(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 417 901 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.08.2024 Bulletin 2024/34

(21) Application number: **23157533.3**

(22) Date of filing: **20.02.2023**

(51) International Patent Classification (IPC):
F25B 43/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25B 43/003; F25B 2339/0441

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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(54) PERPENDICULAR FLOW TYPE FILTER ELEMENT AS WELL AS AN AIR CONDITIONING SYSTEM WITH THE SAME

(57) The present invention relates to a perpendicular flow type filter element (1) for a component (2a, 2b, 2c, 2d, 2e) used in an air conditioning system (48) or an air conditioning system (48) including or realizing a heat pump (49) of a vehicle (50), having a hollow cylinder body (5), through which a fluid flow (3) of fluid can flow, and which extends along a central longitudinal axis (4), a base body (6), and a filter body (7), through which the fluid flow (3) can flow. Said hollow cylinder body (5) limits a flow channel (8) for fluid, which has a flow region (9'), through which the fluid flow (3) can flow in parallel with respect to the central longitudinal axis (4), and a further flow region (9"), through which the fluid flow (3) can flow perpendicularly with respect to the central longitudinal axis (4). It is essential that the base body (6) has a fixing means (10) and a sealing means assembly (11), by means of which the perpendicular flow type filter element (1) can be fixed in a releasable and fluidtight manner to the heat exchanger (2) and that the base body (6) is formed integrally with the hollow cylinder body (5) at least in some sections. The air conditioning system (48) is preferably used in a vehicle (50) with at least partial electric drive. The air conditioning system (48) including or realizing a heat pump system is preferably used in a vehicle with at least partial electric drive.

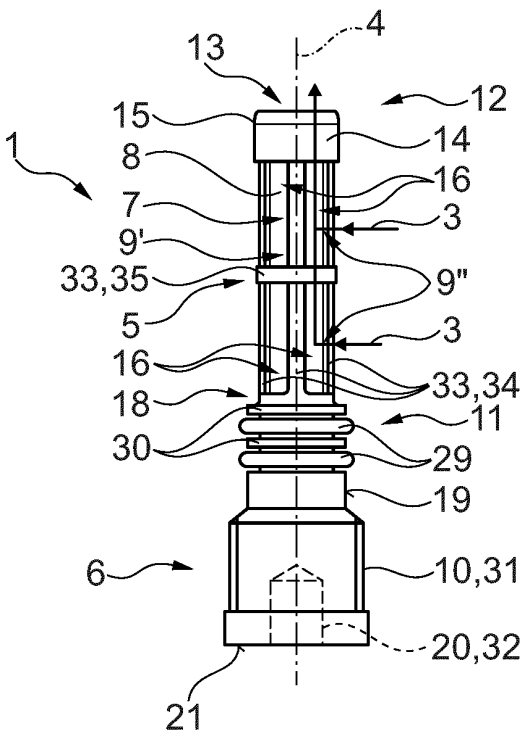

Fig. 2

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Description

[0001] The invention relates to a perpendicular flow type filter element according to the preamble of claim 1. The invention also relates in particular to an air conditioning system with such a perpendicular flow type filter element.

[0002] Heat exchangers of this type are known from the publications DE 10 2019 210022 A1 and CN 103727706 A. Filter elements of the above-mentioned type are described in the publications DE 10 2011 102 899 B4, KR 20060090856 A, EP 3 708 928 A1, EP 3 671 068 A1, and EP 2 587 194 A1.

[0003] A disadvantage of these filter elements is that they are of relatively large construction and furthermore have a small effective filter surface, so that particles, in particular microparticles from the production, which can impact the function of the heat exchanger at least long-term, can remain in a fluid flow, which flows through the heat exchanger.

[0004] The object of the invention lies therefore in providing an enhanced filtering of the said fluid flow. In particular, a heat exchanger comprising at least one such filter element is to also be specified.

[0005] In the case of the present invention, this object is solved in particular by means of the subject matters of the independent claims. Advantageous embodiments are subject matter of the dependent claims and of the description.

[0006] The basic idea of the invention lies in providing a filter element with relatively large filter surface with low package requirements.

[0007] For this purpose, a filter element of the perpendicular flow type for a component used in an air conditioning system of a vehicle or in an air conditioning system including or realizing a heat pump of a vehicle is provided, which has a hollow cylinder body, through which a fluid flow of fluid, in particular refrigerant, can flow, and which extends along a central longitudinal axis, a base body, and a filter body, through which the fluid flow can flow and which is arranged on the hollow cylinder body, for filtering the fluid flow. The hollow cylinder body limits a flow channel for fluid, which has a flow region, through which the fluid flow can flow or flows in parallel or essentially in parallel with respect to the central longitudinal axis, and a further flow region, through which the fluid flow can flow or flows perpendicularly or essentially perpendicularly with respect to the central longitudinal axis. In a state of use of the perpendicular flow type filter element, in which it is installed in an inlet or outlet flange of the said component, especially an outlet flange of a heat exchanger or an outlet flange of a receiver-dryer component, fluid can thus flow into the perpendicular flow type filter element, for example initially perpendicularly with respect to the central longitudinal axis, and can then subsequently flow out of the perpendicular flow type filter element in parallel with respect to the central longitudinal axis, or vice versa. The flow region can thereby advantageously be a fluid outlet region, and the further flow region can be a fluid inlet region. It is essential that the base body is formed integrally with the hollow cylinder body at least in some sections, and has a fixing means and a sealing means assembly, by means of which the perpendicular flow type filter element can be fixed in a releasable and fluid-tight manner to the component, in particular to said outlet flange of the heat exchanger. An advantageous perpendicular flow type filter element is thereby specified, in the case of which a fixing means and a sealing means assembly are formed on the base body, so that corresponding means do not have to be provided on the hollow cylinder body and filter body, and sufficient installation space for a relatively large filter surface remains. By means of a relatively large filter surface, said fluid flow can be filtered more efficiently than before, a premature clogging of the filter body with said particles can in particular be prevented. The specified filter element in particular also has the advantage that particles entrained in the fluid flow, in particular also microparticles, can be separated, so that damages especially to a heat exchanger, in which the perpendicular flow type filter element according to the invention can be installed in its state of use, or to the components thereof (for example a compressor and/or an expansion valve), which are usually caused by these particles, can be prevented reliably. A further advantage of the invention is that all components, especially the heat exchanger, are well protected. Further, the said filter element is specially designed to filter out residual dirt from the fluid in the outlet of the component.

[0008] The hollow cylinder body can advantageously have a round, oval, or angular, in particular rectangular or square, cylinder ring base area. The base body can similarly have a round, oval, or angular, in particular rectangular or square, base area. The cylinder ring base area and the base area are advantageously designed identically with respect to their outer diameters.

[0009] It can furthermore be provided that the base body consists of one piece. The perpendicular flow type filter element thus has a relatively small number of components, so that it is excellently suitable for the production as part of the series production. The one-piece base body and the hollow cylinder body and/or the filter body advantageously form a structural unit, which is integral as a whole, whereby the production is further simplified, and the perpendicular flow type filter element can be handled relatively easily, for example as part of its installation. It can in particular be installed on an outlet flange of the component, especially the heat exchanger, in only a single operating step, so that the initial installation as well as service work following later on the perpendicular flow type filter element are possible quickly and cost-efficiently.

