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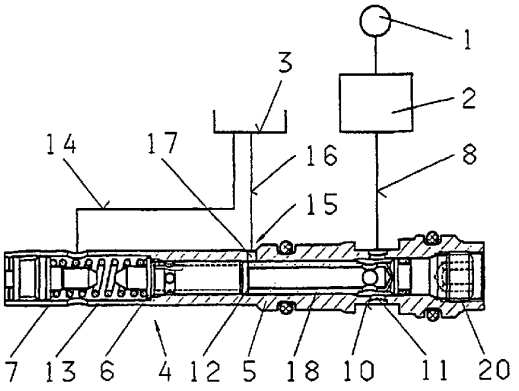
[Fortsetzung auf der nächsten Seite]

(54) Title: CUT-OFF VALVE FOR POWER STEERING SYSTEMS, ESPECIALLY FOR AUTOMOBILES

(54) Bezeichnung: ABSCHNEIDVENTIL FÜR HILFSKRAFTLENKUNGEN, INSBESONDERE FÜR KRAFTFAHRZEUGE



(57) Abstract: A cut-off valve for power steering systems, especially for automobiles, contains a source of a pressure means (1) and a container (3), and is used for limiting a pressure in at least one pressure chamber. The cut-off valve also contains a closing body (6) which can be adjusted against the force of a spring (7) and a fixed throttling point (15) which is located in a connecting line between the pressure chamber that is subjected to a first pressure and a pressure chamber that is subjected to a second pressure. The cross-section of the throttling point (15) can be regulated without being disassembled from the outside. By altering the cross-section of the throttle point (15), it is possible to reduce the width of the tolerance zone or the width of the hysteresis of the valve characteristics to approximately half of the original size.

[Fortsetzung auf der nächsten Seite]

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Cut-off valve for power steering systems, especially for automobiles

The invention concerns a cut-off valve for power steering systems, in particular for automobiles, for limiting the pressure in at least one pressure chamber, in accordance with the preamble of claim 1. The cut-off valve comprises a piston that is adjustable against the force of a spring, and a fixed throttling point, which is arranged in a connecting line between a pressure chamber to which a first pressure is applied and a second pressure chamber to which a second pressure is applied.

A cut-off valve of this kind is known from DE-A1-42 16 053. In a cut-off valve made in accordance with this patent application it is possible to avoid response pressure tolerances of the cut-off valve almost completely. Moreover, manufacturing tolerances of the cut-off valve can be eliminated through this, and further tolerances of other steering components can be compensated for.

However, the measures stated in this document have no influence over the width of the tolerance field of the valve characteristics. When the known cut-off valve is applied, the hysteresis of the valve characteristics is too large for some applications.

It is the object of the invention to improve the cut-off valve in such a way that the width of the tolerance field of the valve characteristics can be reduced to at least 50%.

This object is met through the cut-off valve characterised in claim 1 in that the cross-section of the throttling point is made externally adjustable without dismantling. Through changing the cross-section of the throttling point it is possible to reduce the width of the tolerance field, or the width of the hysteresis of the valve characteristics respectively, so that it amounts to approximately half of the previous value.

Expedient and advantageous embodiments of the invention are stated in the subclaims.

The cross-section of the throttling point may either be infinitely adjustable or adjustable in multiple steps. Infinite adjustment can be effected very simply in that the throttling point is formed by a bore whose cross-section is, for example, adjustable by means of an adjusting screw or an adjusting member, whose axis is essentially perpendicular to the axis of the bore. In this instance the cross-section of the bore is altered in that the adjusting screw is turned in to a greater or lesser depth.

Stepped adjustment of the cross-section of the throttling point can be effected by the following characteristics: The throttling point is formed by one of multiple throttle bores that are arranged on a rotatable, cylindrical adjusting member in one plane, spaced at a

certain angular pitch, and which have varying cross-sections. One of the throttle bores acts in conjunction with a larger fixed bore in the housing, whilst the other throttle bores are closed. Finally, one of the throttle bores is arranged in the connecting line between the retroaction chamber and the return line to the container. For production reasons the throttle bores are expediently arranged in the rotatable adjusting member in one plane and at equal angular distances.

The following presents a detailed description of the invention by way of two exemplary embodiments illustrated in the drawing.

Shown are in:

Fig. 1 a valve characteristic of a power steering system comprising a state-of-the-art cut-off valve;

Fig. 2 a valve characteristic of a power steering system comprising a cut-off valve according to the invention;

Fig. 3 a schematic representation of a power steering system depicting a longitudinal cross-section through a cut-off valve according to the invention in a first exemplary embodiment;

Fig. 4 a longitudinal cross-section through a cut-off valve according to the invention in a second exemplary embodiment;

Fig. 5 a cross-section of the cut-off valve according to the invention through line V-V in Fig. 4.

