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(54) A HEAT EXCHANGER

(57) The object of the invention is, among others, A heat exchanger (1) for a heat exchange between a first fluid and at least second fluid comprising: a plurality of flat plates (10) stacked together to form a core (100) for circulation of the first fluid therein, wherein the core (100) comprises a first pass (100A) called ingress pass, at least one second section (100B) called middle pass, wherein the middle pass is fluidly connected directly to the ingress pass, wherein the first section (100A) comprises at least a first channel (111A) adapted to distribute the first fluid in the first section (100A), a second channel (111B) at least partially fluidly connecting the second section (100B) and the first section (100A), and at least a third channel (111C) fluidly connected at least to the second section (100B), wherein the second channel (111B) further comprises a first conduit (102A) and a second conduit (102B), the conduits (102A, 102B) extending substantially in the stacking direction of the plates (10), wherein the second conduit (102B) comprises a flow restrictor (105) configured to at least partially block the intended first fluid flow between the first section (100A) and the second section (100B).

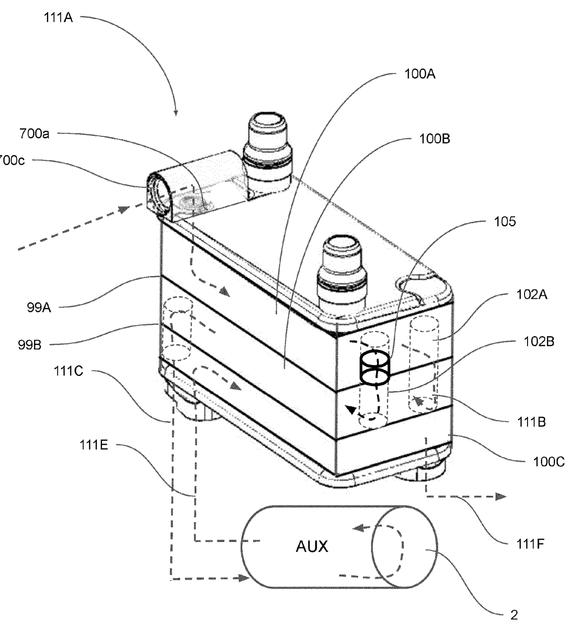

Fig. 3

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Description

FIELD OF THE INVENTION

[0001] The object of the present application is a heat exchanger, in particular a condenser or a gas cooler, for use inter alia in automobile air-conditioning systems.

BACKGROUND OF THE INVENTION

[0002] Known solutions referred to the subject of the application relate to plate heat exchangers. Such heat exchangers are formed by a suitably shaped thin plates forming the heat exchange surface. The plates are usually stamped or extruded to form a pattern of bulges and recesses on their surface. Forming a stack of plates and their tight connection, for example by welding, soldering or screwing between outer protection panels, forms the channel systems between the plates.

[0003] The plates are also provided with openings in appropriate positions, which, after sealing and forming a packet of plates, form inlet and outlet channels for the media participating in heat transfer. It is to be noted that such channels are further in the application referred to as channels substantially perpendicular to the general plane formed by the plates in which the openings are formed. In other words, channels formed by openings in plates are different from the channels, or rather flow pathways formed in-between the plates.

[0004] The essence of the plate heat exchangers is that the flow pathways of media (such as fluids) are interleaved, i.e. the consecutive spaces between the plates are alternatively used for heat-emitting medium and heat-receiving medium. In addition, channel systems formed by the extrusions of adjacent plates, cause the breakdown of the stream of each medium on many smaller streams and the introduction of the turbulence in the flow stream, resulting in better heat transfer between the media.

[0005] Said plate heat exchangers can have various applications, among others, they can serve as evaporators, WCDS (water cooled condensers) and IHX (internal heat exchangers).

[0006] It should be noted that in the case of a heat exchanger in which the heat emitting refrigerant is a gas changing its physical state to a liquid as a result of the cooling, while the heat-receiving coolant is a liquid, the important matter is suitable flow control separately for each of these media, i.e. to reduce the flow speed, to introduce respective turbulences in a flow stream and its suitable dividing while maintaining low pressure drop of the flowing medium.

[0007] Due to the different physical properties of the media participating in heat exchange, it is necessary to form their flow paths through a heat exchanger in different ways so as to obtain the most efficient heat exchange there between.

