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Valve

Abstract

The disclosure relates to a valve comprising a valve housing which has two fluid connection points for guiding a fluid and comprising an actuation device for actuating a main piston of a seat valve, said main piston being received in the valve housing. The valve housing together with the seat valve receives a nonreturn valve. At least one bypass line runs in the valve housing, said bypass line allowing a flow of fluid present at the fluid connection point in the direction of a valve chamber in the open state of the seat valve while bypassing the nonreturn valve, said flow being controllable by the main piston of the seat valve.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to German Patent Application No. DE 10 2022 004 033.6, filed on Oct. 28, 2022 with the German Patent and Trademark Office. The contents of the aforesaid Patent Application are incorporated herein for all purposes.

BACKGROUND

[0002] This background section is provided for the purpose of generally describing the context of the disclosure. Work of the presently named inventor(s), to the extent the work is described in this background section, as well as aspects of the description that may not otherwise qualify as prior art at the time of filing, are neither expressly nor impliedly admitted as prior art against the present disclosure.

[0003] The disclosure relates to a valve comprising a valve housing which has two fluid connection points for guiding fluid and comprising an actuation device for actuating a main piston of a poppet valve, said main piston being received in the valve housing, wherein a non-return valve is received in the valve housing together with the poppet valve.

[0004] DE 10 2012 015 354 A1 discloses a valve, in particular a pilot-operated proportional directional valve, having a valve housing comprising a fluid inlet and a fluid outlet, wherein the fluid flow between the fluid inlet and the fluid outlet can be controlled by a main piston, wherein a pilot control valve chamber is provided on a rear side of the main piston with a pilot control valve closing element that can be moved by an actuation device, the fluid flow being able to be controlled between the pilot control valve chamber and the fluid outlet by means of said pilot control valve closing element, wherein an inflow orifice is arranged between the fluid inlet and the pilot control valve chamber, the opening cross-section of said inflow orifice being able to be reduced by a control element.

[0005] Furthermore, a maximum volume flow controller is provided inside the valve housing, said flow controller comprising a control piston in the form of a spring-loaded non-return valve, said control piston being loaded on a front side by the pressure of the fluid discharged from the pilot control chamber and on a rear side by a compression spring. As such, a flow controller is integrated inside the valve and the inflow orifice cross-section, which can be reduced in size by means of the control element, causes the pressure in the pilot control valve chamber to fall such that it is possible to actively control the opening stroke of the main piston in addition to controlling the pilot control valve seat. The lower the differential pressure between the fluid inlet and the fluid outlet, the larger the opening stroke of the valve can be set to be to permit the flow control function.

SUMMARY

[0006] A need exists to provide a valve which combines two different valve types with one another in a shared housing in a space-saving manner. This may, e.g., increase the application possibilities for such valve constructions.

[0007] The need is addressed by the subject matter of the independent claim(s). Embodiments of the invention are described in the dependent claims, the following description, and the drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** shows the form of a longitudinal section through a de-energised example opened valve in an unactuated position;

[0009] FIG. **2** shows the same example valve as in FIG. **1** in an activated and thus closed position;

[0010] FIG. **3** shows an example hydraulic circuit for the de-energised open example valve according to FIG. **1**;

[0011] FIG. **4** takes the form of a longitudinal section through a further de-energised example closed valve in an unactuated position;

[0012] FIG. **5** shows the same example valve as in FIG. **4** in an activated and thus open position; and

[0013] FIG. **6** shows an example hydraulic circuit for the de-energised closed valve according to FIG. **4**.

DESCRIPTION

[0014] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description, drawings, and from the claims.

[0015] In the following description of embodiments of the invention, specific details are described in order to provide a thorough understanding of the invention. However, it will be apparent to one of ordinary skill in the art that the invention may be practiced without these specific details. In other instances, well-known features have not been described in detail to avoid unnecessarily complicating the instant description.