[0010] It can advantageously be provided that, on an axial end, the hollow cylinder body has a front-side outlet axial opening and that, on the axial end or in the region of the axial end, the hollow cylinder body furthermore has

a sealing lip, which revolves in a closed manner around the central longitudinal axis and which is arranged on the outer circumferential side on a circumferential wall of the hollow cylinder body, for sealing the perpendicular flow type filter element with respect to an outlet flange of the component, especially the heat exchanger. The hollow cylinder body can furthermore have at least one inlet circumferential opening, which penetrates the circumferential wall. It can further be provided that the filter body is arranged on the circumferential wall, spanning the at least one inlet circumferential opening, and, in a state of use of the perpendicular flow type filter element, in which the perpendicular flow type filter element is advantageously arranged on the outlet flange of the component, especially heat exchanger, can be or is flown through by the fluid flow transversely with respect to the central longitudinal axis. On a counter axial end opposite to the axial end, the hollow cylinder body can thereby be closed in a fluid-tight manner by the base body. It is advantageous thereby when the outlet axial opening advantageously has a round, oval, or angular, in particular rectangular or square, shape. Said sealing lip is advantageously embodied integrally with the hollow cylinder body and/or protrudes radially to the outside with respect to the hollow cylinder body. The hollow cylinder body and the sealing lip can in particular be molded in a common operating step and can thus be provided relatively cost-efficiently. It can furthermore advantageously be provided that said filter body completely spans or covers, respectively, the at least one inlet circumferential opening, so that said fluid flow has to flow completely through the filter body without any detours. As a whole, it can be ensured with these measures that, in the state of use of the perpendicular flow type filter element, the fluid flow does in fact flow completely through the filter body and does not flow past the latter.

[0011] It is further advantageous when the base body is designed cylindrically, in particular in round-cylindrically, and has an outer circumferential surface, on which the sealing means assembly for sealing the perpendicular flow type filter element is arranged or formed. Said fixing means can furthermore be arranged or formed on the outer circumferential surface of the base body. It is also advantageous when the base body has an actuating means, which is configured for carrying out an installation of the perpendicular flow type filter element on the component, especially the heat exchanger. The actuating means can be arranged or formed, for example, on a front surface of the base body, which faces away with respect to the hollow cylinder body. The arrangement of the actuating means on the front surface allows for a simple tool accessibility, so that the perpendicular flow type filter element can be installed relatively easily and, for example, by means of a tool, which is common in practice. In particular service work on the perpendicular flow type filter element or on the heat exchanger, respectively, can thus be performed quickly and cost-efficiently. By means of said sealing means assembly, the perpendicular flow type filter element can be sealed in a fluid-tight manner relatively easily with respect to the outlet flange of the component, especially the heat exchanger, so that an unintentional escape of fluid into the surrounding area of the component, especially the heat exchanger, can be prevented. The perpendicular flow type filter element can furthermore be releasably installed on the component, especially the heat exchanger, in particular on an outlet flange of the heat exchanger, by means of said actuating means and said fixing means.

[0012] In the alternative, it can be provided that the base body is designed in multiple pieces. For this purpose, the base body is advantageously divided into two cylindrical, in particular round-cylindrical, base body sections. It is advantageous when the first base body section is arranged integrally on the hollow cylinder body, and the second base body section is formed separately with respect to the first base body section and the hollow cylinder body. It can further be provided that the first base body section has an outer circumferential surface, on which the sealing means assembly is arranged or formed, the second base body section has an outer circumferential surface, on which the fixing means is arranged or formed, and the second base body section has a front surface, on which an actuating means is arranged or formed, which is configured for carrying out an installation of the perpendicular flow type filter element on the component, especially the heat exchanger. The front surface advantageously faces away with respect to the hollow cylinder body. Here, the arrangement of the actuating means on the front surface also allows for a simple tool accessibility, so that the perpendicular flow type filter element or the second base body section, respectively, can be installed relatively easily and, for example, by means of a tool, which is common in practice. An advantageous embodiment is thus specified for a multi-piece perpendicular flow type filter element. It can in particular be installed in or on the component, especially the heat exchanger, in that the structural unit formed of the first base body section and the hollow cylinder body (and the filter body) is initially pressed or inserted, for example, into the connecting flange of the component, especially the heat exchanger, and the second base body section is then subsequently installed into the connecting flange of the component, especially the heat exchanger, by means of its fixing and actuating means. Said structural unit can thereby be fixed in a final manner in the connecting flange of the component, especially the heat exchanger, by means of the second base body section.

[0013] It can be advantageous when, on an axial end, the hollow cylinder body has a front-side outlet axial opening, wherein a sealing lip, which revolves in a closed manner around the central longitudinal axis and which is arranged on the outer circumferential side on a circumferential wall of the hollow cylinder body, for sealing the perpendicular flow type filter element with respect to an outlet flange of the component, especially the heat exchanger, is arranged on the axial end. In particular, the

hollow cylinder body has at least one inlet circumferential opening, which passes through the circumferential wall. It can furthermore be provided that the filter body is arranged on the circumferential wall, spanning the at least one inlet circumferential opening, and, in the state of use of the perpendicular flow type filter element, can be or is flown through transversely by the fluid flow with respect to the central longitudinal axis. The first base body section can thereby be arranged integrally on a counter axial end of the hollow cylinder body opposite to the axial end, and so as to close the counter axial end in a fluid-tight manner. The statements made above with regard to the one-piece perpendicular flow type filter element furthermore apply analogously. According to this, the outlet axial opening can advantageously have a round, oval, or angular, in particular rectangular or square, shape., and the sealing lip can advantageously be embodied integrally with the hollow cylinder body and/or can protrude radially to the outside with respect to the hollow cylinder body. The hollow cylinder body and the sealing lip can furthermore be molded in a common operating step and can thus be provided relatively cost-efficiently. It can advantageously also be provided that said filter body completely spans or covers, respectively, the at least one inlet circumferential opening, so that said fluid flow flows completely through the filter body. As a whole, it can likewise be ensured with these measures that, in the state of use of the perpendicular flow type filter element, the fluid flow does in fact flow completely through the filter body and does not flow past the latter.

[0014] It can further advantageously be provided that said first base body section has an impact surface, which is opposite with respect to the hollow cylinder body, the second base body section has a counter impact surface, and that, in the state of use of the perpendicular flow type filter element, the impact surface and the counter impact surface abut on one another with contact. It can be advantageous thereby when, by means of the second base body section, an actuating force, which is or will be introduced on the second base body section as part of the installation of the perpendicular flow type filter element on the outlet flange of the component, especially the heat exchanger, is or will be transferred from the second base body section to the first base body section via the counter impact surface and impact surface. The structural unit formed of the first base body section and the hollow cylinder body (and the filter body) can thus be fixed in a final manner to the outlet flange of the component, especially the heat exchanger, by means of the second base body section. During the installation of the perpendicular flow type filter element, it is in particular provided that the structural unit formed of the first base body section and the hollow cylinder body (and the filter body) is initially pressed or inserted into the outlet flange of the component, especially the heat exchanger, wherein the second base body section is then inserted into the outlet flange of the heat exchanger, and is fixed to the outlet flange of the component, especially the heat exchanger, by means of the fixing and actuating means thereof. An actuating force is thereby applied to the second base body section, which, when its counter impact surface and the impact surface of the first base body section abut on one another, is transferred from the second base body section to the first base body section or said structural unit, respectively, via the counter impact surface and the impact surface. As a whole, this has the advantage that the structural unit of the first base body section and the hollow cylinder body (and the filter body) is free from fixing and actuating means.

[0015] It can further advantageously be provided that the sealing means assembly has at least one sealing ring or, alternatively, two separate sealing rings. If two separate sealing rings are provided, it can be advantageous when the two sealing rings are axially spaced apart from one another via holding protrusions of the first base body section or of the base body, which revolve in a closed manner around the central longitudinal axis and which protrude radially with respect to the central longitudinal axis. The sealing ring or the sealing rings can be realized by means of O rings. The sealing ring or the sealing rings can alternatively be realized by means of a 2K rubber molded part or a 2K TPE molded part. The base body or the first base body section and the sealing ring or the sealing rings can in particular be molded integrally, whereby a relatively cost-efficient provision is possible. The holding protrusions can likewise be embodied integrally with the base body or the first base body section.