[0008] The above-described solution of heat exchangers comprising a packet of pressed metal sheets is not favorable to an independent shaping of the channel system for the gaseous medium and liquid medium due to the fact that the extrusion of a metal sheet influences simultaneously both on a shape of its surface which forms a channel system for the gaseous refrigerant as well as on the surface interacting with a liquid coolant. Therefore, in such system it is not possible any influence on the shape of the flow path of one medium independently of the shape of the second refrigerant flow path.

[0009] The prior art heat exchangers suffer from the high entry speed of the fluid into the first pass, where the density of the fluid is the lowest. The first pass may not be filled uniformly by the refrigerant and therefore overall heat exchange between the refrigerant and the coolant may be negatively impacted. Thus, there is a need to improve the distribution of the refrigerant fluid in at least primal pass of the refrigerant.

SUMMARY OF THE INVENTION

[0010] The object of the invention is, among others, A heat exchanger for a heat exchange between a first fluid and at least second fluid comprising:

- a plurality of flat plates stacked together to form a core for circulation of the first fluid therein, wherein the core comprises a first pass called ingress pass, at least one second section called middle pass, wherein the middle pass is fluidly connected directly to the ingress pass, wherein the first section comprises at least a first channel adapted to distribute the first fluid in the first section, a second channel at least partially fluidly connecting the second section and the first section, and at least a third channel fluidly connected at least to the second section, wherein the second channel further comprises a first conduit and a second conduit, the conduits extending substantially in the stacking direction of the plates, wherein the second conduit comprises a flow restrictor configured to at least partially block the intended first fluid flow between the first section and the second section.

[0011] Advantageously, the flow restrictor is arranged at the frontier of the first pass and the second pass so that it is part of the first pass only.

[0012] Advantageously, the first pass further comprises an unrestricted zone and a restricted zone wherein the unrestricted zone is fluidly communicated with the second pass at least by the first conduit and the second conduit, and the restricted zone is fluidly communicated with the second pass only via the first conduit.

[0013] Advantageously, the flow restrictor is fluidly connected with portion of the first pass being at least partially distanced from the second pass by the means of the restricted zone.

[0014] Advantageously, the second conduit being associated with the restricted zone is fluidly insulated form the second pass.

[0015] Advantageously, the first conduit and a second conduit comprise a substantially circular cross- section, wherein the hydraulic diameter of the first conduit is equal to the hydraulic diameter of the second conduit.

[0016] Advantageously, the first conduit and a second conduit comprise a substantially circular cross- section, wherein the hydraulic diameter of the first conduit is greater than the hydraulic diameter of the second conduit.

[0017] Advantageously, the core further comprises an egress pass called a third pass, wherein the egress pass remains in indirect fluidal communication with the middle pass so that the middle pass is configured to convey the first fluid, wherein the egress pass is configured to convey the second fluid, the second fluid being different from the first fluid.

[0018] Advantageously, the first fluid in the middle pass flows in the opposite direction with respect to the second fluid flowing in the egress pass.

[0019] Advantageously, said heat exchanger comprises a fourth section called coolant section, said coolant section being configured for circulation of a third fluid therein, wherein the coolant section extends across the entire heat exchanger, so that the fourth section may exchange the heat with all other sections.

[0020] Advantageously, the coolant section is divided into several substantially U-shaped sections.

[0021] Advantageously, the first and the second fluid is a refrigerant, whereas the third fluid is a coolant.

[0022] Advantageously, the core is fluidly connected with the ingress block, wherein in terms of hydraulic diameter the ingress block is complementary to the first channel.

[0023] Advantageously, the ingress pass and the middle pass are divided by a first baffle plate, the first baffle plate being configured to block the flow of the first fluid through the first channel and direct it in-between the plates of the core through the first pass towards the second channel.

[0024] Advantageously, the egress pass and the middle pass are divided by a second baffle plate, the second baffle plate being configured to block the flow of the first fluid through the second channel and direct it in-between the plates of the core through the second pass towards the third channel, the second baffle plated being further configured to block the flow of the first fluid through a fifth channel and direct it in-between the plates of the core through the egress pass towards a sixth channel.

[0025] By improving the distribution of the first fluid in the ingress pass the overall performance of the heat exchanger may not only be improved, but also controlled according to the design and needs. Needless to say this invention allows lowering the pressure drop inside the heat exchanger without increasing the external dimensions thereof.

BRIEF DESCRITPTION OF DRAWINGS

[0026] Examples of the invention will be apparent from and described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows a perspective view of the heat exchanger showing refrigerant inlet with jumper line, coolant inlet and coolant outlet.