[0016] In some embodiments, at least one bypass line runs in the valve housing, said bypass line routing a fluid flow present at one fluid connection point in the direction of a valve chamber when the poppet valve is in the open state, while bypassing the non-return valve. Said flow being able to be controlled by the main piston of the poppet valve, the non-return valve integrated in the valve housing is, if required, in a position to be able to discharge fluid on the consumer side via the valve into the abutting fluid circuit at a very low opening pressure and with low throughflow loss, in turn with a relatively large opening cross-section.

[0017] As such, it is possible to increase the scope of application for such valve constructions. For example, the valve can be very readily combined with hydraulic damping cylinders as the consumer, in particular in the form of so-called stabilisers as part of a vehicle chassis. By using the valve, the respective stabiliser is designed to be operated more rigidly when cornering than when driven off-road, when a softer spring compression of the chassis is generally desirable.

[0018] In some embodiments, the poppet valve is a 2/2 directional poppet valve, in particular a pilot-operated 2/2 directional poppet valve. As such, in the opposite direction to the non-return valve, the volume flow can be released as a function of the switching position of the tightly seated 2/2 directional valve by means of an electrical signal to the actuation device. In some embodiments 10 as a modular system, the 2/2 directional poppet valve can be normally open (NO) or normally closed (NC) in the basic position depending on the version selected. The internal return of the fluid from one connection point in the valve housing to the rear side of the 2/2 directional poppet valve makes it possible to configure the valve accordingly with only two ports. For example, in this process, the non-return valve is arranged in a fluid connection between one and the other fluid connection point in the valve housing.

[0019] For example, the non-return valve comprises a spring-loaded closing body, which blocks the fluid connection in the direction of the other fluid connection point as soon as the fluid pressure at one fluid connection point is higher than at the other fluid connection point. If, on the other hand, the fluid pressure at the other fluid connection point is higher than at the first fluid connection point, the non-return valve opens.

[0020] The aforementioned modular system for the valve permits solutions in which, in an actuated

position of the 2/2 directional poppet valve, a fluid passage from the bypass line into the valve chamber is blocked or released and, in an unactuated position, it is released or blocked respectively.
[0021] Particularly favourable flow forces arise when introducing fluid into the valve if, adjacent to the further fluid connection point and opposite one another, viewed in the active direction, the closing body of the non-return valve and the piston-like main piston of the 2/2 directional poppet valve are guided in a longitudinally displaceable manner in the valve housing, wherein the valve chamber is permanently connected to the further fluid connection point in a fluid-conveying manner. In particular, the closing and main piston are arranged concentrically with respect to the longitudinal or displacement axis of the valve.
[0022] For example, in this case it may be provided that an orifice is permanently connected between the valve chamber and the further fluid connection point. By virtue of this optional integration of an orifice, it is possible to monitor the volume flow via the 2/2 directional poppet valve.
[0023] In some embodiments, it is further provided that the pilot control of the poppet valve comprises a pilot control piston, which engages through the main piston of the poppet valve and which is operatively connected to the main piston, for example by means of an energy accumulator, such as a compression spring. For the purpose of indirect control of the main piston, the actuation device acts exclusively on the pilot control piston in this process.
[0024] For example, the pilot control piston controls an axial orifice in the main piston, which orifice, in the released state, establishes a permanent fluid connection between the valve chamber and a pilot control chamber, which is at least partially delimited by the valve piston. In addition, the main piston comprises a radial orifice, which can be supplied with fluid via a fluid passage between the outer circumference of the main piston and the adjacent inner circumference of the valve housing and which emerges in the pilot control chamber. When the pilot control piston is opened, i.e., the pilot control piston has lifted off the pilot control seat of the main piston, pilot control oil flows via the series-connected radial orifice and the pilot control seat or axial orifice respectively, wherein the resulting pressure difference at the radial orifice ensures a lower pressure in the pilot control chamber, which ultimately opens the poppet valve by means of the main piston. The free diameter of the radial orifice is in this case selected to be slightly smaller than the free diameter of the axial orifice. Otherwise, such valve pilot controls may be state of the art, as is shown for example in DE 10 2012 015 354 A1.
[0025] For example, the actuation device used comprises a solenoid and when said solenoid is energised, a solenoid armature actuates the pilot control valve such that the main piston which is thus controlled indirectly moves into a position which blocks the fluid passage between the respective bypass line and the valve chamber or into a position releasing said fluid passage respectively.
[0026] The valve is discussed in greater detail below with reference to the drawings and further embodiments. Specific references to components, process steps, and other elements are not intended to be limiting. The drawings are not to scale.
[0027] The valve shown in FIG. **1** comprises a valve housing referred to in its entirety as **10**. The valve housing **10** can be constructed in multiple parts as shown in FIG. **1** and may be received by means of corresponding sealing systems in a valve block, which is not shown in further detail, in the customary manner. The valve housing **10** comprises two fluid connection points **12**, **14** for guiding fluid, for example in the form of a hydraulic medium. Furthermore, the valve comprises an actuation device referred to in its entirety as **16** for actuating a main piston **18** received in the valve housing **10**, said main piston forming part of a poppet valve referred to in its entirety as **20**. Together with the poppet valve **20**, a non-return valve **22** is received in the aforementioned valve housing **10**. It is characteristic that, starting from the free end face of the valve housing **10**, a bypass line **24** at least partially passes through said valve housing, said bypass line routing a fluid flow present at one fluid connection point **12** in the direction of a valve chamber **26** when the poppet

