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(54) Electro valve for the supply of a wash fluid into a washing machine, in particular a household appliance

(57) The present invention relates to an electrovalve (1) for the supply of a washing fluid into a washing machine, in particular for household use, said electrovalve (1) comprising:
- at least one inlet duct (10) for said washing fluid;
- at least one outlet duct (20) for the washing fluid;
- an intermediate duct (30) for connecting said at least one inlet duct (10) to said at least one outlet duct (20).

The present invention is characterized in that said electrovalve (1) comprises an elastic element (50) made of compressible material, said elastic element (50) being adapted to compensate for any increase in the volume and/or pressure of the washing fluid, in particular due to freezing.

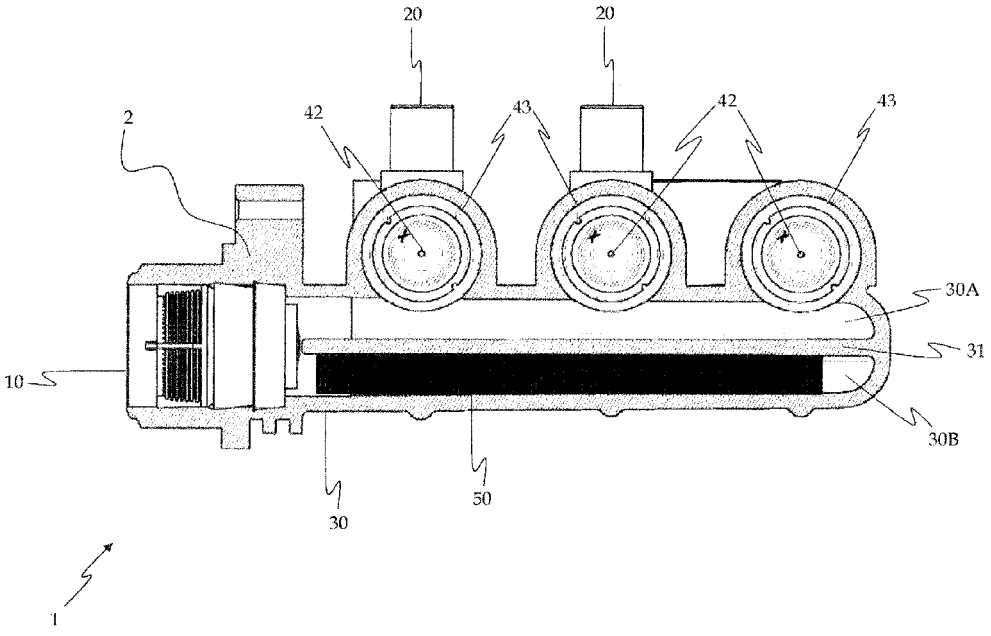

Fig. 2

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Description

[0001] The present invention relates to an electrovalve for the supply of a washing fluid into a washing machine, in particular for household use, according to the preamble of claim 1.

[0002] The present invention further relates to a washing machine which comprises said electrovalve.

[0003] It is known that household washing machines, e.g. laundry washing machines, dishwashers and the like, comprise at least one electrovalve connected to the water main for the supply of water needed for washing laundry or crockery.

[0004] An electrovalve of a known type typically has a main body that comprises:

- at least one inlet duct for a washing fluid, which can be connected, for example, to a tap of the water main,
- at least one outlet duct for the washing fluid, which can be connected, for example, to a washing machine,
- an intermediate duct for connecting said at least one inlet duct to said at least one outlet duct .

[0005] Furthermore, known electrovalves typically include interception means for intercepting the flow of said washing fluid towards said outlet duct. In particular, said intercepting means may comprise at least one electromagnet electrically connected to the served washing machine, which, through a timer of its own, controls at appropriate times (e.g. at the beginning and at the end of a washing step) the power supplied to the electromagnet in order to open and close a section of the electrovalve, in particular a section of the intermediate duct of the electrovalve.

[0006] Known electrovalves are often positioned, usually together with the washing machines in which they have been installed, in an external environment, e.g. a balcony or a terrace of a house; as a consequence, the washing machine and its electrovalve are exposed to the environmental conditions of that external environment.