Fig. 2 shows a bottom part of the heat exchanger shown in Fig. 1, wherein another view on the jumper line with refrigerant inlet is present, as well as the refrigerant outlet and refrigerant connection to auxiliary device such as bottle.

Fig. 3 shows a simplified perspective view of Fig.1, wherein the heat exchanger is connected to auxiliary device, such as bottle.

Fig. 4 shows an exemplary standalone plate forming the core of the heat exchanger.

Fig. 5 shows a cross- section view of the core where the second channel is present.

Fig. 6 shows another perspective view of the heat exchanger showing flow pattern for the coolant fluid.

DETAILED DESCRIPTION OF EMBODIMENTS

[0027] The invention concerns, among other a heat exchanger 1 for a motor vehicle. In particular, the invention concerns a plate-type heat exchanger 1, for example, a water cooled condenser (WCDS). The heat exchanger 1 may be configured for a heat exchange between a first fluid and at least second fluid.

[0028] The heat exchange between the fluids may be carried out by the means of plurality of flat plates 10 stacked together to form a core 100 for circulation of the first fluid therein. The flat plates 10 are usually made from metallic material. The thickness of all the plates may be the same, wherein said thickness is measures in perpendicular with respect to the general plane of the flat plate 10. Alternatively, the thickness of two consecutive flat plates 10 may be different.

[0029] Fig. 1 shows a perspective view of the heat exchanger showing refrigerant inlet with jumper line, coolant inlet and coolant outlet whereas Fig. 2 shows a bottom part of the heat exchanger shown in Fig. 1, wherein another view on the jumper line with refrigerant inlet is present, as well as the refrigerant outlet and refrigerant connection to auxiliary device such as bottle. The flat plates 10 stacked together to form a core 100 comprise multiple components which in the picture may be blurry and it would be difficult to show other technical features. Thus, for the sake of clarity, the core 100 is simplified in the remaining figures.

[0030] The core 100 may comprise a first section 100A called ingress pass. The ingress pass 100A, or in general any "pass" or "section" may be regarded as the part of the core in which the fluid, for example the first fluid, flows in the same direction and in the same sense.

[0031] Further, the core 100 may comprise at least one second section 100B called middle pass. In another aspect of the invention, the core 100 may further comprise a third section 100C called egress pass. The middle pass 100B is fluidly connected directly to the ingress pass 100A, and the egress pass 100C, if present, may be fluidly connected indirectly to the middle pass 100B. For the sake of clarity, the figures represent more complicated variant of the heat exchanger, i.e. one which comprises the egress pass 100C.

[0032] The term "directly" means that the middle pass 100B is arranged subsequently to the ingress pass 100A and that they are fluidly connected by some means. In other words, in case of direct connection no other pass or component is located between ingress pass 100A and middle pass 100B. The egress pass 100C however is fluidly connected with the middle pass 100B indirectly, i.e. there is some other subcomponent on the path of the fluid. As shown in figures, the middle pass 100B is connected directly with a third channel 111C. The third channel 111C runs through the egress pass 100C (without fluidal communication therewith) in order to enable direct fluidal communication between the heat exchanger 1 to an auxiliary device 2 (AUX device). The auxiliary device 2 may be regarded as the sub-component which is not at the first glance structurally integrated with the heat exchanger 1. This definition however, does not exclude functional connection between the heat exchanger 1 and the auxiliary device 2. Hence one of the examples of the AUX device 2 may be for instance a receiver drier (bottle). It should be noted that the AUX device 2 may or may not change the properties of the first fluid flowing therein. For this reason the fluid entering the AUX device through the third channel 111C is the first fluid coming from, inter alia, mille pass 100B whereas the fluid exiting the AUX device may be regarded as the second fluid, due to aforementioned potential change in its properties. Thus, the egress pass 100C is not filled by the first fluid, but by the second fluid despite the fact the egress pass 100C, the AUX device 2 and the first and second passes 100A, 100B belong to the same loop.

[0033] It should be noted that the ingress pass 100A and the egress pass 100C are named functionally, i.e. the ingress pass is the first pass to allow the fluid to circulate within the heat exchanger 1 whereas the egress pass 100C is the last pass that conveys the fluid within the core 100 of the heat exchanger 1. The middle pass 100B may thus comprise several sub-sections fluidly connected between each other so that the U-flow is provided between consecutive sub-sections of said middle passes 100B. Similarly, the U-flow may be provided between the first section 100A and the second section 100B and the second section 100B and the third section 100C.