[0016] It can be advantageous when the fixing means has or forms an external thread and/or the actuating means has or forms a tool receptacle for introducing a screw-in torque required for carrying out the installation of the perpendicular flow type filter element with external thread on the outlet flange of the component, especially the heat exchanger. Alternatively, it can be provided that the fixing means is or forms an outer circumferential surface configured for forming a press-fit connection and/or the actuating means has or forms a flat force introduction surface for introducing a pressing force necessary for establishing the press-fit connection. The force introduction surface is advantageously the front surface of the base body or of the second base body section. Advantageous fixing and actuating means are thereby specified, by means of which the perpendicular flow type filter element can be installed relatively easily on the component, especially the heat exchanger, and can be handled easily as part of service work.

[0017] It can further advantageously be provided that the hollow cylinder body limits or has a support structure, which supports the hollow cylinder body and/or the filter body axially and/or transversely to the central longitudinal axis in the region of the at least one inlet circumferential opening. Said support structure can in particular have at least one longitudinal rib and/or at least one circumferential rib. The at least one longitudinal rib and the at least one circumferential rib can be connected to one another integrally. The support structure is advantageously also

arranged on the filter body and/or radially supports said support structure with respect to the central longitudinal axis.

[0018] The filter body is advantageously realized by means of a filter net, which has a mesh size, which lies between 50 μm and 200 μm or which is preferably 100 μm. It goes without saying, however, that the filter body can also be realized by means of other filter materials, for example a woven filter medium, a cardboard structure, a woven fabric or the like. This has the advantage that particles entrained in the fluid flow, even microparticles, can be separated reliably from the fluid flow. Damages to the component, especially the heat exchanger or the components thereof, can thus be prevented, so that components, especially the heat exchangers, equipped with the perpendicular flow type filter element can attain relatively long service lives with simultaneously relatively long maintenance intervals.

[0019] According to a further basic idea of the invention, it can be provided that a component, especially a heat exchanger, for a vehicle is provided, which has at least one perpendicular flow type filter element according to the preceding description. A component, especially the heat exchanger, equipped accordingly provides the advantage of a relatively long service life with simultaneously relatively long maintenance intervals. The particles, in particular microparticles, entrained in the fluid flow during the operation of the component, especially the heat exchanger, are separated efficiently by means of the perpendicular flow type filter element installed on the component, especially the heat exchanger, so that no damages can be caused to the component, especially the heat exchanger, i.e. to the components thereof, such as, for example, a compressor and/or an expansion valve, by means of these particles. Further, the said perpendicular flow type filter element may be used in addition to a basic filter element which is usually installed in the component, especially the heat exchanger, for filtering the said fluid flow. Furthermore, the at least one perpendicular flow type filter element may be placed in the outlet flange of the component, especially the heat exchanger. Furthermore, it can be provided that the component, especially the heat exchanger, for a battery electric vehicle having at least one additional filter element in addition to the said at least one perpendicular flow type filter element and/or the component, especially the heat exchanger, is realized by a plate heat exchanger.

[0020] It can thereby advantageously be provided that said component, especially the heat exchanger, has: two collectors, which are fluidically connected to one another via flat tubes, wherein a first path for the fluid flow of fluid, in particular refrigerant, leads through the collectors and the flat tubes, and a second path for a further fluid flow of fluid, in particular coolant, leads around the flat tubes, so that heat energy can be transferred from the one fluid flow to the other further fluid flow, or vice versa. The component, especially the heat exchanger, has an outlet flange for letting out the fluid flow of fluid. The outlet flange has a filter receptacle for receiving an individual perpendicular flow type filter element according to the above description. The outlet flange is arranged on said collector and is connected to the latter so as to fluidically communicate therewith so that the first path extends through the filter receptacle, wherein a perpendicular flow type filter element is inserted into the filter receptacle with its outlet axial opening first, and is releasably fixed to the outlet flange by means of the fixing means. The filter receptacle is divided by means of the perpendicular flow type filter element into a ring-shaped inlet space, which is formed between the outlet flange and the perpendicular flow type filter element transversely with respect to the central longitudinal axis, and aside from that, into a discharge space, which is formed between the outlet flange and the perpendicular flow type filter element, wherein the inlet space is sealed in a fluid-tight manner with respect to the discharge space by means of the sealing lip of the perpendicular flow type filter element, and wherein the inlet space is sealed in a fluid-tight manner with respect to a surrounding area of the component, especially the heat exchanger, by means of the sealing means assembly of the perpendicular flow type filter element. At least one further filter element for filtering the fluid flow of refrigerant can in particular be arranged in the first path, upstream with respect to the perpendicular flow type filter element. The further filter element can advantageously be installed in a component of the heat exchanger, through which said fluid flow leads, it can be arranged, for example, in a capacitor.

[0021] In addition, the invention can be used on so called receivers-dryer components of a AC system (Air Conditioning system). The installation at the inlet of a compressor of the AC system is also possible.

[0022] According to a further basic idea of the invention, the use of the aforementioned component, especially the heat exchanger, in a vehicle, in particular a battery electric vehicle with electric drive and/or hybrid drive and/or fuel cell drive, or in a cooling circuit of a battery electric vehicle, in particular a battery electric vehicle with electric drive and/or hybrid drive and/or fuel cell drive, is intended. Furthermore, a cooling circuit of a battery electric vehicle, in particular a battery electric vehicle with electric drive and/or hybrid drive and/or fuel cell drive, is provided, which comprising at least one heat exchanger as it is described above. The said heat exchanger may be comprising at least one or more perpendicular flow type filter elements according to the preceding description.

[0023] According to an optional idea of the invention, the use of the aforementioned heat exchanger in a heat pump system or a heat pump circuit of a battery electric vehicle, in particular a battery electric vehicle with electric drive and/or hybrid drive and/or fuel cell drive, can be intended. Furthermore, a heat pump system or a heat pump circuit of a battery electric vehicle, in particular a battery electric vehicle with electric drive and/or hybrid drive and/or fuel cell drive, is provided, comprising at least

one heat exchanger as it is described above. The said heat exchanger may be comprising at least one or more perpendicular flow type filter elements according to the preceding description.

[0024] According to an optional idea of the invention, an air conditioning system for a vehicle or an air conditioning system for a vehicle including or realizing a heat pump is provided. It comprising at least one perpendicular flow type filter element according to the preceding description.

[0025] It may be provided, that the said air conditioning system for a vehicle or the said air conditioning system for a vehicle including or realizing a heat pump further comprising the following components: at least two heat exchangers, a compressor and

- either a receiver-dryer component with a main filter placed therein, wherein the at least one perpendicular flow filter element is arranged in an outlet flange of one heat exchanger of this at least two heat exchangers, and/or wherein the at least one perpendicular flow filter element or a further at least one perpendicular flow filter element is arranged in an inlet flange of the compressor, wherein the at least one perpendicular flow filter element and/or the further at least one perpendicular flow filter element additionally acts to the said main filter of the receiver-dryer component,
- or a receiver-dryer component, wherein the at least one perpendicular flow filter element is arranged in an outlet flange of the receiver-dryer component and used as a main filter for the said air conditioning system for a vehicle or the said air conditioning system for a vehicle including or realizing a heat pump.

[0026] According to an optional idea of the invention, a receiver-dryer-component for an air conditioning system for a vehicle or an air conditioning system for a vehicle including or realizing a heat pump is provided. The receiver-dryer-component comprising a receiver, a dryer arranged in or on the receiver, at least one outlet flange and at least one perpendicular flow type filter element according to the preceding description, wherein the at least one perpendicular flow filter element is arranged in one outlet flange of this at least one outlet flange.

[0027] Further important features and advantages of the invention follow from the subclaims, from the drawings, and from the corresponding figure description on the basis of the drawings.

[0028] It goes without saying that the above-mentioned features and the features, which will be described below, cannot only be used in the respective specified combination, but also in other combinations, or alone, without leaving the scope of the present invention.

[0029] Preferred exemplary embodiments of the invention are illustrated in the drawings and will be described in more detail in the following description, whereby identical reference numerals refer to identical or similar or functionally identical components.