valve **20** is open, while bypassing the non-return valve **22**, and as such this fluid flow is controlled by the main piston **18** of the poppet valve **20**. The main or valve piston **18** and the pilot control piston **44** form a 2/2 directional poppet valve; in particular, this is a pilot-operated 2/2 directional poppet valve, which is explained in further detail below.

[0028] The non-return valve **22** is arranged in a fluid connection between one **12** and the other fluid connection point **14**. The non-return valve **22** comprises a spring-loaded closing body **28**, which blocks the fluid connection in the direction of the other fluid connection point **14** as soon as the fluid pressure at one fluid connection point **12** is higher than at the other fluid connection point **14**. In FIG. **1**, the closing body **28** is in its position blocking the aforementioned fluid connection; which is supported by a closing spring **29**, which is designed as a compression spring and acts on the closing body **28**. The non-return valve **22** comprises a so-called tripod **30** facing the fluid connection point **12** on the inlet side, which makes it possible to implement the fluid flow between the legs of the tripod **30** to establish the aforementioned fluid connection. When the non-return valve **22** is opened, as shown in FIG. **2**, fluid which is present at the further fluid connection point **14** therefore flows via the aforementioned fluid connection unimpeded in the direction of the fluid connection point **12**. When the non-return valve **22** is opened, oil therefore always flows from the connection point **14** to the connection point **12**, as the non-return valve **22** pushes itself up. When the non-return valve **22** is closed, the corresponding fluid path is blocked. By creating a permanent fluid connection to a fluid chamber **32** in the valve housing **10**, the channel-like further fluid connection point **14** engages radially in the valve housing **10**. The channel-like fluid connection point **14** can, in this process, be distributed multiple times along the outer circumference of the valve housing **10**, creating the fluid connection to the central fluid chamber **32**.

[0029] The main piston **18** is configured as a valve piston of the poppet valve **20** and is shown in FIG. **1** in its open position. In this case, the free end face of the main piston **18** lifts off a conically extending valve seat **34** in the valve housing **10**. When the poppet valve **20** is opened, as shown in FIG. **1**, a fluid connection is established via the valve seat **34** between a pre-valve chamber **36** and the actual valve chamber **26**. In this process, the pre-valve chamber **36** is selected such that its diameter is larger than the valve chamber **26**, and the valve seat **34** with its walls ensures the transition between the two chambers **26** and **36**. Furthermore, the pre-valve chamber **36** is permanently connected to the bypass line **24**, which extends parallel to a longitudinal axis **38** of the valve, wherein, although this is not shown in more detail, a plurality of corresponding bypass lines may if necessary also be received in a parallel arrangement to the longitudinal axis **38** and radially spaced apart from one another in the valve housing **10**. Furthermore, an orifice **40** with a predefinable cross-section is provided between the valve chamber **26** and the fluid chamber **32**.