[0007] Also, the production cycles of valves and washing machines may include testing steps where water is used for simulating the operation thereof, and water may remain in the hydraulic circuit of said valves or washing machines, which are then stored or transported in unconditioned environments, where they are exposed to environmental conditions similar to those of an external environment.

[0008] In fact, the electrovalve may be affected by very cold or frosty operating environments (usually an external environment or an environment comparable to an external environment), in particular when it contains a certain quantity of washing fluid; in such a situation, in fact, the washing fluid contained in the electrovalve may freeze and (as known) increase in volume, thus possibly breaking the electrovalve.

[0009] Of course, a broken electrovalve will pose a number of problems such as, for example, impossibility of using the washing machine or flooding the environment where the washing machine and the electrovalve have been placed.

[0010] In some solutions known in the art, the problem of an electrovalve breaking due to freezing of the washing fluid contained therein has been faced by realizing said electrovalve in a manner such that it comprises heating means which, when activated, allow warming up some portions of the electrovalve itself, thus avoiding the risk that the washing fluid contained in the electrovalve might freeze.

[0011] However, such solutions have proved to be costly and to require a more complex realization of the whole electrovalve. In addition, such solutions are not suitable for damage prevention when the electrovalve or the washing machine are not connected to the electric mains, as is the case, for example, during storage or transportation.

[0012] In this frame, it is the main object of the present invention to provide an electrovalve for the supply of a washing fluid into a washing machine, in particular for household use, and a related washing machine, which are so realized as to overcome the drawbacks of the prior art.

[0013] It is another object of the present invention to provide an electrovalve so realized as to be unaffected by the environmental conditions of the place that houses the washing machine and its electrovalve.

[0014] It is a further object of the present invention to provide an electrovalve so realized as to be unaffected by very cold or frosty operating environments, in particular when it contains a certain quantity of washing fluid.

[0015] In particular, it is an object of the present invention to make said electrovalve in a manner such that it can be prevented from breaking due to the washing fluid contained therein freezing and expanding.

[0016] It is yet another object of the present invention to provide an electrovalve so realized that it is not excessively costly and it is not excessively difficult and complex to manufacture.

[0017] Said objects are achieved by the present invention through an electrovalve for the supply of a washing fluid into a washing machine, in particular for household use, and a related washing machine, incorporating the features set out in the appended claims, which are intended to be an integral part of the present description.

[0018] Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting explanatory example, wherein:

- Fig. 1 is a side view of an electrovalve for the supply of a washing fluid into a washing machine, in particular for household use, according to the present invention;
- Fig. 2 is a view of a first cross-section of the electro-

valve of Fig. 1, in particular said first cross-section running along a plane A-A of the electrovalve of Fig. 1 ;

- Fig. 3 is a view of a second cross-section of the electrovalve of Fig. 1, in particular said second cross-section running along a plane B-B substantially perpendicular to the plane A-A of Fig. 1.

[0019] Referring now to the annexed drawings, reference numeral 1 designates as a whole an electrovalve for the supply of a washing fluid into a washing machine, in particular for household use, according to the present invention.

[0020] It should be noted that said washing machine is not shown in the annexed drawings.

[0021] The electrovalve 1 according to the present invention comprises a main body 2, which comprises at least one inlet duct 10 for a washing fluid; for example, said inlet duct 10 can be connected to a tap (not shown) of a water main.

[0022] The electrovalve 1 further comprises at least one outlet duct 20 for the washing fluid, e.g. said at least one outlet duct 20 can be connected to the washing machine.

[0023] The electrovalve 1 further comprises an intermediate duct 30 for connecting said at least one inlet duct 10 to said at least one outlet duct 20.

[0024] In addition, the electrovalve 1 comprises interception means 40 for selectively allowing or preventing the flow of said washing fluid from the inlet duct 10 to said outlet duct 20.

[0025] In particular, said interception means 40 may comprise at least one drive element 41 (e.g. an electromagnet) electrically connected to the served washing machine, which will control at appropriate times (typically at the beginning and at the end of a certain wash step), for example through a timer of its own, the power supplied to the drive element 41 in order to activate a shut-off element 42 for opening or closing a section of the electrovalve 1, in particular a section of the intermediate duct 30 that communicates with said at least one outlet duct 20.

