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(54) ACCUMULATOR WITH FLUID LEVEL INDICATOR

(57) The invention relates to an accumulator (1) comprising:
- a housing (2);
- a piston (3) arranged in the housing and movable in an axial direction, wherein the piston seals on the inner wall of the housing and divides the housing in a first fluid tight space (5) and a second space (6);
- a supply opening (7) arranged in the housing (2) and in fluid connection with the first fluid tight space (5);
- urging means for urging the piston towards the supply opening, wherein the urging means are arranged in the second space;
- a magnet (8) arranged at the circumference of the piston and adjacent to the housing inner wall, wherein the housing is of a non-ferromagnetic material, such as stainless steel; and
- an indicator (11) arranged on the outside of the housing and movable in axial direction, wherein the indicator comprises at least a ferromagnetic part for interaction with the attractive force of the magnet.

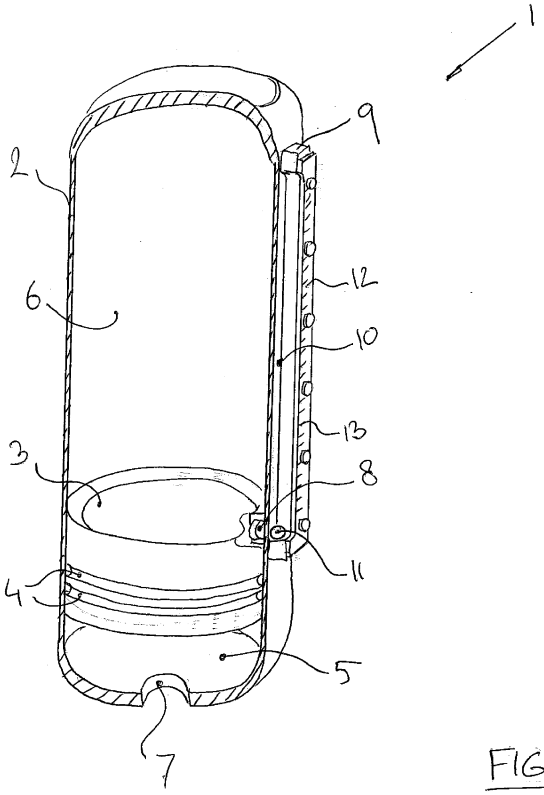

FIG 1

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Description

[0001] The invention relates to an accumulator comprising:

- a housing;
- a piston arranged in the housing and movable in an axial direction, wherein the piston seals on the inner wall of the housing and divides the housing in a first fluid tight space and a second space;
- a supply opening arranged in the housing and in fluid connection with the first fluid tight space;
- urging means for urging the piston towards the supply opening, wherein the urging means are arranged in the second space.

[0002] In a hydraulic system a fluid under pressure is used. Such a hydraulic system, for example a hydraulic system to power a hydraulic cylinder or a cooling cycle, could be provided with an accumulator to compensate for volume variation of the fluid due to thermal variation.

[0003] To optimize the performance of such hydraulic system, the fluid volume charged in the hydraulic loop should be adjusted with accuracy. If too much fluid is charged and the fluid volume expands due to an increase of temperature, the accumulator cannot fully compensate for this volume increase, such that the pressure in the hydraulic system will rise, increasing the chance on damage of components of the hydraulic system.

[0004] If too little fluid is charged it could occur that the desired operating pressure in the system cannot be reached, such that the hydraulic system does not perform optimally.

[0005] So, it is important to know with accuracy the fluid volume contained in the hydraulic system, which can be derived from the fluid level in the accumulator of the system.

[0006] It is known to use sightglasses to provide an indicator for the fluid level in a reservoir. Such a sightglass could be a transparent vertical tube, which is in fluid communication with the reservoir. The height of the fluid in the tube provides a indication of the fluid level in the reservoir.

[0007] It is also known, to provide a float in the vertical tube, wherein the float is provided with a magnet and wherein a movable indicator is provided on the outside of the vertical tube, which interacts with the attractive force of the magnet. Such a system allows for the measurement of fluids, which are not suitable to be in contact with the transparent material of a sightglass or for fluids which are under pressure.

[0008] The disadvantage of such systems is that the vertical tube always needs to be aligned with the gravitational force to obtain a correct reading. For example, if the reservoir with the sightglass is tilted, then even an almost empty reservoir can fully fill the tube with fluid causing a reading as if the reservoir is completely full.

[0009] It is an object of the invention to reduce or even remove the above mentioned disadvantages.