[0030] The difference in diameter between the piston diameter of the main piston **18** and the valve seat **34** forms a kind of circular ring and the surface area of this circular ring is selected such that it is approximately half the size of the rear side of the piston arranged opposite thereto, which forms the largest diameter. If the pressure on the rear side of the main piston **18** is almost half as high as the pressure on the aforementioned circular ring, the piston is then able to move to the right as viewed on FIG. **1**. The corresponding diameter configuration for a main piston **18** is standard in a pilot-operated poppet valve **20**, with the result that no further detail is provided in this respect at this juncture. The aforementioned pilot control for the main piston **18**, i.e., for the poppet valve **20**, is referred to in its entirety as **42**. The aforementioned pilot control **42** has a pilot control piston **44**, which engages through the main piston **18** while partly maintaining a radial distance from said main piston. As shown in FIG. **1**, in this process a piston tip of the pilot control piston **44** engages through an axial orifice **46** in the main piston **18** and, when the axial orifice **46** is released via the pilot control piston **44**, this creates a fluid-conveying connection between a pilot control chamber **48** and the chamber **26**.

[0031] Furthermore, the piston-shaped main piston **18** has a radial orifice **50** on an outer circumference, which, via a channel-like fluid passage **52**, is connected in a permanently fluid-

conveying manner to the pre-valve chamber **36** and, as such, is in permanent fluid connection with the bypass line **24**, which is connected to the fluid connection point **12**. In particular, the channel-like fluid passage **52** is created via a recessed groove along the outer circumference of the main piston **18**.

[0032] The rear side of the main piston **18** is not supported on a plate guide **54**, through which the pilot control piston **44** engages and which instead serves as a contact for a conical compression spring **56**, which is in contact via its other free end with a further plate guide **58**, which is securely connected to the pilot control piston **44**. The piston stroke of the main or valve piston **18** is limited by the fact that, when the main piston **18** reaches the pilot control piston **44**, the pilot control oil flow has dried up and the main piston **18** is then no longer able to open any further.

[0033] The pilot control piston **44** can be controlled by an actuating rod **60**, particularly guided in a longitudinally displaceable manner in the housing of the actuation device **16**, i.e., inside the solenoid assembly, wherein one end of the actuating rod **60** is in contact with the pilot control piston **44** and the other end or end region of the actuating rod engages in a customary manner in a solenoid armature **62**, which can be guided in a longitudinally displaceable manner in a pole tube **64**, and when a coil winding **66** of the actuation device **16** is energised, moves from its de-energised starting position according to FIG. **1** into its energised actuation position according to FIG. **2**, wherein, in this manner, the main piston **18** can be controlled indirectly via the pilot control piston **44**, in particular moved into its closing position as shown on FIG. **2**, in which the fluid connection between the pre-valve chamber **36** and the valve chamber **26** is interrupted in that, specifically, the conical contact part of the main piston **18** comes into contact with the valve seat **34** in the valve housing **10**. The pilot control piston **44** closes the valve seat **46**. As a result, the pilot control oil flow dries up and no further pilot control oil flows at the radial orifice **50**. Thus, the pressure difference via this orifice becomes zero and the same pressure prevails on the rear side of the main piston **18** as on the circular ring **36**. Due to the circumstance that the rear side of the piston of the main piston **18** is twice the surface area of the circular ring **36**, this leads to a force that closes the main piston **18**.