[0026] Preferably, said electrovalve 1 comprises a plurality of outlet ducts 20; in such an embodiment, the electrovalve 1 also comprises a number of drive elements 41 and shut-off elements 42 matching the number of outlet ducts 20, so that each one of said drive elements 41 can be controlled to move the shut-off element and, as a result, to open or close a section of the intermediate section 30 that communicates with each one of said outlet ducts 20.

[0027] As can be seen in the annexed drawings, the electrovalve 1 comprises three outlet ducts 20 (one outlet duct 20 being visible in Fig. 1 and the other two being visible in Fig. 2) and three drive elements 41 associated therewith, with the respective shut-off elements 42; it is however clear that the number of outlet ducts 20 and of the respective drive elements 41 associated with the shut-off elements 42 may be different.

[0028] In accordance with the present invention, said electrovalve 1 comprises an elastic element 50 made of compressible material, said elastic element 50 being adapted to compensate for any increase in the volume and/or pressure of the washing fluid, in particular due to freezing.

[0029] Preferably, the elastic element 50 comprises an impermeable outer surface, such that it does not allow the washing fluid to penetrate into the elastic element 50.

[0030] Moreover, said elastic element 50 comprises a closed-cell internal structure; such a type of internal structure prevents the element from incorporating or absorbing any fluid, which would reduce the compressibility and the final effectiveness of said elastic element 50.

[0031] The elastic element 50 is realized with an elongated shape, in particular having a substantially cylindrical section; it is however clear that the elastic element 50 may also have other shapes, e.g. a shape having a substantially square, rectangular, pentagonal, hexagonal, etc. section.

[0032] In a preferred embodiment, said elastic element 50 is housed in said intermediate duct 30 of the electrovalve 1.

[0033] The special provision of the elastic element 50 according to the present invention allows to overcome the drawbacks of prior-art electrovalves and to make the electrovalve 1 of the present invention not subject to the environmental conditions of the place where it is installed; consequently, the electrovalve 1 according to the present invention is not affected by very cold or frosty operating environments, in particular when it contains a certain quantity of washing fluid.

[0034] In fact, the elastic element 50 made of compressible material allows to compensate for the increase in the volume of the washing fluid due to freezing; as a result, this leads to prevent the electrovalve 1 from breaking.

[0035] Furthermore, the electrovalve 1 according to the present invention, in particular because of the presence of the elastic element 50, is adapted to compensate for or suppress any instantaneous increase in the pressure of the washing fluid, thus improving the characteristics of that phenomenon known in the art as "water hammer".

[0036] It is also apparent that the electrovalve 1 according to the present invention is reliable and does not require any difficult, complex or costly manufacturing steps.

[0037] In accordance with the present invention, said intermediate duct 30 comprises at least one wall 31 adapted to divide said intermediate duct 30 into a first compartment 30A for the washing fluid flow and a second compartment 30B adapted to accommodate the elastic element 50, said first compartment 30A and said second compartment 30B being in communication with each other.

[0038] The provision of said at least one wall 31 allows

to obtain an optimal flow of the washing fluid in said first compartment 30A. At the same time, the fact that said first compartment 30A and said second compartment 30B communicate with each other allows the elastic element 50 to exert its compensating (or shock-absorbing) action against the increased volume of the washing fluid in the electrovalve 1, since the washing fluid can flow freely from the first compartment 30A to the second compartment 30B, and vice versa.

[0039] As can be seen in particular in Fig. 3, said at least one wall 31 extends from an internal face of the intermediate duct 30 in a manner such as to define a passage 32 for putting said first compartment 30A and said second compartment 30B in communication with each other and allowing the washing fluid to pass.

[0040] It is however clear that said at least one wall 31 may comprise a pair of walls 31 (Figs. 2 and 3 only show one wall 31) extending from the internal face of the intermediate duct 30 and remaining so spaced from each other as to define a passage (not shown) that substantially corresponds to the passage designated by reference numeral 32 in Fig. 3.

[0041] As clearly shown in Fig. 3, said first compartment 30A is interposed between the second compartment 30B and a recess 43 of said interception means 40, in particular a recess 43 of the shut-off element 42 of the interception means 40.

[0042] It must also be pointed out that in Fig. 3 the shut-off element 42 is shown in a position where it prevents the washing fluid from flowing from the first compartment 30A and from the second compartment 30B to the outlet duct 20; it is apparent that, in particular upon activation of the drive element 41, the shut-off element 42 may switch to a position (not shown in the drawings) that allows the washing fluid to flow from the first compartment 30A and from the second compartment 30B to the outlet duct 20.