[0010] This object is achieved with an accumulator according to the preamble, which accumulator is characterized by:

- a magnet arranged at the circumference of the piston and adjacent to the housing inner wall, wherein the housing is of a non-ferromagnetic material, such as stainless steel; and
- an indicator arranged on the outside of the housing and movable in axial direction, wherein the indicator comprises at least a ferromagnetic part for interaction with the attractive force of the magnet.

[0011] An accumulator does not need a specific orientation to provide its function to the hydraulic system. The accumulator can be arranged upside down and the piston will still be urged towards the supply opening of the accumulator. The axial position, which the piston will assume in the housing, is dependent of the amount of fluid in the hydraulic system, the pressure of the fluid in the hydraulic system and the force of the urging means in the accumulator. Thus the position of the piston provides for an indication of the fluid level, independent on the orientation of the accumulator.

[0012] So, the position of the piston is made visible from the outside by arranging a magnet at the circumference of the piston, which magnet can attract a ferromagnetic part of an indicator on the outside of the housing.

[0013] A fluid tight space is a space impermeable for fluids like liquid or gas. This ensures that with the first fluid tight space, none of the fluid in the hydraulic system, which is connected to the first space via the supply opening, can leak along the piston into the second space. This first fluid tight space is required for the accumulator to perform its function and to maintain the amount of fluid in the hydraulic system.

[0014] A preferred embodiment further comprises an elongate indicator housing arranged on the housing wall, wherein the indicator housing comprises a elongate guide for guiding the indicator in axial direction.

[0015] The indicator housing will shield the indicator from any dirt or the like, which otherwise could impede the movement of the indicator. Especially, if the indicator is arranged on the accumulator during the lifetime of the accumulator, the indicator housing ensures that the even after a substantial part of the lifetime, the indicator still can move as desired.

[0016] Preferably, the elongate guide is a linear channel, wherein the indicator is a ball and wherein the ball rolls through the channel under influence of the movement of the magnet on the piston.

[0017] By using a ball in a linear channel as the indicator, the indicator will have a low friction such that the magnetic field of the magnet can easily pull the ball through the linear channel and differences between the position of the indicator and the position of the piston are minimized.

[0018] In a further preferred embodiment of the accumulator according to the invention the indicator housing comprises a sightglass to observe the position of the indicator.

[0019] Preferably, a scale extends along the path of the indicator. The scale can be set such that one can read the amount of fluid in the hydraulic system just by determining the position of the indicator relative to the scale.

[0020] In yet another embodiment of the accumulator according to the invention blocking means are arranged in the housing for blocking rotation of the piston.

[0021] Due to friction between the piston and the inner surface of the housing, the piston could rotate slowly, when it is moved up and down in the housing. This would cause the magnet to move out of alignment with the indicator and cause wrong readings or even malfunction of the indicator. By blocking the rotation of the position, it is always ensured that the magnet is aligned in tangential direction with the indicator.

[0022] In yet another embodiment of the accumulator according to the invention the urging means comprise a spring.

[0023] In still another embodiment of the accumulator according to the invention the second space is fluid tight and the urging means comprise a gas arranged in the second space.

[0024] By ensuring that the second space is also fluid tight, a gas can be supplied to the second space, which gas will act as a gasspring. When the second space is provided with a filling opening, one can simply set the pressure of the gas in the second space and provide an easy adjustable accumulator, which is suited for a variety of different hydraulic systems.

[0025] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

Figure 1 shows a cross-sectional perspective view of an embodiment of an accumulator according to the invention.

Figure 2 shows a cross-sectional view of the embodiment of figure 1.

[0026] Figures 1 and 2 shows an accumulator 1 having a cylindrical housing 2 with a piston 3 movable in axial direction and arranged in the housing 1. The piston 3 has two circumferential grooves 4 to accommodate seals (not shown) for sealing the piston 3 on the inner surface of the housing 2 and to ensure that the first space 5 below the piston 3 is fluid tight and to ensure that the second space 6 above the piston 3 is also fluid tight.

[0027] The housing 2 is provided at the bottom with a supply opening 7 to supply a fluid under pressure to the first space 5. This fluid will move the piston 3 up, such that the gas in the second space 6 will be compressed until an equilibrium is achieved between the gas pressure in the second space 6 and the fluid pressure in the first space 5.

[0028] The piston 3 further comprises a magnet 8, which is arranged at the circumference of the piston 3 adjacent to the wall of the housing 2.

[0029] At the outside a indicator housing 9 is arranged on the housing 2. The indicator housing 9 has a linear channel 10, which extends in axial direction of the housing 2. A ferromagnetic ball 11 is arranged in the linear channel 10, such that the magnet 8 can attract through the housing 2 of non-ferromagnetic material the ferromagnetic ball 11 and pull it along the linear channel 10 when the piston 3 moves up and down in the housing 2.