[0034] The aforementioned pilot control with an axial orifice **46** and a radial orifice **50** may also be standard (DE 10 2012 015 354 A1), with the result that no further detail is provided in this respect at this juncture. The actuation device **16** therefore acts as shown on the pilot control piston **44** and closes or opens the pilot control seat in the form of the axial orifice **46** in the energised or de-energised state. When the pilot control piston **44** is opened, pilot control oil also flows in the direction of the valve chamber **26** with a further orifice **40** via the series-connected radial orifice **50** and the pilot control seat in the form of the axial orifice **46**, wherein the pressure difference at the radial orifice **50** ensures a lower pressure in the pilot control chamber **48**, which ultimately leads to the main piston **18** opening as shown in FIG. **1**. Thanks to the pilot control stage, i.e., due to the pilot control **42**, the poppet valve **20** can be actuated with low magnetic forces and thus in an energy-saving manner by means of the actuation device **16**. It is clear that, in order to energise the coil winding **66**, the actuation device **16** must be able to be connected to a power supply source by means of a plug **68** in the customary manner. To ensure that no obstacles to operation of the solenoid armature **62** arise, both the actuating rod **60** and the solenoid armature **62** are provided with a through hole, such that the pressure prevailing in the pilot control chamber **48** also acts on the rear side of the solenoid armature **62** and thus allows pressure-compensated valve operation.

[0035] As is also evident from the circuit diagram shown in FIG. **3**, a hydraulic consumer which is not shown in further detail, for example in the form of a hydraulic operating cylinder, such as a damping or stabiliser cylinder, is connected on the outlet side of the valve between the two fluid connection points **12**, **14**. The non-return valve **22** is also connected on the valve side between the fluid connection points **12**, **14**, said valve closing in the direction of the connection point **14** and opening in the reverse direction. Furthermore, at least one individual bypass line **24** is connected to the fluid connection point **12** and bypassing the non-return valve **22**, said bypass line in turn being

connected on the outlet side to the electromagnetically actuatable poppet valve **22** on the inlet side, which, as shown in FIG. **3**, is held in the opened position as shown in FIG. **1** by means of the pilot control **42**, wherein, accordingly, the actuation device **16** is not energised and the open position (NO) is reached by using the compression spring **56**.

[0036] However, as, according to the drawing in FIG. **2**, the main piston **18** of the poppet valve **20** is kept closed by the actuation device **16** with a magnetic force that is in the magnitude of approximately 8 to 10 bar fluid pressure, the internal non-return valve function only comes into play when, in the context of pressure protection, the fluid pressure present in the valve chamber **26** is higher than the magnetic force of the actuation device **16** keeping the main piston **18** closed. Under normal circumstances, it is simply the case that when the fluid pressure at the further fluid connection point **14** is higher than at the first fluid connection point **12**, the non-return valve **22** opens in the direction of the fluid connection point **12** and thus releases the fluid connection from 14 to 12, specifically via the fluid chamber **32** in the valve housing **10**. The non-return valve **22** that is used accordingly has only a very small opening pressure of 0.2 to 0.5 bar, for example; however, as shown in FIG. **2** in particular, this releases a very large throughflow cross-section between the closing body **28** of the non-return valve **22** and the assigned adjacent valve seat **72** in the valve housing **10**, such that, when there is an extremely low pressure difference, a discharge takes place via the fluid connection point **12** from one actuator side of the hydraulic consumer to the other actuator side, to which the valve is connected as shown in the figures.

[0037] Even when controlling the poppet valve **20**, the valve design dictates that for example up to 95% fluid flows from the connection point **14** to the connection point **12**, whereas via the poppet valve **20** only approximately 5% fluid is intended to be returned to the fluid connection point **12** from the fluid connection point **14** via the poppet valve **20** and the bypass line **24**, bypassing the non-return valve **22**, which is unobjectionable. In order to keep the non-return function of the non-return valve **22** “moderate”, i.e., to ensure a low opening pressure with low pressure losses AP, the associated closing spring **29**, which controls the closing body **28**, is only provided with a low spring force and is thus responsible for the near-time opening operation with the closing body **28** at low fluid pressures in a correspondingly “softly” actuated manner.