[0030] In each case schematically,

Fig. 1 shows a highly simplified sectional view, which is to be understood only symbolically, of a heat exchanger according to the invention, which is equipped with a perpendicular flow type filter element according to the invention according to a first embodiment,

Fig. 2 shows a perpendicular flow type filter element according to the invention according to a further embodiment in a perspective view,

Fig. 3 shows a perpendicular flow type filter element according to the invention according to a further embodiment in a perspective view,

Fig. 4 to 6 showing preferred embodiments of an air conditioning system for a vehicle or air conditioning system for a vehicle including or realizing a heat pump comprising at least one perpendicular flow type filter element and

Fig. 7 a simplified preferred embodiment of a receiver-dryer component for an air conditioning system for a vehicle.

[0031] Figs. 1 to 3 show different embodiments of a perpendicular flow type filter element, which is identified as a whole with reference numeral 1, which is configured to filter out particles, in particular microparticles, from a fluid flow 3 of fluid, in particular refrigerant. According to the embodiment according to Fig. 1, the perpendicular flow type filter element 1 is installed on a component, hereinafter a heat exchanger 2, and, according to the embodiments according to Figs. 2 and 3, is configured to be installed on such a component, especially the heat exchanger 2.

[0032] A section of a cut-open heat exchanger 2 is illustrated in Fig. 1, whereby only one collector 37 of the two collectors of the heat exchanger 2 can be seen. Flat tubes 39 are arranged on one side on the collector 37, and an outlet flange 36 on the other side, wherein a first path 40, which is visualized in Fig. 1 by means of arrows, for the fluid flow 3 of fluid extends through the collector 37, the flat tubes 39, and the outlet flange 36, so that these components can be flown through by the fluid flow 3 and are flown through during the operation of the heat exchanger 2. The outlet flange 36 is arranged downstream with respect to the collectors as well as the flat tubes 39, so that it is flown through by the fluid flow 3 as last component of the heat exchanger 2. A second path 41, which is likewise visualized by arrows, for a further

fluid flow 45 of fluid, in particular coolant, leads around the flat tubes 39, so that the flat tubes 39 can quasi be flown through by the fluid flow 3 and can be flown around by the further fluid flow 45. Heat energy can thus be transferred efficiently from the one fluid flow 3 to the other further fluid flow 45, or vice versa.

[0033] The outlet flange 36 is configured to drain fluid from the heat exchanger 2, for example into a heat exchanger component, which is connected downstream from the heat exchanger 2 and which is not illustrated in the present case. The outlet flange 36 is further configured to receive said perpendicular flow type filter element 1, namely in the manner that the fluid can flow through the perpendicular flow type filter element 1 downstream from the heat exchanger 2 prior to leaving the heat exchanger 2 and can be filtered. For this purpose, the outlet flange 36 has a filter receptacle 42, in which the perpendicular flow type filter element 1 is received completely and is fixed to the outlet flange 36 in a state, which is identified as state of use 17.

[0034] Looking at Figs. 2 and 3, it can be seen that the perpendicular flow type filter element 1 has a hollow cylinder body 5, through which the fluid flow 3 can flow and which extends along a central longitudinal axis 4, a base body 6, and a filter body 7, through which the fluid flow 3 can flow, for filtering the fluid flow 3, which is arranged on the hollow cylinder body 5. The hollow cylinder body 5 limits a flow channel 8 for the fluid flow 3, which has a flow region 9' and a further flow region 9". The fluid flow 3 can thereby flow through the flow region 9' in parallel or at least essentially in parallel with respect to the central longitudinal axis 4. The fluid flow 3 can flow through the further flow region 9" perpendicularly or at least essentially perpendicularly with respect to the central longitudinal axis 4, so that the present filter element thus forms a filter of the perpendicular flow type. On an axial end 12, the hollow cylinder body 5 furthermore has a front-side outlet axial opening 13 for the fluid flow 3. A sealing lip 15, which revolves in a closed manner around the central longitudinal axis 4 and which is arranged on the outer circumferential side on a circumferential wall 14 of the hollow cylinder body 5, for sealing the perpendicular flow type filter element 1 with respect to the outlet flange 36 of the heat exchanger 2, can further be seen in the region of the axial end 12. The hollow cylinder body 5 furthermore has several inlet circumferential openings 16, which pass completely through the circumferential wall 14 and through which fluid can reach into the hollow cylinder body 5. The inlet circumferential openings 16 advantageously lie in the further flow region 9". Said filter body 7 spans the inlet circumferential openings 16 completely and is additionally arranged firmly on the circumferential wall 14, so that the fluid flow 3 can flow or flows through the filter body 7 transversely with respect to the central longitudinal axis 4 in the state of use 17 of the perpendicular flow type filter element 1. It is now essential that the base body 6 has or forms a fixing means 10 and a sealing means assembly 11, by means of which the perpendicular flow type filter element 1 can be fixed releasably and in a fluid-tight manner to the heat exchanger 2. In the present case, the base body 6 is formed integrally with the hollow cylinder body 5 at least in some sections. Due to the fact that the fixing means 10 and a sealing means assembly 11 are arranged or formed, respectively, exclusively on the base body 6, corresponding means do not need to be provided on the hollow cylinder body 5 and filter body 7, so that installation space for a relatively large filter surface is available there. In order to be able to provide a sufficient stability of the perpendicular flow type filter element 1 and/or a support of the filter body 7 in the region of the inlet circumferential openings 16 during the operation of the heat exchanger 2, it is provided in a purely exemplary manner that the hollow cylinder body 5 has a support structure 33 of longitudinal ribs 34 and circumferential ribs 35 in this region, which supports the hollow cylinder body 5 and the filter body 7.

[0035] According to the embodiment illustrated in Fig. 2, it is furthermore provided that the base body 6 is designed in one piece and cylindrically. The hollow cylinder body 5 is further closed integrally and in a fluid-tight manner by the base body 6 on a counter axial end 18 opposite to the axial end 12. In this case, the base body 6 has, in an exemplary manner, an outer circumferential surface 19, on which said sealing means assembly 11 for sealing the perpendicular flow type filter element 1 is arranged or formed. In the present case, the sealing means assembly 11 is realized in the form of two sealing rings 29, which are axially spaced apart from one another via holding protrusions 30 of the base body 6, which revolve in a closed manner around the central longitudinal axis 4 and which protrude radially with respect to the central longitudinal axis 4. Said fixing means 10 is furthermore arranged or formed on said outer circumferential surface 19 of the base body 6. In the present case, it is realized by means of an external thread 31. The base body 6 furthermore has an actuating means 20, which is configured for carrying out an installation of the perpendicular flow type filter element 1 on the heat exchanger 2 and which is arranged on a front surface 21 of the base body 6 facing away with respect to the hollow cylinder body 5 and which is realized by means of a tool receptacle 32 for introducing a screw-in torque required for carrying out the installation of the perpendicular flow type filter element 1 on the outlet flange 36 of the heat exchanger 2.

[0036] The embodiment of the perpendicular flow type filter element 1 illustrated in Fig. 3 differs from the preceding embodiment in particular in that the base body 6 is designed in multiple pieces and is divided into two separate, cylindrically formed base body sections 22, 23. In an exemplary manner, the first base body section 22 is arranged integrally on the hollow cylinder body 5, namely on a counter axial end 18 of the hollow cylinder body 5 opposite to the axial end 12, so that the hollow cylinder body 5 is closed in a fluid-tight manner. The first base body section 22, the hollow cylinder body 5, and the filter body thus form a structural unit. It is furthermore provided

that the first base body section 22 has an outer circumferential surface 24, on which said sealing means assembly 11 is arranged or formed. In the present case, the sealing means assembly 11 is realized as in the case of the preceding embodiment by means of two sealing rings 29, which are axially spaced apart from one another via holding protrusions 30 of the first base body section 22, which revolve in a closed manner around the central longitudinal axis 4 and which protrude radially with respect to the central longitudinal axis 4.

