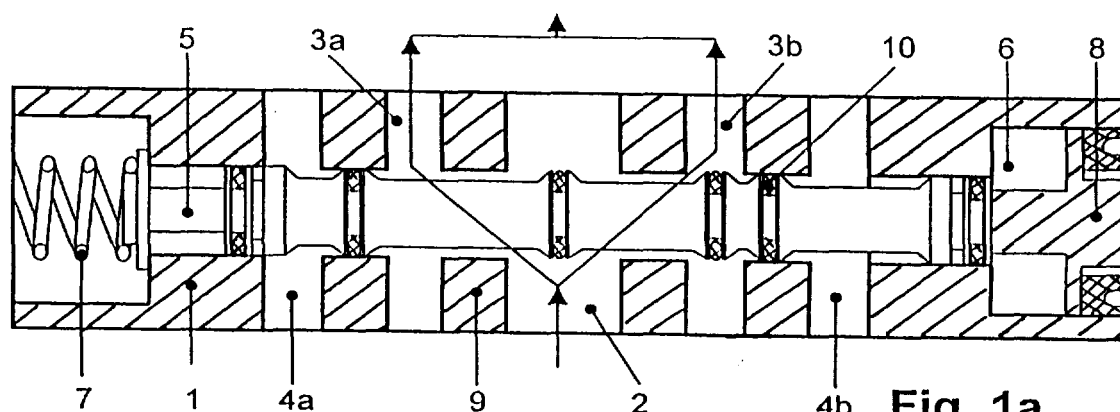
(57) This invention relates to a multiway valve for controlling the flow of a pressure medium from a fluid supply conduit or an exhaust conduit to a fluid delivery conduit comprising

ports (2, 3a, 3b, 4a, 4b) guided axially movable in said hole and

means for moving said switching means relative to said valve housing (1) disposed on at least one end of said switching means.

a valve housing (1) with a substantially cylindrical axial hole which has a plurality of annular steps (9) forming inner chambers with corresponding outer ports (2, 3a, 3b, 4a, 4b) for connecting said conduits,
means for switching the fluid flow between said

According to the invention said steps (9) form at least two inner chambers for the delivery port (3a, 3b) and also at least two inner chambers for the exhaust port (4a, 4b).



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DescriptionField of the invention

[0001] This invention relates to a multiway valve for controlling the fluid flow of a pressure medium.

Background of the invention

[0002] Such valves are known from the catalogue "Know-How In Pneumatics" issued by AB Rexroth Mecman, Stockholm, in 1998, page 5.64. The disclosed 3/2-way-valve has a valve housing by which the valve is mountable on sub-bases. On the valve housing one supply port for compressed air, one delivery port, and one exhaust port are disposed. The valve has two switching positions; "opened" and "closed", and it is controlled by air pressure. The valve housing is provided with an axial hole which has a plurality of steps to form inner seat elements and chambers. The chambers are connected with the outer ports. The fluid flow of the pressure medium is controlled by the seat elements and a valve tappet as means for switching. Therefore the movable valve tappet is axially guided in said hole. To move the valve tappet in an axially manner, its one end is formed as a piston. The piston works together with a cylindrical control-chamber integrated in the valve housing so that the switching position of the valve is controllable by air pressure. To return the valve tappet to the normal position, a spring is disposed between the valve tappet and the valve housing.

[0003] The 3/2-way-valve is often used in addition to a single-acting cylinder. A single-acting cylinder is driven by a pressure medium, e.g. air pressure, in one direction and a built-in spring in the other direction and can only perform work in the direction that is driven by the pressure medium. Therefore the pressure chamber of the cylinder is connected with the delivery port of the valve over a delivery conduit. The delivery port of the valve is connected with its supply port in order to move outwardly the piston rod of the cylinder against the force of its built-in spring. The exhaust port is cut off. For moving the piston rod of the cylinder inwardly, the delivery port is connected with the exhaust port and the supply port is cut off. The built-in spring of the cylinder moves the piston rod into the direction desired.

[0004] For some applications it is necessary to move the piston rod with a high speed. The speed depends on the flow rate of the valve. Thus it is known to design bigger supply and exhaust channels of the valve. This has the undesired effect that the valve housing and the switching means grow bigger. Another possibility is to use two 3/2-way-valves in a parallel way, but this increases the costs of such application enormously.

[0005] It is an aim of the invention to provide a development which in contrast to the prior art provides a high flow rate through a relatively small valve housing and switching means.

Summary of the invention

[0006] This aim is obtained in a multiway valve of the above-mentioned kind by using the features of the characterising part of claim 1. So the invention provides at least two chambers in the valve housing only for the delivery conduit and also at least two chambers only for the exhaust conduit. The invention allows a high flow rate of a multiway valve.

Furthermore, this valve has a relatively small valve housing and switching means.