[0043] The special provision of said at least one wall 31 and the particular position of the second compartment 30B allow to prevent the elastic element 50 from obstructing neither the first compartment 30A nor the recess 43 of the shut-off element 42; as a result, the particular shape of the components of the electrovalve 1 according to the present invention allows both to obtain an adequate flow of the washing fluid in said first compartment 30A and to avoid an improper operation of the interception means 40, in particular of the shut-off element 42.

[0044] The features and advantages of the electrovalve 1 according to the present invention and of the related washing machine are apparent from the above description.

[0045] In particular, the provision of the elastic element 50 according to the present invention allows to overcome the drawbacks of the prior art and to make said electrovalve 1 in a manner such that it is unaffected by the environmental conditions of the installation place.

[0046] A further advantage of the electrovalve 1 according to the present invention is that the elastic element 50 allows said electrovalve 1 to be unaffected by severe conditions in the operating environment, in particular when it contains a certain quantity of washing fluid. In fact, the elastic element 50 made of compressible material allows to compensate for the increase in the volume of the washing fluid due to freezing and, as a consequence, to prevent the electrovalve 1 from breaking.

[0047] The electrovalve 1 according to the present invention is also adapted to compensate for or suppress any instantaneous increase in the pressure of the washing fluid, thus improving the characteristics of that phenomenon known in the art as "water hammer".

[0048] In addition, the electrovalve 1 according to the present invention is reliable without being excessively costly and without requiring any excessively difficult and complex manufacturing steps in order to avoid that any frozen washing fluid might cause the electrovalve 1 to break.

[0049] The special provision of said at least one wall 31 and the particular position of the second compartment 30B adapted to house the elastic element 50 allow both to obtain an adequate flow of the washing fluid in the first compartment 30A and to avoid an improper operation of the interception means 40, in particular of the shut-off element 42.

[0050] The electrovalve and the related washing machine described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea; it is also clear that in the practical implementation of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements. It can therefore be easily understood that the present invention is not limited to the above-described electrovalve and related washing machine, but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. An electrovalve (1) for the supply of a washing fluid into a washing machine, in particular for household use, said electrovalve (1) comprising:

   - at least one inlet duct (10) for said washing fluid;
   - at least one outlet duct (20) for the washing fluid;
   - an intermediate duct (30) for connecting said at least one inlet duct (10) to said at least one outlet duct (20),

   characterized in that

   said electrovalve (1) comprises an elastic element (50) made of compressible material, said elastic element (50) being adapted to compensate for any increase in the volume and/or pressure of the wash-

ing fluid, in particular due to freezing.

2. An electrovalve (1) according to claim 1, **characterized in that** said elastic element (50) comprises an impermeable outer surface, such that it does not allow the washing fluid to penetrate into the elastic element (50).

3. An electrovalve (1) according to one or more of the preceding claims, **characterized in that** said elastic element (50) comprises a closed-cell internal structure.

4. An electrovalve (1) according to one or more of the preceding claims, **characterized in that** said elastic element (50) is realized with an elongated shape.

5. An electrovalve (1) according to one or more of the preceding claims, **characterized in that** said elastic element (50) is realized with a shape having a substantially cylindrical section.

6. An electrovalve (1) according to one or more of the preceding claims, **characterized in that** said elastic element (50) is housed within said intermediate duct (30) of the electrovalve (1).

7. An electrovalve (1) according to claim 6, **characterized in that** said intermediate duct (30) comprises at least one wall (31) adapted to divide said intermediate duct (30) into a first compartment (30A) for the washing fluid flow and a second compartment (30B) adapted to accommodate the elastic element (50), said first (30A) and second (30B) compartments being in communication with each other.

8. An electrovalve (1) according to claim 7, **characterized in that** said at least one wall (31) extends from an internal face of the intermediate duct (30) in a manner such as to define a passage (32) for putting said first compartment (30A) and said second compartment (30B) in communication with each other and allowing the washing fluid to pass.