[0037] The second base body section 23 has an outer circumferential surface 25, on which said fixing means 10 is arranged or formed. In the present case, it is realized by means of an external thread 31. Fixing means are neither provided on the first base body section 22 nor on the hollow cylinder body 5. The second base body section 23 furthermore has a flat front surface 26, on which an actuating means 20 is arranged or formed, which is configured for carrying out an installation of the perpendicular flow type filter element 1 on the heat exchanger 2. It is furthermore important to explain that the first base body section 22 has a flat impact surface 27, which is opposite with respect to the hollow cylinder body 5, and that the second base body section 23 has a flat counter impact surface 28. The impact surface 27 and the counter impact surface 28 are abutted on one another with contact in the state of use 17 of the perpendicular flow type filter element 1. By means of the second base body section 23, an actuating force, which is introduced on the second base body section 23 as part of the installation of the perpendicular flow type filter element 1 on the outlet flange 36 of the heat exchanger 2, can thus be transferred from the second base body section 23 to the first base body section 22. This has the advantage that the structural unit of the first base body section 22 and the hollow cylinder body 5 (and the filter body 7) can quasi by fixed in a final manner to the outlet flange 36 of the heat exchanger 2 by means of the second base body section 23.

[0038] The fig. 4 illustrates a preferred embodiment of an air conditioning system 48, short AC system, for a vehicle 50 or air conditioning system 48 for a vehicle 50 including or realizing a heat pump 49. It comprises a fluid circuit 53 with the following components 2a, 2b, 2c, 2d, 2e fluidically arranged therein: exemplary three heat exchangers 2a, 2b, 2e, namely a heat exchanger 2a serving as a condenser, a further heat exchanger 2b serving as an evaporator and a further heat exchanger 2e serving as a condenser subcooler for the heat exchanger 2a, further exemplary a compressor 2d for compressing the fluid, further exemplary an expansion valve 54 and further exemplary a receiver-dryer component 2c with a main filter placed therein. It is exemplary provided, that the at least one perpendicular flow filter element 1 is arranged in an outlet flange 2b1 of said heat exchanger 2b serving as an evaporator and/or the at least one perpendicular flow filter element 1 or a further at least one perpendicular flow filter element 1 is arranged in an inlet flange 2d1 of the compressor 2d and/or the at least one perpendicular flow filter element 1 or a further at least one perpendicular flow filter element 1 is arranged in an outlet flange 2e1 of the further heat exchanger 2e serving as a condenser subcooler. Alternatively, it can be provided, that the receiver-dryer component 2c is provided without a main filter, wherein only one at least one perpendicular flow filter element 1 is provided which is arranged in an outlet flange 2c1 of the receiver-dryer component 2c and used as a main filter.

[0039] The fig. 5 illustrates a further preferred embodiment of an air conditioning system 48 for a vehicle 50 or air conditioning system 48 for a vehicle 50 including or realizing a heat pump 49. It differs from the embodiment shown in Fig. 4 in that, only two heat exchangers 2a, 2b are provided, namely a heat exchanger 2a serving as an outside heat exchanger, short OHX, and a further heat exchanger 2b serving as an evaporator for a cabin of the vehicle 50. It is further provided, that the at least one perpendicular flow filter element 1 is arranged in an outlet flange 2b1 of said heat exchanger 2b serving as an evaporator for a cabin of the vehicle 50 and/or the at least one perpendicular flow filter element 1 or a further at least one perpendicular flow filter element 1 is arranged in an inlet flange 2d1 of the compressor 2d and/or the at least one perpendicular flow filter element 1 or a further at least one perpendicular flow filter element 1 is arranged in an outlet flange 2a1 of the further heat exchanger 2a serving as an outside heat exchanger. Alternatively, it can be provided, that the receiver-dryer component 2c is provided without a main filter, but only one at least one perpendicular flow filter element 1 is provided which is arranged in an outlet flange 2c1 of the receiver-dryer component 2c and used as a main filter. Overall, this can realize an air conditioning operation mode of the said air conditioning system 48 for the vehicle 50 or air conditioning system 48 for the vehicle 50 including or realizing a heat pump 49.

[0040] The fig. 6 illustrates a further preferred embodiment of an air conditioning system 48 for a vehicle 50 or air conditioning system 48 for a vehicle 50 including or realizing a heat pump 49. It corresponds to the embodiment of Fig. 5 with the difference that the heat exchanger 2a is serving as a condenser as heater for the said cabin of the vehicle 50 and the heat exchanger 2b serving as an outside heat exchanger, short OHX. This can realize a heat pump operation mode of the said air conditioning system 48 for the vehicle 50 or air conditioning system 48 for the vehicle 50 including or realizing a heat pump 49.

[0041] Fig. 7 is a simplified preferred embodiment of a receiver-dryer-component 2c for an air conditioning system 48 for the vehicle 50 or an air conditioning system 48 for the vehicle 50 including or realizing a heat pump 49. The receiver-dryer-component 2c comprising a receiver 2c3 for fluid, a dryer 2c2 for drying fluid arranged on the receiver 2c3, at least one outlet flange 2c1 and at least one perpendicular flow type filter element 1 according to the invention. Exemplary, the said at least one perpendicular flow filter element 1 is arranged in the one outlet flange 2c1 of this at least one outlet flange 2c1.

The said at least one perpendicular flow filter element 1 is therefore used as main filter in the outlet flange 2c1 of the receiver-dryer-component 2c.

[0042] It is further mentioned, that the said vehicle 50 can realize a battery electric vehicle, in particular a battery electric vehicle with electric drive and/or hybrid drive and/or fuel cell drive. It can also have at least a partial electric drive.

Claims

1. A perpendicular flow type filter element (1) for a component (2a, 2b, 2c, 2d, 2e) used in an air conditioning system (48) of a vehicle (50) or in an air conditioning system (48) including or realizing a heat pump (49) of a vehicle (50),

   - comprising a hollow cylinder body (5), through which a fluid flow (3) of fluid can flow, and which extends along a central longitudinal axis (4), a filter body (7), which is arranged thereon and through which the fluid flow (3) can flow, for filtering the fluid flow (3), and a base body (6),
   - wherein the hollow cylinder body (5) limits a flow channel (8) for fluid, which has a flow region (9'), through which the fluid flow (3) can flow in parallel with respect to the central longitudinal axis (4), and a further flow region (9"), through which the fluid flow (3) can flow perpendicularly with respect to the central longitudinal axis (4),

   characterized in that

   - the base body (6) has a fixing means (10) and a sealing means assembly (11), by means of which the perpendicular flow type filter element (1) can be fixed in a releasable and fluid-tight manner to the component (2a, 2b, 2c, 2d, 2e),
   - the base body (6) is formed integrally with the hollow cylinder body (5) at least in some sections.

2. The perpendicular flow type filter element (1) according to claim 1,
   characterized in that
   the base body (6) consists of one piece.

3. The perpendicular flow type filter element (1) according to claim 1 or 2,
   characterized in that

   - on an axial end (12), the hollow cylinder body (5) has a front-side outlet axial opening (13),
   - on the axial end (12), the hollow cylinder body (5) furthermore has a sealing lip (15), which revolves in a closed manner around the central longitudinal axis (4) and which is arranged on the outer circumferential side on a circumferential wall (14) of the hollow cylinder body (5), for sealing the perpendicular flow type filter element (1) with respect to an outlet flange (36) of the component (2a, 2b, 2c, 2d. 2e),
   - the hollow cylinder body (5) has at least one inlet circumferential opening (16), which passes through the circumferential wall (14),
   - the filter body (7) is arranged on the circumferential wall (14), spanning the at least one inlet circumferential opening (16), and, in a state of use (17) of the perpendicular flow type filter element (1), can be or is flown through by the fluid flow (3) transversely with respect to the central longitudinal axis (4),
   - on a counter axial end (18) opposite to the axial end (12), the hollow cylinder body (5) is closed in a fluid-tight manner by the base body (6).