[0007] It can be useful that the chambers for the delivery conduit and/or the chambers for the exhaust conduit are interconnected via fluid channels disposed in the valve housing. Moreover, only three ports are needed (one supply port, one delivery port, one exhaust port) on the valve housing. This integrated solution requires a delivery port and an exhaust port of a larger size. A supply port of a larger size is not necessary because the pressed supply air does not need a channel or a conduit with a large cross-section.

[0008] It is also possible to connect the chambers for the delivery conduit and/or the chambers for the exhaust conduit with outer conduits. In that case the valve housing has five ports (one supply port, two parallel delivery ports, two parallel exhaust ports). This valve is more flexible in special applications.

[0009] For a slide valve the switching means comprise a cylindrical valve slide with radial grooves for routing the fluid flow. Annular seals are disposed in corresponding seal-grooves on the outer surface of said slide for sealing said slide in the valve housing. It is also possible to dispose the seals inside the hole of the housing. For a poppet valve the switching means comprise at least one valve tappet that works together with corresponding valve seats located in the valve housing.

[0010] In a preferred embodiment of the invention the means for moving the switching means comprise a piston that is guided in a control-chamber at one end of said switching means. The control-chamber works together with a return spring disposed at the other end of the switching means to form a mono-stable valve. For a bi-stable valve it is possible to dispose two pistons with corresponding chambers on both ends of e.g. a slide as switching means. In another embodiment of the invention the means for moving the switching means comprise an electromagnet with an armature connected with the switching means.

[0011] The foregoing and other aspects will become apparent from the following detailed description of the invention when considered in conjunction with the enclosed drawings.

Brief description of the drawings

[0012]

Fig.1a is a cross-sectional view of a valve, showing

the switching means in the opened position,

Fig.1b is a cross-sectional view of a valve, showing the switching means in the closed position,

Fig.2a is a schematic diagram of a 5/2 normally-open mono-stable valve for a special application,

Fig.2b is a schematic diagram of a 5/2 normally-close mono-stable valve for another special application, and

Fig.2c is a schematic diagram of a 5/2 normally-open/normally-close bi-stable valve for another special application.

Detailed description of the Drawings

[0013] The multiway valve shown in Fig.1a has a valve housing 1 which is provided with the usual ports for pressure air to connect outer conduits. Therefore, one port 2 allows to connect the supply conduit of a pressure air source, two ports 3a and 3b are connected with the delivery conduit and two ports 4a and 4b are connected with the exhaust conduit or with a silencer. To get a high flow through the valve housing the delivery ports 3a and 3b and the exhaust ports 4a and 4b are arranged in pairs. Inside the valve housing 1 there is a slide 5 as switching element, said slide 5 is axially movable. The position of the slide 5 inside the valve housing 1 is controlled by supply of control fluid into a control-chamber 6 which is located at one end of the slide 5 and presses against the action of a return spring 7. Therefore, one end of the slide 5 is formed like a piston 8. The return spring 7 is disposed at the other end of the slide 5. For controlling the fluid flow, the inner section of the valve housing 1 is substantially shaped as a hole which has a plurality of steps 9 forming inner chambers for the corresponding outer ports 2, 3a, 3b, 4a and 4b. The slide 5 has annular seals 10 which are disposed in corresponding seal-grooves on the outer surface of slide 5. The function of the above described multiway valve (where Fig.1a shows the position of the slide) is such that the pressured air in the supply port 2 flows into an annular chamber outwardly the mid portion of the slide 5, from where the air is delivered through the delivery ports 3a and 3b to a consumer such as a working cylinder. In this situation the control-chamber 6 is released and the slide 5 is returned because of the spring action of the return spring 7.

[0014] When pressurising the control-chamber 6 shown in Fig.1b the slide 5 moves (in the figure to the left), whereby the supply port 2 is cut off over the annular seals 10 of the slide 5 and the annular steps 9 of the valve housing 1. Now, the pressured air from the working cylinder flows through the delivery ports 3a and 3b into an annular chamber outwardly the mid portion of the slide 5, from where the air is delivered through the exhaust ports 3a and 3b into the atmosphere.

[0015] Fig.2a shows a 5/2 normally-open mono-stable valve for a special application. The numerical indices in the Fig.2a to 2c describe the following ports:

1 - supply port

2, 4 - delivery port

3, 5 - exhaust port

[0016] Such a valve is preferably used instead of two 3/2-valves if a high flow rate for a high speed of the piston rod is needed for a single acting cylinder.

[0017] In another special application as shown in Fig.2b, the 5/2 normally-open mono-stable valve is used for the control of two single acting cylinders which have to work simultaneously. This application ensures that both cylinders move at the same time.

[0018] The embodiment described in Fig.2c shows a 5/2 normally-open/normally-close bi-stable valve which is connected with one single acting cylinder for getting a higher flow rate than a 5/2 bi-stable valve.