[0038] While FIG. **1** shows a valve solution in which the valve is opened in the de-energised state (NO), FIG. **2** shows the closed valve solution in the energised state. When the pilot control piston **44** is opened, the valve tightens when the flow passes from the valve chamber **26** to the valve chamber **36** and only a limited volume flow is possible via the two orifices **46**, **50**. In the embodiment shown in FIGS. **4** and **5**, in the de-energised state, the valve assumes its closed position (NC) or, as shown in FIG. **5**, the valve is opened in the energised state. For this purpose, the compression spring **56** shown in FIGS. **1** to **3** is omitted and instead such a compression spring **74** is arranged between the movable solenoid armature **62** and a pole core **63** of the pole tube **64**. The aforementioned components are surrounded by a solenoid housing **65**. Furthermore, the pilot control piston **44** is securely connected via a snap ring connection **76** to one of the free end faces of the solenoid armature **62**. If the actuation device **16** is thus de-energised, the compression spring **74** exerts a force on the solenoid armature **62** and, in this manner, the pilot control **42** is controlled such that the main piston **18** of the poppet valve **20** passes into its closing position as shown on FIG. **4**.

[0039] If, however, as shown on FIG. **5**, the actuation device **16** is energised, by pressing together the compression spring **74**, the solenoid armature **62** passes into its right-hand actuation position, as shown in the viewing direction, in which the pilot control **42** controls the main piston **18** such that a releasing fluid connection is established between the fluid connection points **12**, **14** via the respective bypass line **24**, the pre-valve chamber **36**, the thus released valve seat **34**, the valve chamber **26**, the orifice **40**, the fluid chamber **32** and the radial channel passage to the fluid connection point **14** from the direction of the connection point **12**. Otherwise, the structure of the valve according to FIGS. **4** and **5** substantially corresponds to the structure of the valve shown in

FIGS. **1** and **2**, and it is clear that a kind of modular system is thus created in which various types of such valves can be produced in a standardised construction with few basic components. As such, the same components, along with the same reference numerals, are reproduced for all structural components of the valves shown in FIGS. **1** to **6** and the explanations thus provided for the first embodiment also apply accordingly to the second embodiment.

[0040] FIG. **6** shows a corresponding circuit diagram position as shown in FIG. **3**; this time for the valve solution according to FIGS. **4** and **5**. Accordingly, the poppet valve **20** is closed in the de-energised state (NC) (FIG. **4**) and opened in the energised state (FIG. **5**). Accordingly, all valve solutions according to FIGS. **1** to **6**, fulfil the central object of guiding the fluid volume flow in a flow direction, for example from the fluid connection point **14** to the fluid connection point **12** via the non-return valve **22** with a very small opening pressure and low throughflow losses, whereas, as a function of the switching position of the tightly seated 2/2 directional poppet valve **20**, the volume flow from the port **12** to the port **14** is blocked or released by means of an electrical signal to the actuation device **16**. The volume flow can be manifestly influenced in this process with the aid of the orifice **40**. The 2/2 directional poppet valve **20** can be normally open (NO), as shown in FIG. **1** or normally closed (NC), as shown in FIG. **4** depending on the version. By integrating two valves **20** and **22** in a shared valve housing **10**, there is no need for additional valves and associated external pipework, which helps save costs and increases functional reliability.

[0041] The invention has been described in the preceding using various exemplary embodiments. Other variations to the disclosed embodiments may be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word “comprising” does not exclude other elements or steps, and the indefinite article “a” or “an” does not exclude a plurality. A single processor, device, or other unit may be arranged to fulfil the functions of several items recited in the claims. Likewise, multiple processors, devices, or other units may be arranged to fulfil the functions of several items recited in the claims.

[0042] The term “exemplary” used throughout the specification means “serving as an example, instance, or exemplification” and does not mean “preferred” or “having advantages” over other embodiments. The term “in particular” and “particularly” used throughout the specification means “for example” or “for instance”.