The illustration of the power steering system, in which the cut-off valve according to the invention is installed, shows only one source for a pressure medium 1, one retroaction chamber 2 and one container 3. Further components of the power steering system, which are however not necessary to understand the present invention, can be seen, for example, in DE-A1-42 16 053. Essential for the invention is the presence of two pressure chambers that are pressurised to different pressure levels. One pressure chamber is the retroaction chamber 2 and the second one is the container 3.

Cut-off valve 4 contains in a valve housing 5 a blocking member 6, upon which the force of a spring 7 acts, which forces it into its closed position.

The direct connection between retroaction chamber 2 to container 3 is cut off by blocking member 6. This connection comprises a line 8 that is arranged between the retroaction chamber 2 and the valve housing 5. Said line 8 ends in an annular groove 10 of valve housing 5, which is connected via multiple boreholes 11 to the inner cavity 12 of valve housing 5. The connection between retroaction chamber 2 and container 3 continues through a spring chamber 13 and a line 14.

The cut-off valve 4 is designed according to the pressure balance principle. Here, different levels of pressure are applied to each of the end faces of blocking member 6.

The return pressure from container 3 is applied to the end face of blocking member 6 located in spring chamber 13. The pressure that lies between that of the retroaction chamber 2 and that of container 3 is applied to that end face of blocking member 6 that is located in the inner cavity 12 of valve housing 5. To obtain this pressure in the inner cavity 12 a throttling point 15 is arranged between inner cavity 12 and container 3, in which said throttling point 15 is connected with container 3 via line 16. The cross-section of throttling point 15 is adjustable.

In the exemplary embodiment according to Fig. 3 the throttling point 15 can be made adjustable in that the throttling point 15 is formed by a borehole 17 in valve housing 5, whose cross-section can be altered by an adjusting member 18 that is inserted into the inner cavity 12. In the exemplary embodiment according to Fig. 3 the adjusting member 18 takes the form of an adjusting screw whose axial position can be changed via a thread 20. Fig. 3 shows the adjusting member 18 in a position in which borehole 17 is fully closed. Thus the cross-section of throttling point 15 equals zero. Through turning the throttling point 15 out of its thread 20 the cross-section of throttling point 15 can be increased. This permits a very accurate adjustment and reduction of the tolerance field width of the valve characteristics.

The tolerance field width that is achievable with the cut-off valve according to the invention is shown in Fig.2. It demonstrates that the tolerance field width of the valve characteristics is smaller by the hatched area

than the tolerance field width of a state-of-the-art cut-off valve, as depicted in Fig. 1.

In the exemplary embodiment according to Fig. 3 the throttling point 15 is infinitely variable. In contrast, in the exemplary embodiment according to Fig. 4 the throttling point 15 is adjustable in multiple steps. With this embodiment it is possible to provide an adjusting member 21 with fixed settings of throttle cross-sections that have been recognised as advantageous. In this instance a bores 22 with a larger diameter is provided in valve housing 5. One of a number of throttle bores 23 can be made to connect with said borehole 22. The throttle bores 23 are arranged in the adjusting member 21 in one plane and at a certain angular pitch. It is expedient to choose a uniform angular pitch. The throttle bores 23 have different diameters. The adjusting member 21 can be rotated such that each time one of the throttle bores 23 is connected with borehole 22. After such an adjustment the adjusting member 21 can be fixed with a locking screw 24.

If the pressure medium source 1 is connected directly or indirectly to the boreholes 17 or 22 respectively instead of container 3, the throttling point 15 acts as a pilot throttle through which the pressure in the retroaction chamber can be adjusted. This makes it possible to influence the position of the valve characteristic in the tolerance band, in a corresponding manner such as in the exemplary embodiments of Fig. 3 and 4.

Reference numbers

1	Pressure medium source
2	Retroaction chamber
3	Container
4	Cut-off valve
5	Valve housing
6	Blocking member
7	Spring
8	Line
9	-
10	Annular groove
11	Borehole
12	Inner cavity
13	Spring chamber
14	Line
15	Throttling point
16	Line
17	Borehole
18	Adjusting member
19	-
20	Thread
21	Adjusting member
22	Borehole
23	Throttle bore
24	Locking screw

Claims

1. Cut-off valve for power steering systems, in particular for automobiles, comprising a pressure medium source (1) and a container (3), for limiting a pressure in at least one pressure chamber, comprising a blocking member (6) that is adjustable against the force of a spring (7), and a fixed throttling point (15), which is arranged in a connecting line between a pressure chamber to which a first pressure is applied and a second pressure chamber to which a second pressure is applied, characterised in that the cross-section of the throttling point (15) is made externally adjustable without dismantling.

2. Cut-off valve according to claim 1, characterised in that the throttling point (15) is formed by a borehole (17) whose cross-section is infinitely adjustable.

3. Cut-off valve according to claim 2, characterised in that the cross-section of borehole (17) is adjustable by means of an adjusting member (18) whose axis is essentially perpendicular to the axis of the borehole.

4. Cut-off valve according to claim 3, characterised in that the adjusting member (18) takes the form of an adjusting screw that is axially adjustable.