[0019] The invention is not limited by the embodiments described above which are presented as examples only but can be modified in various way within the scope of protection defined by the appended patent claims.

Claims

1. Multiway valve for controlling the flow of a pressure medium from a fluid supply conduit or an exhaust conduit to a fluid delivery conduit comprising

a valve housing (1) with a substantially cylindrical axial hole which has a plurality of annular steps (9) forming inner chambers with corresponding outer ports (2, 3a, 3b, 4a, 4b) for connecting said conduits,

means for switching the fluid flow between said ports (2, 3a, 3b, 4a, 4b) guided axially movable in said hole and

means for moving said switching means relative to said valve housing (1) disposed on at least one end of said switching means, characterized in that

said steps (9) form at least two inner chambers for the delivery port (3a, 3b) and also at least two inner chambers for the exhaust port (4a, 4b).

2. Multiway valve according to claim 1, characterized in that

the chambers for the delivery port (3a, 3b) and/or the chambers for the exhaust port (4a, 4b) are interconnected with outer conduits.

3. Multiway valve according to claim 1, characterized in that

the chambers for the delivery port (3a, 3b) and/or the chambers for the exhaust conduct (4a, 4b) are interconnected with fluid channels

disposed in the valve housing (1).

4. Multiway valve according to claim 1, characterized in that

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the switching means comprise a cylindrical valve slide (5) with radial grooves for routing the fluid flow.

5. Multiway valve according to claim 4, characterized in that 10

annular seals (10) are disposed in corresponding seal-grooves disposed on the outer surface of said slide (5) or in the hole of the housing (1) 15 for sealing said slide (5) in said hole.

6. Multiway valve according to claim 1, characterized in that

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the switching means comprise at least one valve tappet that works together with corresponding valve seats located in the hole.

7. Multiway valve according to claim 1, characterized in that 25

the means for moving said switching means comprise a piston (8) that is guided in a control-chamber (6) at one end of said switching means. 30

8. Multiway valve according to claim 7, characterized in that

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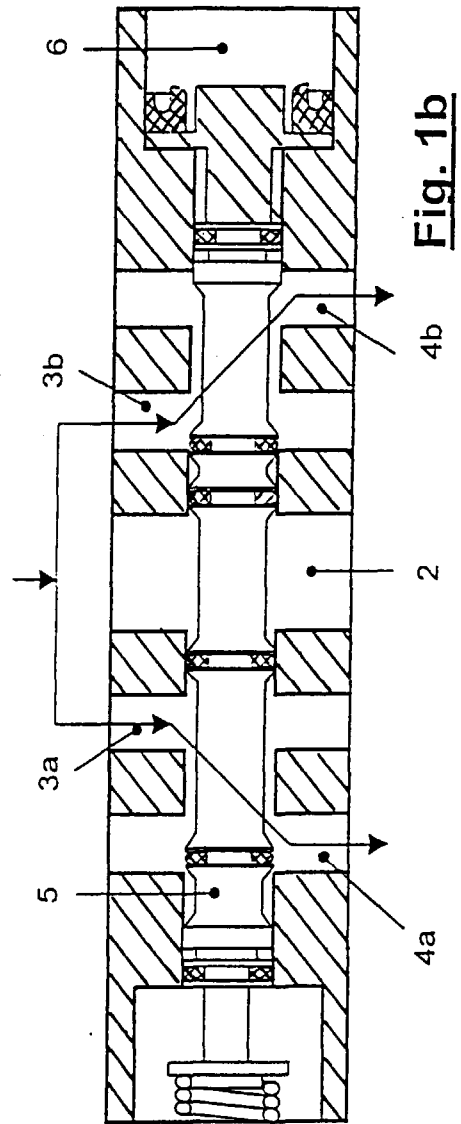
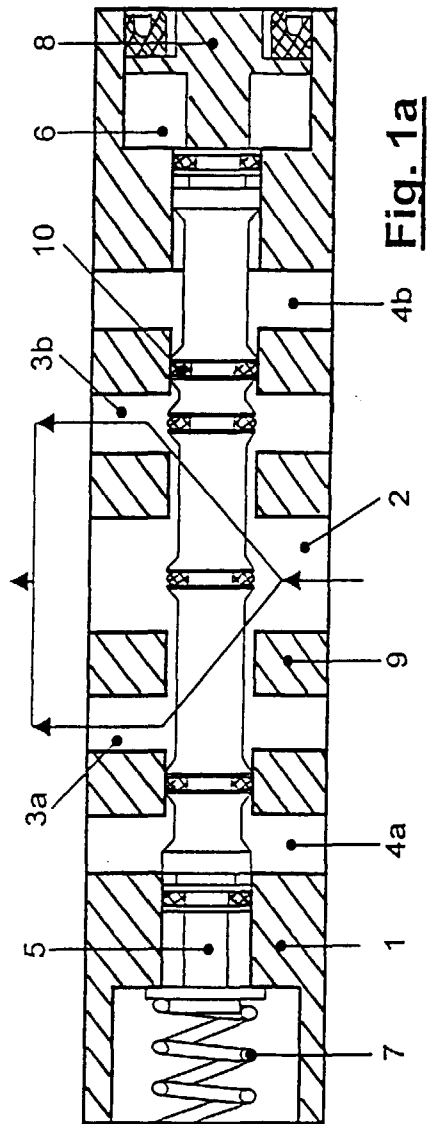
said control-chamber (6) works together with a return spring (7) disposed at the other end of said switching means.