9. An electrovalve (1) according to claim 7, **characterized in that** said at least one wall (31) comprises a pair of walls (31) extending from the inner face of the intermediate duct (30) and remaining so spaced from each other as to define a passage that puts said first compartment (30A) and said second compartment (30B) in communication with each other.

10. An electrovalve (1) according to one or more of claims 8 and 9, **characterized in that** said first compartment (30A) is interposed between the second compartment (30B) and a recesses (43) of said interception means (40), in particular of a shut-off element (42) of said interception means (40).

11. An electrovalve (1) according to one or more of the preceding claims, **characterized in that** it comprises a plurality of outlet ducts (20).

12. An electrovalve (1) according to claim 11, **characterized in that** it comprises a number of drive elements (41) and shut-off elements (42) matching the number of outlet ducts (20).

13. A washing machine, in particular for household use, which comprises an electrovalve (1) according to one or more of the preceding claims 1 to 12.

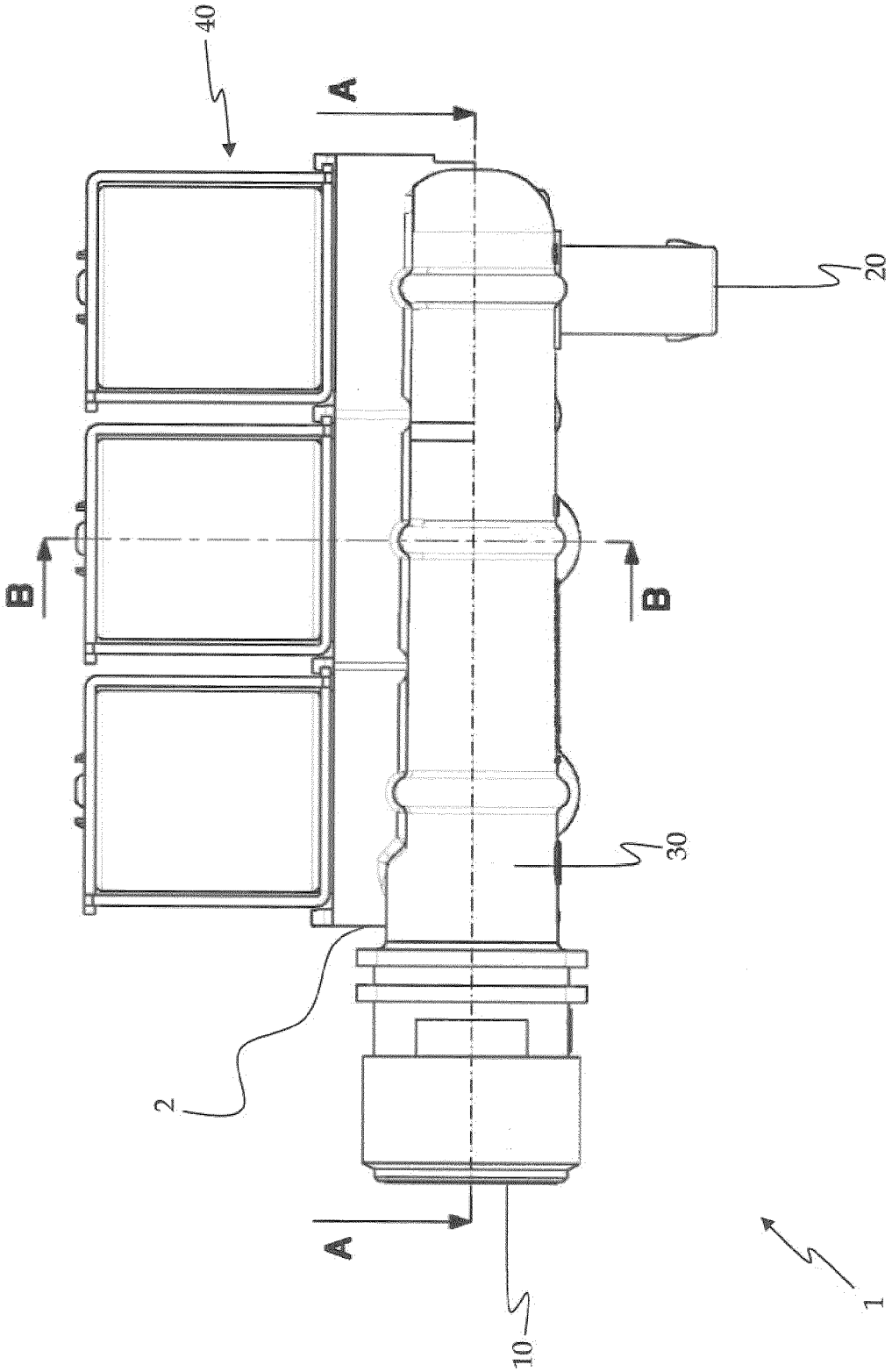

Fig. 1

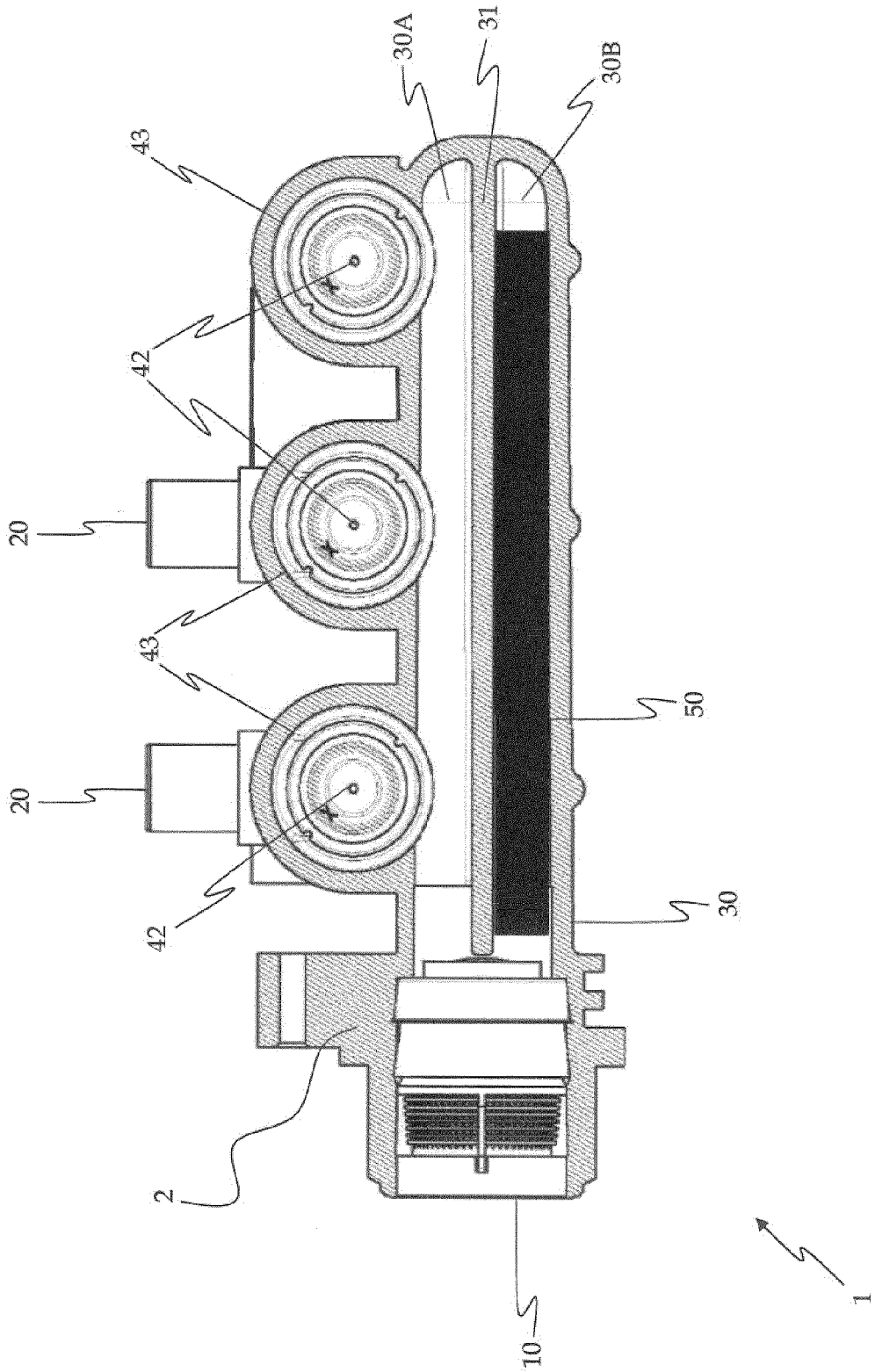

Fig. 2

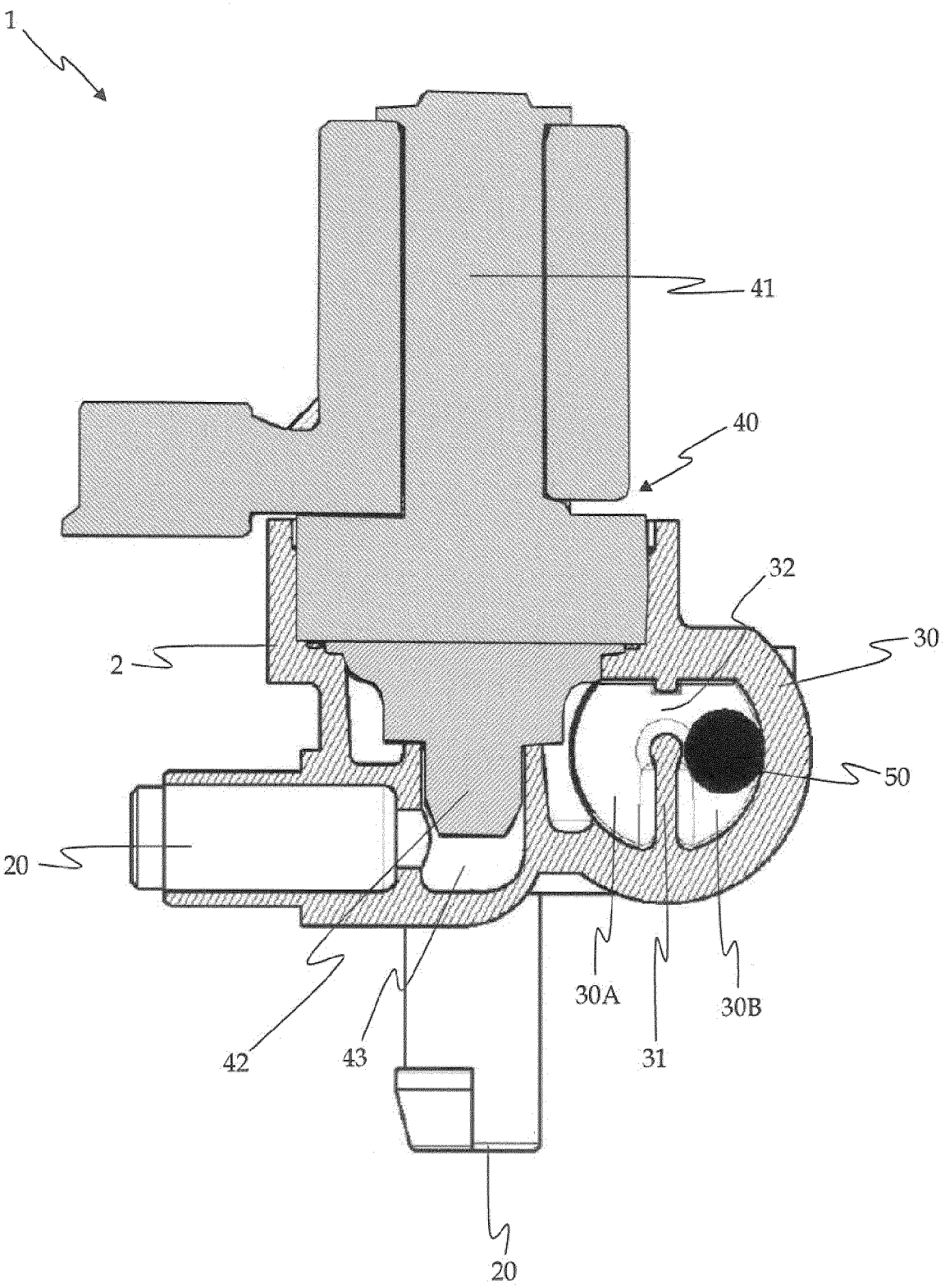

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 12 17 8123

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1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 October 2012	Fachin, Fabiano

CATEGORY OF CITED DOCUMENTS

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