5. Cut-off valve according to claim 1, characterised by the following features:
- the throttling point (15) is formed by one of many throttle bores (23);
- the throttle bores (23) are arranged on a rotatable, cylindrical adjusting member (21) in one plane and at a certain angular pitch, and have different cross-sections;
- one of the throttle bores (23) acts in conjunction with a larger borehole (22) in a valve housing, whereas the remaining throttle bores (23) are closed;
- one of the throttle bores (23) is arranged in the connecting line between the pressure chamber to which the first pressure is applied and the second pressure chamber to which the second pressure is applied.

6. Cut-off valve according to claim 5, characterised in that the throttle bores (23) are arranged on the rotatable adjusting member (21) in one plane and at an equal angular pitch.

7. Cut-off valve according to one of the claims 1 to 6, characterised in that the pressure chamber to which a first pressure is applied is a retroaction chamber (2) and that the second pressure chamber to which a second pressure is applied is the container (3).

8. Cut-off valve according to one of the claims 1 to 6, characterised in that the pressure chamber to which

the first pressure is applied is formed by the pressure medium source (1), and that the second pressure chamber to which a second pressure is applied is formed by a retroaction chamber (2).

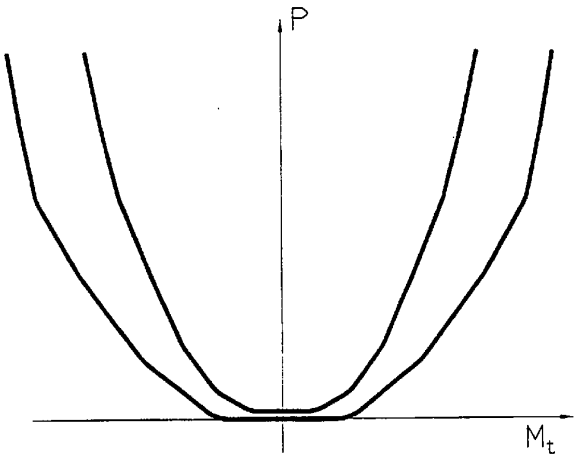

Fig. 1

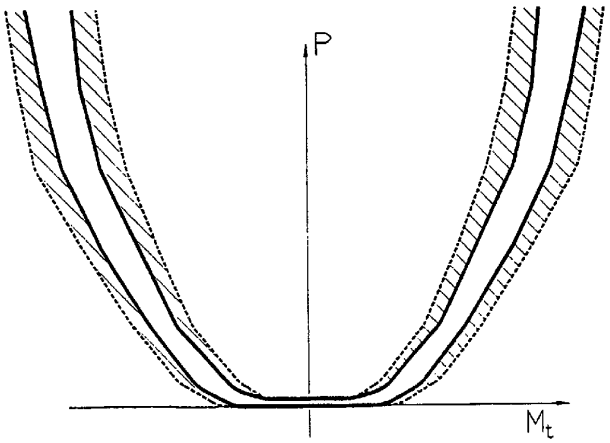

Fig. 2

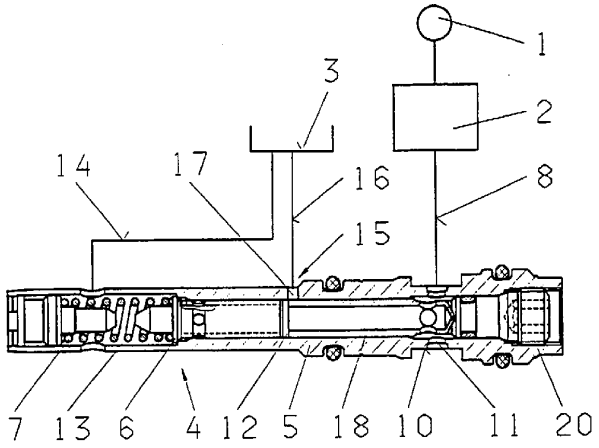

Fig. 3

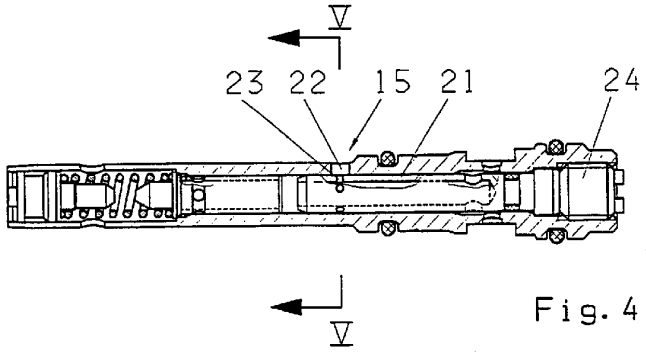

Fig. 4

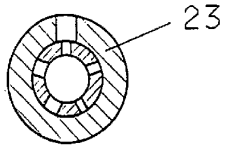

Fig. 5