9. Multiway valve according to claim 1, characterized in that 40

the means for moving said switching means comprise an electromagnet with an armature connected with said switching means. 45

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5/2 No Mono-stable

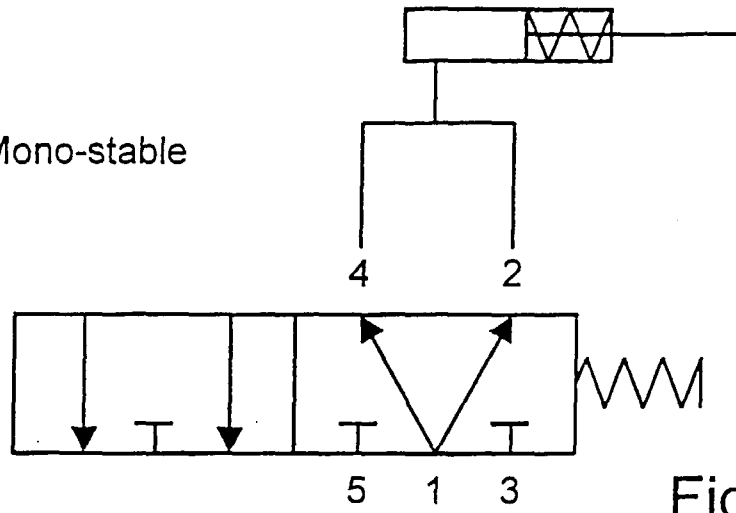


Fig. 2a

5/2 Nc Mono-stable

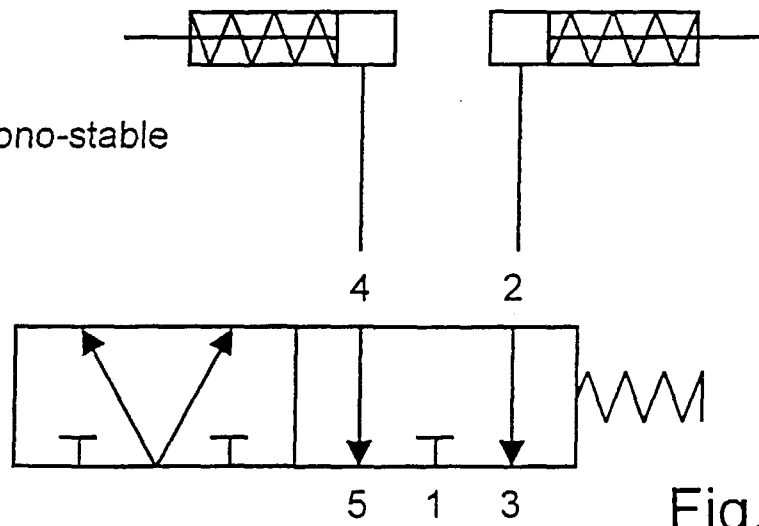


Fig. 2b

5/2 No/Nc Bi-stable

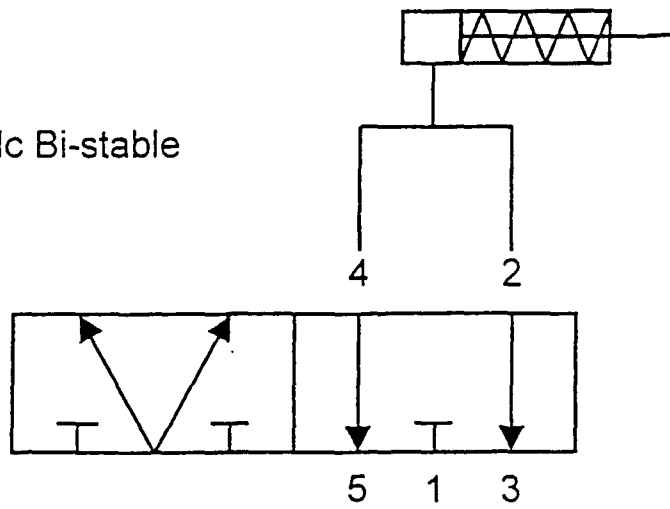


Fig. 2c