4. The perpendicular flow type filter element (1) according to one of the preceding claims, **characterized in that**

   - the base body (6) is designed cylindrically, in particular in round-cylindrically, and has an outer circumferential surface (19), on which the sealing means assembly (11) for sealing the perpendicular flow type filter element (1) is arranged or formed,
   - wherein the fixing means (10) is furthermore arranged or formed on the outer circumferential surface (19) of the base body (6),
   - wherein the base body (6) furthermore has an actuating means (20), which is configured for carrying out an installation of the perpendicular flow type filter element (1) on the component (2a, 2b, 2c, 2d, 2e), and which is arranged or formed on a front surface (21) of the base body (6), which faces away with respect to the hollow cylinder body (5).

5. The perpendicular flow type filter element (1) according to claim 1,
   characterized in that

   - the base body (6) consists of multiple pieces, and/or
   - the base body (6) has two base body sections (22, 23), which are formed cylindrically, in particular round-cylindrically.

6. The perpendicular flow type filter element (1) according to claim 5,
   characterized in that
   the one, first base body section (22) is arranged integrally on the hollow cylinder body (5), and the other, second base body section (23) is formed separately with respect to the first base body section (22) and

the hollow cylinder body (5).

7. The perpendicular flow type filter element (1) according to claim 6,
characterized in that

- the first base body section (22) has an outer circumferential surface (24), on which the sealing means assembly (11) is arranged or formed,
- the second base body section (23) has an outer circumferential surface (25), on which the fixing means (10) is arranged or formed,
- the second base body section (23) has a front surface (26), on which an actuating means (20) is arranged or formed, which is configured for carrying out an installation of the perpendicular flow type filter element (1) on the component (2a, 2b, 2c, 2d, 2e).

8. The perpendicular flow type filter element (1) according to claim 6 or 7,
characterized in that

- on an axial end (12), the hollow cylinder body (5) has a front-side outlet axial opening (13),
- on the axial end (12), the hollow cylinder body (5) furthermore has a sealing lip (15), which revolves in a closed manner around the central longitudinal axis (4) and which is arranged on the outer circumferential side on a circumferential wall (14) of the hollow cylinder body (5), for sealing the perpendicular flow type filter element (1) with respect to an outlet flange (36) of the component (2a, 2b, 2c, 2d, 2e),
- the hollow cylinder body (5) has at least one inlet circumferential opening (16), which passes through the circumferential wall (14),
- the filter body (7) is arranged on the circumferential wall (14), spanning the at least one inlet circumferential opening (16), and, in a state of use (17) of the perpendicular flow type filter element (1), can be or is flown through by the fluid flow (3) transversely with respect to the central longitudinal axis (4),
- the first base body section (22) is arranged integrally on a counter axial end (18) of the hollow cylinder body (5) opposite to the axial end (12), and so as to close the counter axial end (18) in a fluid-tight manner.

9. The perpendicular flow type filter element (1) according to one of claims 6 to 8, **characterized in that**

- the first base body section (22) has an impact surface (27), which is opposite with respect to the hollow cylinder body (5),
- the second base body section (23) has a counter impact surface (28),
- in a state of use (17) of the perpendicular flow type filter element (1), the impact surface (27) and the counter impact surface (28) abut on one another with contact.

10. The perpendicular flow type filter element (1) according to claim 9,
characterized in that
by means of the second base body section (23), an actuating force, which is introduced on the second base body section (23) as part of an installation of the perpendicular flow type filter element (1) on the component (2a, 2b, 2c, 2d, 2e), is transferred from the second base body section (23) to the first base body section (22) via the counter impact surface (28) and the impact surface (27).

11. The perpendicular flow type filter element (1) according to one of the preceding claims, **characterized in that**

- the sealing means assembly (11) has at least one sealing ring (29), or
- the sealing means assembly (11) has two sealing rings (29), which are axially spaced apart from one another via holding protrusions (30) of the first base body section (22) or of the base body (6), which revolve in a closed manner around the central longitudinal axis (4) and which protrude radially with respect to the central longitudinal axis (4).

12. The perpendicular flow type filter element (1) according to one of the preceding claims, **characterized in that**
the hollow cylinder body (5) has a support structure (33), which supports the hollow cylinder body (5) and/or the filter body (7) axially and/or transversely to the central longitudinal axis (4) in the region of the at least one inlet circumferential opening (16).

13. Air conditioning system (48) for a vehicle (50) or air conditioning system (48) for a vehicle (50) including or realizing a heat pump (49) comprising at least one perpendicular flow type filter element (1) according to claims 1 to 12.

14. The air conditioning system (48) for a vehicle (50) or the air conditioning system (48) for a vehicle (50) including or realizing a heat pump (49) according to claim 13, wherein it further comprising the following components (2a, 2b, 2c, 2d, 2e):

- at least two heat exchangers (2a, 2b, 2e),
- a compressor (2d) and
- either a receiver-dryer component (2c) with a main filter placed therein,

wherein the at least one perpendicular flow filter element (1) is arranged in an outlet flange (2a1, 2b1, 2e1) of one heat exchanger (2a, 2b, 2e) of this at least two heat exchangers (2a, 2b, 2e), and/or
wherein the at least one perpendicular flow filter element (1) or a further at least one perpendicular flow filter element (1) is arranged in an inlet flange (2d1) of the compressor (2d),
wherein the at least one perpendicular flow filter element (1) and/or the further at least one perpendicular flow filter element (1) additionally acts to the said main filter of the receiver-dryer component (2c),

- or a receiver-dryer component (2c), wherein the
at least one perpendicular flow filter element (1) is arranged in an outlet flange (2c3) of the receiver-dryer component (2c) and used as a main filter.

15. Receiver-dryer component (2c) for an air conditioning system (48) for a vehicle (50) or an air conditioning system (48) for a vehicle (50) including or realizing a heat pump (49), wherein the receiver-dryer-component (2c) comprising:

- a receiver (2c1),
- a dryer (2c2) arranged in or on the receiver (2c1),
- at least one outlet flange (2c3),
- at least one perpendicular flow type filter element (1) according to claims 1 to 12,
- wherein the at least one perpendicular flow filter element (1) is arranged in one outlet flange (2c3) of this at least one outlet flange (2c3).