[0030] The linear channel 10 is covered by a transparent plate 12, such that a user can easily determine the position of the piston 3 inside of the housing 2 through the indicator ball 11.

[0031] The transparent plate 12 can be provided with a scale 13, which facilitates determining the exact position of the indicator ball 11 and accordingly the amount of fluid inside the first space 5.

[0032] The amount of fluid inside the first space 5 is in turn an indicator for the amount of fluid in the hydraulic system in which the accumulator 1 is arranged.

Claims

1. Accumulator comprising:

- a housing;
- a piston arranged in the housing and movable in an axial direction, wherein the piston seals on the inner wall of the housing and divides the housing in a first fluid tight space and a second space;
- a supply opening arranged in the housing and in fluid connection with the first fluid tight space;
- urging means for urging the piston towards the supply opening, wherein the urging means are arranged in the second space;

characterized by

- a magnet arranged at the circumference of the piston and adjacent to the housing inner wall, wherein the housing is of a non-ferromagnetic material, such as stainless steel; and
- an indicator arranged on the outside of the housing and movable in axial direction, wherein the indicator comprises at least a ferromagnetic part for interaction with the attractive force of the magnet.

2. Accumulator according to claim 1, further comprising an elongate indicator housing arranged on the housing wall, wherein the indicator housing comprises a elongate guide for guiding the indicator in axial direction.

3. Accumulator according to claim 2, wherein the elongate guide is a linear channel, wherein the indicator is a ball and wherein the ball rolls through the channel under influence of the movement of the magnet on the piston.

4. Accumulator according to claim 2 or 3, wherein the indicator housing comprises a sightglass to observe the position of the indicator.

5. Accumulator according to any of the previous claims, wherein a scale extends along the path of the indicator.

6. Accumulator according to any of the preceding claims, wherein blocking means are arranged in the housing for blocking rotation of the piston.

7. Accumulator according to any of the preceding claims, wherein the urging means comprise a spring.

8. Accumulator according to any of the preceding claims 1 - 6, wherein the second space is fluid tight and wherein the urging means comprise a gas arranged in the second space.