[0043] The mere fact that certain measures are recited in mutually different dependent claims or embodiments does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1-**12**. (canceled)

13. A valve comprising a valve housing which has two fluid connection points for guiding fluid and comprising an actuation device for actuating a main piston of a poppet valve, said main piston being received in the valve housing, wherein the valve housing together with the poppet valve receives a non-return valve, wherein at least one bypass line runs in the valve housing, said bypass line routing a fluid flow present at one fluid connection point in the direction of a valve chamber when the poppet valve is in the open state, while bypassing the non-return valve, said flow being able to be controlled by the main piston of the poppet valve.

14. The valve of claim 13, wherein the poppet valve is a 2/2 directional poppet valve.

15. The valve of claim 13, wherein the non-return valve is arranged in a fluid connection between one and the other fluid connection point.

16. The valve of claim 13, wherein the non-return valve comprises a spring-loaded closing body, which blocks the fluid connection in the direction of the other fluid connection point as soon as the fluid pressure at one fluid connection point is higher than at the other fluid connection point.

17. The valve of claim 13, wherein a fluid passage from the bypass line into the valve chamber is a) normally closed in an actuated position and normally open in an unactuated position of the poppet valve or b) normally open in the actuated position and normally closed in the unactuated position of the poppet valve.
18. The valve of claim 13, wherein, adjacent to the further fluid connection point and opposite one another, the closing body of the non-return valve and the main piston of the poppet valve are guided in a longitudinally displaceable manner in the valve housing and in that the valve chamber is permanently connected to the further fluid connection point in a fluid-conveying manner.
19. The valve of claim 13, wherein an orifice is connected between the valve chamber and the further fluid connection point, said orifice being able to generate a differential pressure which is dependent on the volume flow in a throughflow direction from the fluid connection point to the further fluid connection point.
20. The valve of claim 13, wherein the pilot control of the poppet valve comprises a pilot control piston, which engages through the main piston of the poppet valve, and which is operatively connected to the pilot control piston
21. The valve of claim 13, wherein, for the purpose of indirect control of the main piston, the actuation device acts exclusively on the pilot control piston.
22. The valve of claim 13, wherein the pilot control piston controls an axial orifice in the main piston, which, in the released state, creates a permanent fluid connection between the pilot control chamber and the valve chamber.
23. The valve of claim 13, wherein the main piston also has a radial orifice, which can be supplied with fluid via a fluid passage between the outer circumference of the main piston and the adjacent inner circumference of the valve housing and which emerges in the pilot control chamber.
24. The valve of claim 13, wherein the actuation device comprises a coil winding and when said coil winding is energised, a solenoid armature actuates the pilot control valve such that the main piston moves into a position that blocks the fluid passage between the respective bypass line and the valve chamber or into a position releasing said fluid passage respectively.
25. The valve of claim 13, wherein the poppet valve is a pilot-operated 2/2 directional poppet valve.
26. The valve of claim 14, wherein the non-return valve is arranged in a fluid connection between one and the other fluid connection point.
27. The valve of claim 14, wherein the non-return valve comprises a spring-loaded closing body, which blocks the fluid connection in the direction of the other fluid connection point as soon as the fluid pressure at one fluid connection point is higher than at the other fluid connection point.
28. The valve of claim 15, wherein the non-return valve comprises a spring-loaded closing body, which blocks the fluid connection in the direction of the other fluid connection point as soon as the fluid pressure at one fluid connection point is higher than at the other fluid connection point.
29. The valve of claim 14, wherein a fluid passage from the bypass line into the valve chamber is a) normally closed in an actuated position and normally open in an unactuated position of the poppet valve or b) normally open in the actuated position and normally closed in the unactuated position of the poppet valve.
30. The valve of claim 15, wherein a fluid passage from the bypass line into the valve chamber is a) normally closed in an actuated position and normally open in an unactuated position of the poppet valve or b) normally open in the actuated position and normally closed in the unactuated position of the poppet valve.
31. The valve of claim 13, wherein the pilot control of the poppet valve comprises a pilot control piston, which engages through the main piston of the poppet valve, and which is operatively connected to the pilot control piston by means of an energy accumulator.
32. The valve of claim 31, wherein the energy accumulator is a compression spring.