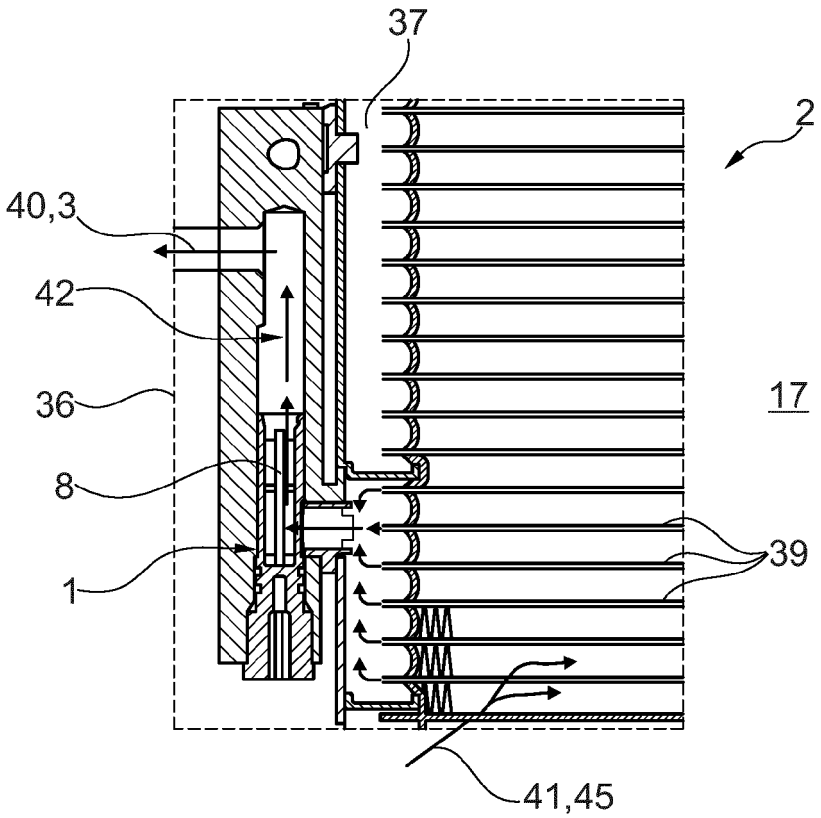
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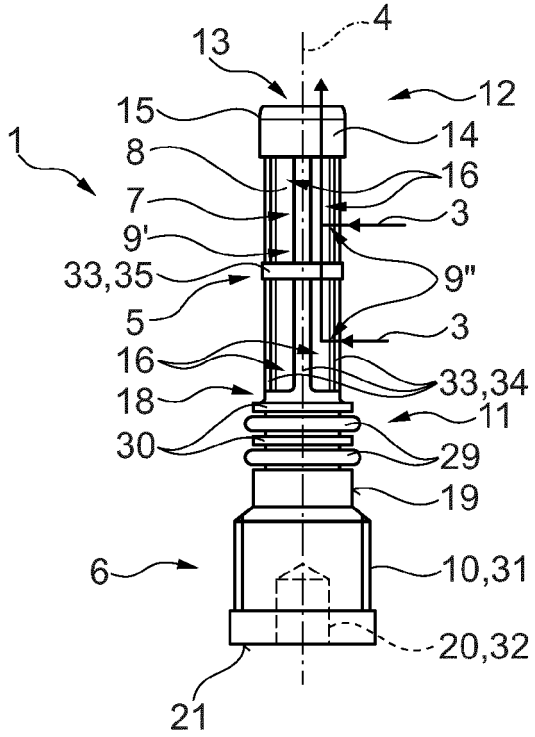
Fig. 1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21

Fig. 2

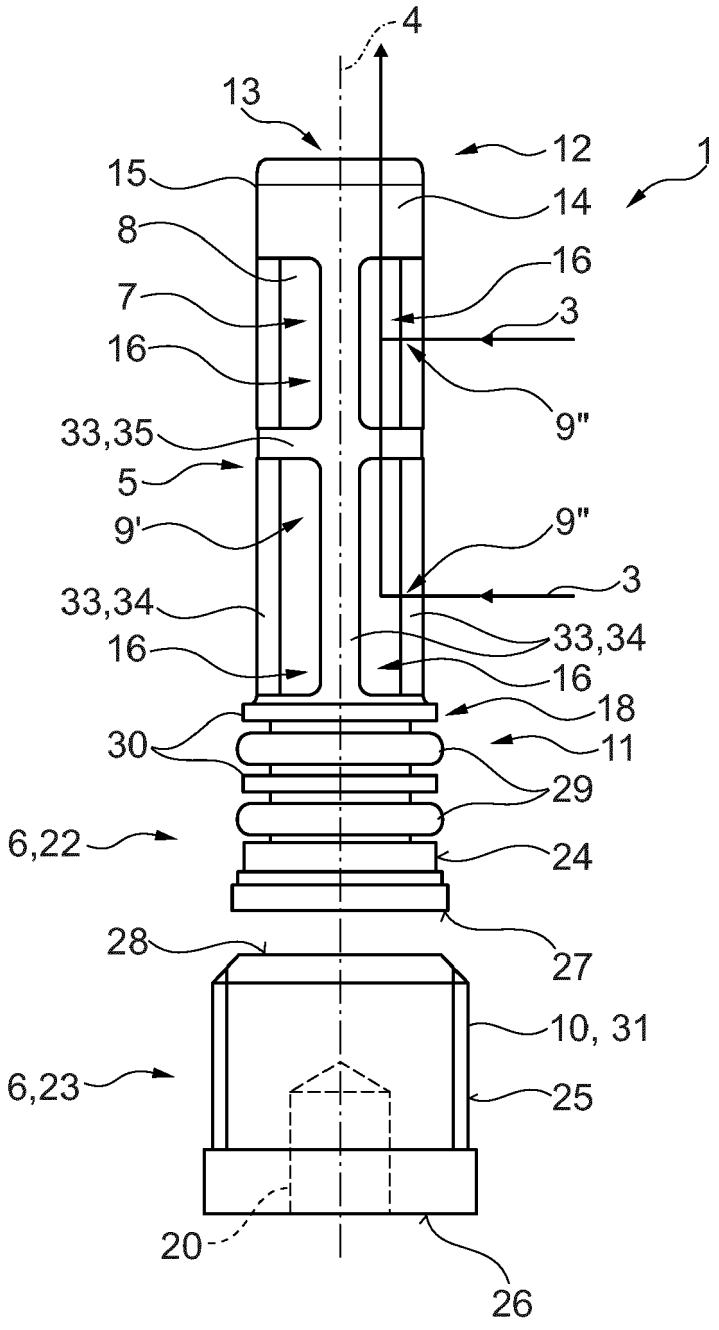
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Fig. 3

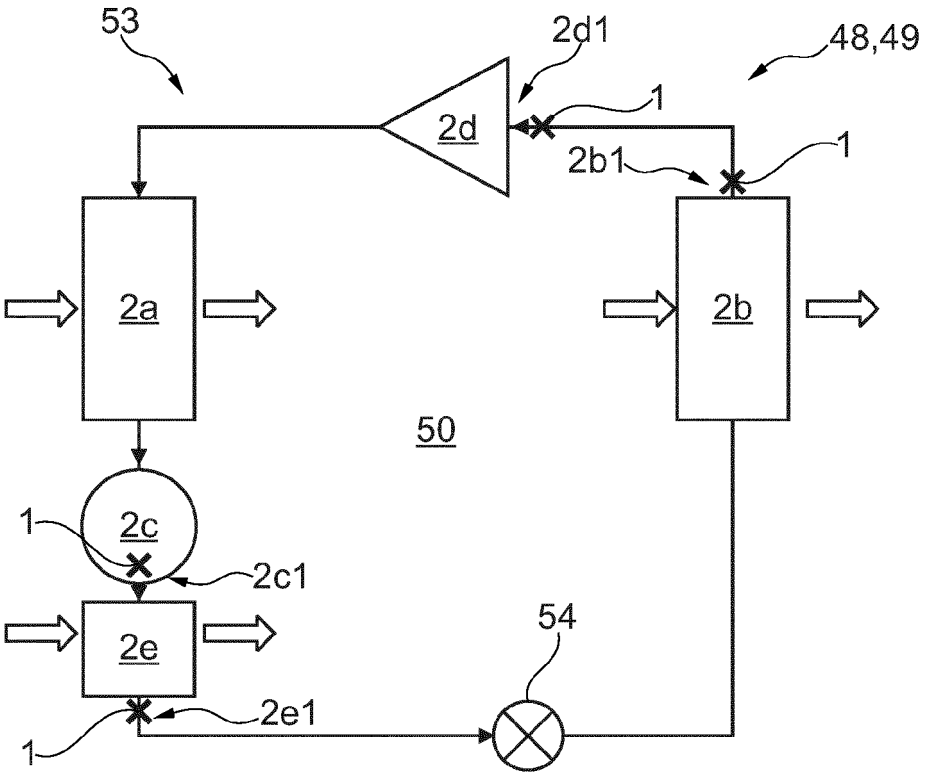
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Fig. 4