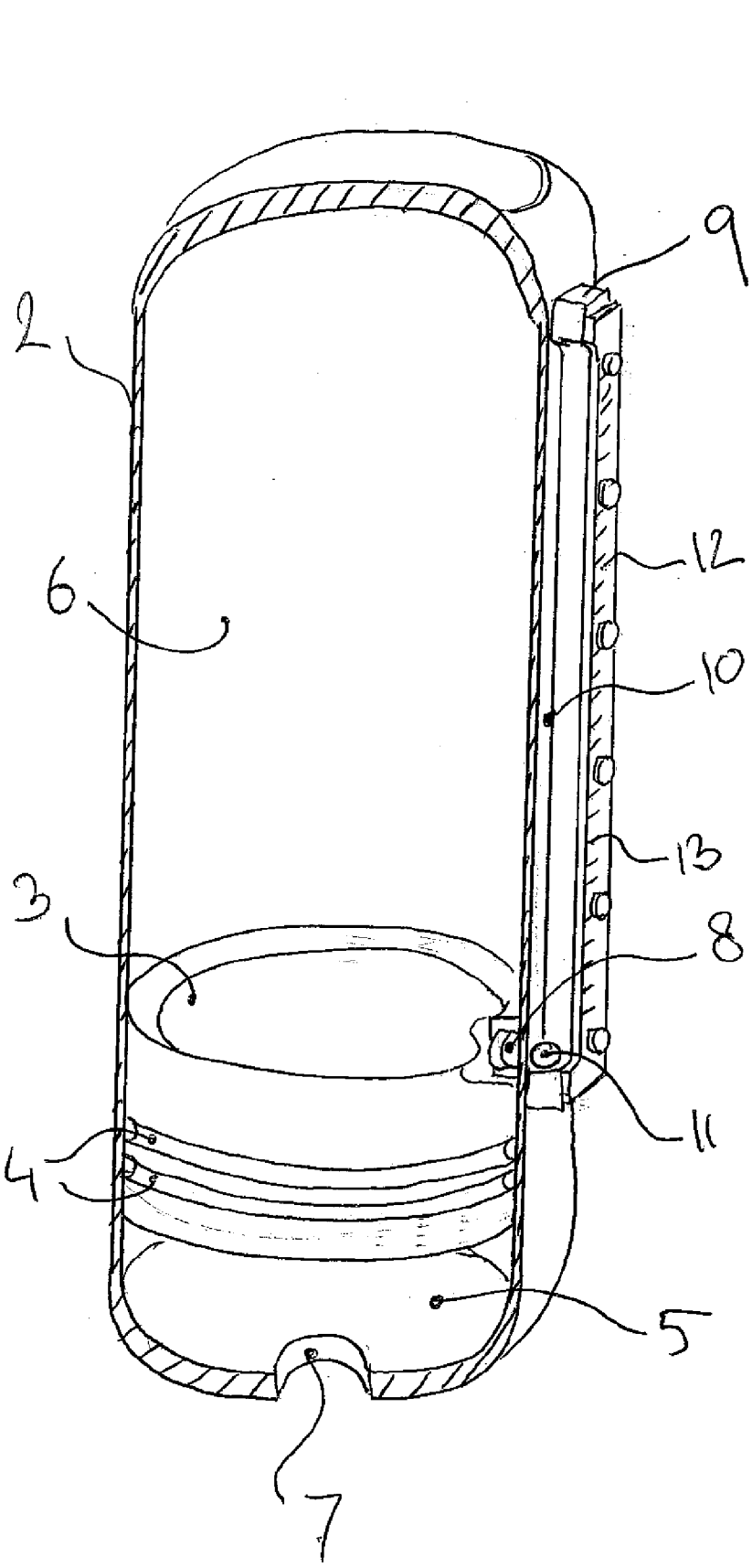

FIG 1

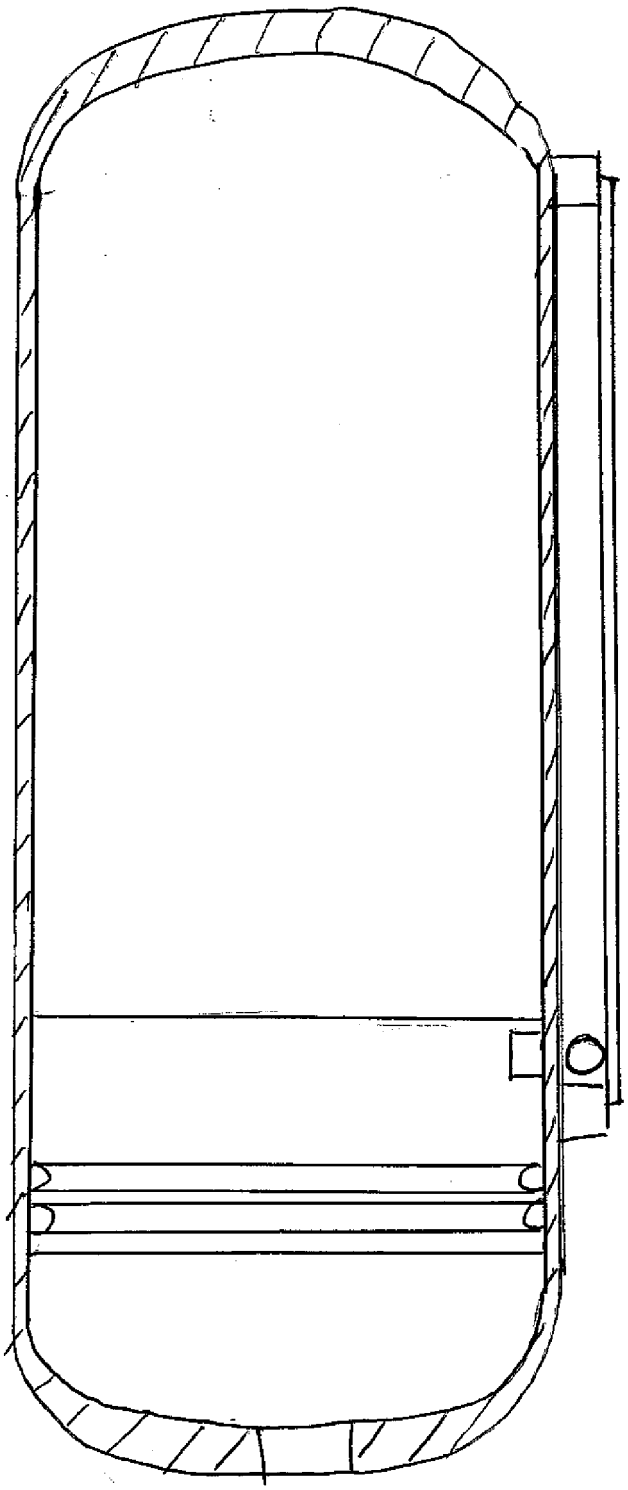

FIG2

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EUROPEAN SEARCH REPORT

Application Number
EP 16 30 6201

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 February 2017	Carlier, François

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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