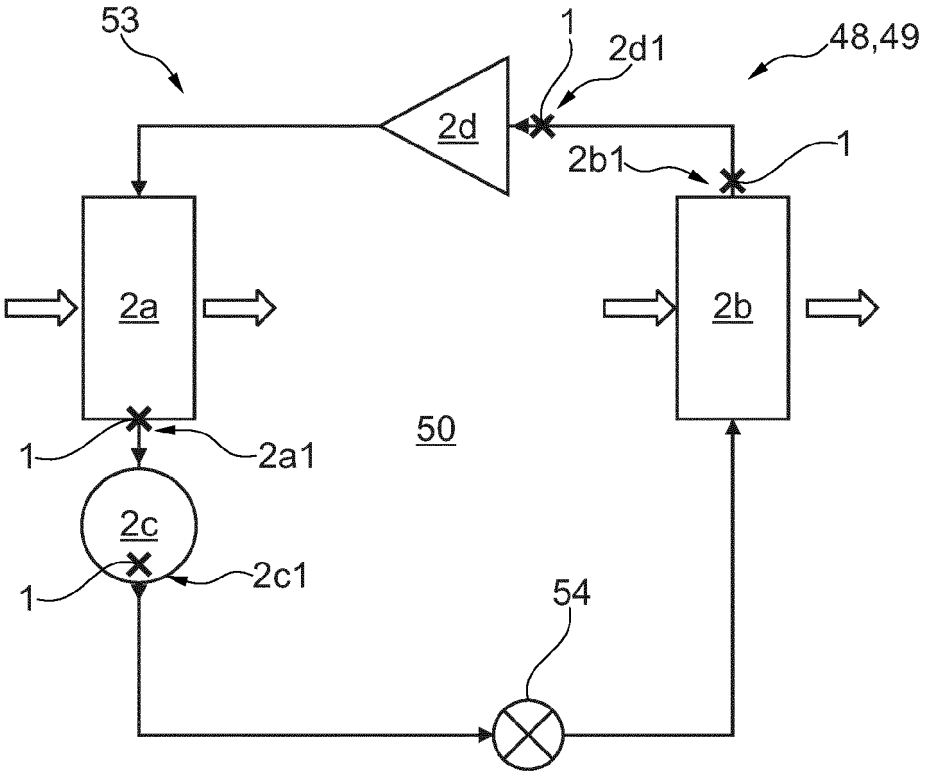
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Fig. 5

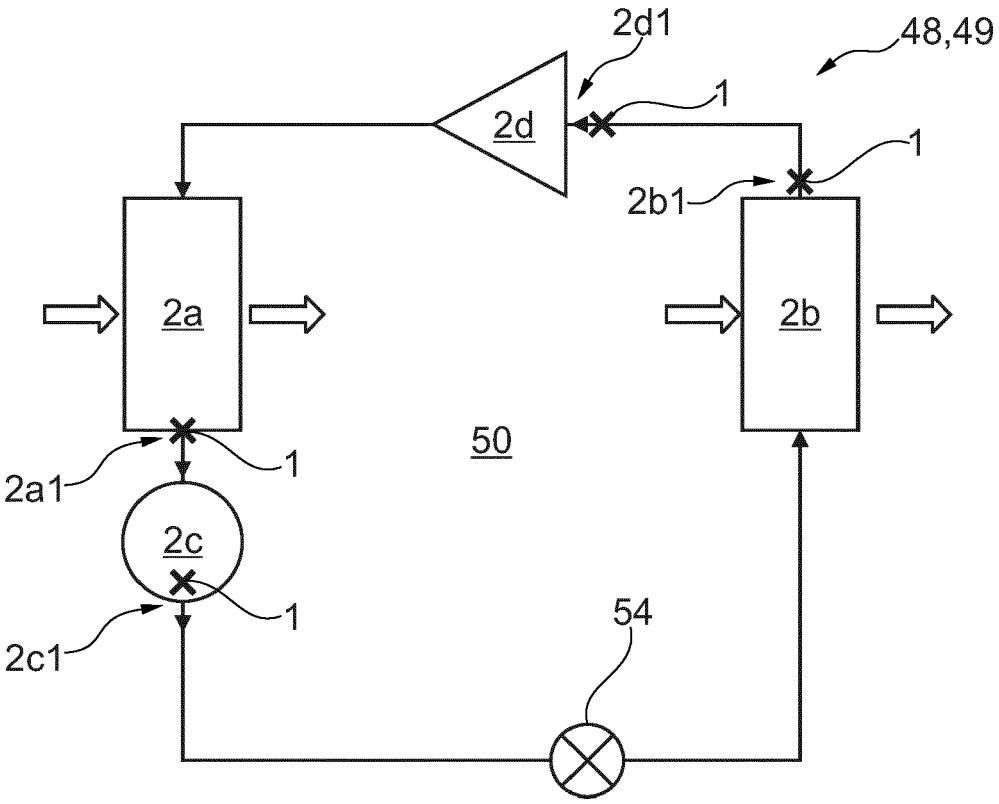

Fig. 6

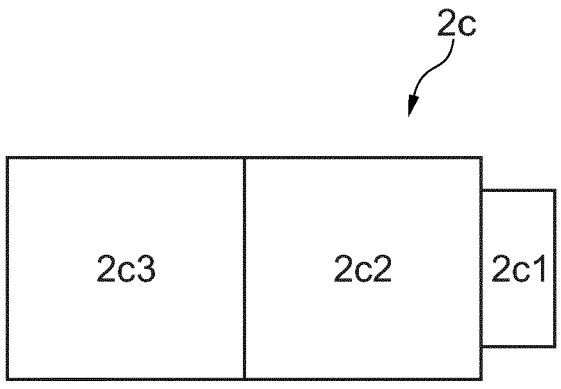

Fig. 7

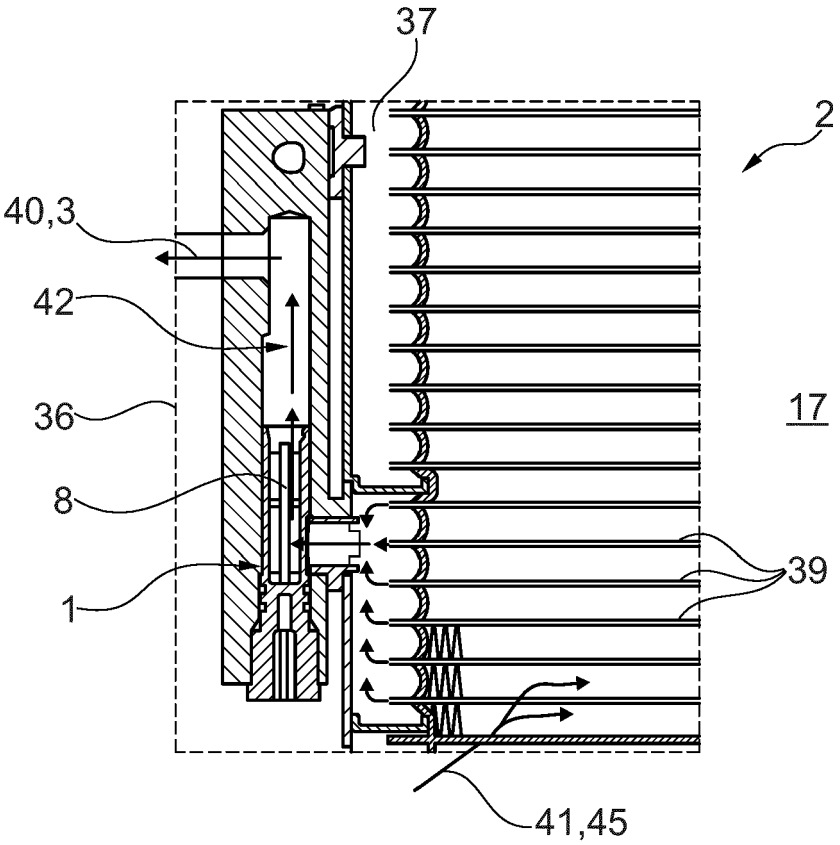

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 7533

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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	16 August 2023	Ritter, Christoph

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16-08-2023

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