[0034] The first section 100A comprises at least a first channel 111A adapted to distribute the first fluid in the first section 100A, a second channel 111B fluidly connecting the second section 100B and the first section 100A, and at least a third channel 111C fluidly connected at least to the second section 100B. In other words, the first channel 111A the second channel 111B and the third channel 111C may be regarded as first manifold 111A, second manifold 111B and a third manifold 111C, respectively.

[0035] As shown in Fig. 3, the second channel 111B may comprise a first conduit 102A and a second conduit 102B. The conduits 102A, 102B may extend substantially in the stacking direction of the plates 10. The term "conduit" refers to the hollow space provided in the flat plate which allows circulation of the first fluid between the first section 100A and the second section 100B. This hollow space may be of substantially circular cross-section. Alternatively, the hollow space may comprise a cross-section of any other shape.

[0036] In the preferred embodiment, the first conduit 102A and a second conduit 102B comprise a substantially circular cross- section, wherein the hydraulic diameter of the first conduit 102A is equal to the hydraulic diameter of the second conduit 102B. This allows the first fluid to evenly fill the first channel 111B, so that the fluid is distributed in the first section 100A at the same flow rate through both conduits 102A 102B.

[0037] Alternatively, the hydraulic diameter of the first conduit 102A may be greater than the hydraulic diameter of the second conduit 102B. Of course, this works also the other way around, so if the second conduit 102B comprises a hydraulic diameter which is greater than the hydraulic diameter of the first conduit 102A the observed technical effect is likely to be the same.

[0038] However, in case the first conduit 102A and the second conduit 102B are exactly the same, the flow rate of the first fluid in the upper part of the first section 100A will be limited which may lead to pressure drop in the first section 100A and reduced performance. It should be noted that the term "upper" depends on particular orientation of the heat exchanger 1, namely that the first pass 100A is furthermost from the ground level, the egress pass 100C is the pass closest to the ground level, and the middle pass 100B is sandwiched between the first pass 100A and the third pass 100C. Of course, in case the third pass 100C is not present, the pass closes to the ground level is the middle pass 100B. Such description in view of the fixed orientation of the heat exchanger 1 is necessary to describe and understand that the prior art first pass 100A may not be able to be uniformly filled by the first fluid.

[0039] In order to ensure a uniform first fluid distribution in the first pass 100A, the second conduit 102B may comprise a flow restrictor 105. The flow restrictor 105 may be configured to at least partially block the intended first fluid flow between the first section 100A and the second section 100B. This will allow to fill upper parts of the first pass without a pressure drop penalty.

[0040] The flow restrictor 105 may be understood in functional context. In other words, any means of partially blocking of the intended first fluid flow between the first section 100A and the second section 100B are envisaged.

[0041] For instance, the flow restrictor may be in form of plurality of collars protruding from each of the stacked plates 10, so that they form a cylinder having axis of elongation substantially parallel with respect to the stacking direction of the plates 10. Said cylinder is formed to at least partially block the intended first fluid flow between the first section 100A and the second section 100B, so it protrudes outwardly from the middle section 100A and through the first section 100A so that said cylinder allows the fluidal communication between the upper portion of the first section 100A and the middle section 100B.

[0042] For instance, the flow restrictor 105 may be in form of passages for the fluid, wherein the first passage may be in a form of apertures forming the first conduit 101A and the second passage may be in a form of apertures forming the second conduit 101B, wherein apertures forming one conduit are of the bigger cross-section compared to the apertures forming the other conduit. This allows buid-up and gather the fluid so that it reaches the upper plates of the first pass 100A.

[0043] For instance, the flow restrictor 105 may be in a form of a cylinder which is tight-fitted in the apertures in the plates 10 forming the first pass 100A.

[0044] Said flow restrictor is thus arranged at the frontier of the first pass 100A and the second pass 100B so that it is part of the first pass 100A only. In other words, the flow restrictor 105 does not restrict the flow in the second pass 100B or any other pass.

[0045] In view of the aforementioned upper and lower portions of the first pass 100A, it may be understandable that the first pass 100A further comprises an unrestricted zone 100Z and a restricted zone 100X. The terms unrestricted and restricted refer purely to the flow restrictor presence 105. The unrestricted zone 100Z is fluidly communicated with the second pass 100B at least by the first conduit 102A and the second conduit 102B, and the restricted zone 100X is fluidly communicated with the second pass 100B only via the first conduit 102A. Hence, the flow restrictor 105 is fluidly connected with portion of the first pass 100A being at least partially distanced from the second pass 100B by the means of the restricted zone 100X. Hence, the second conduit 102B being associated with the restricted zone 100X is fluidly insulated form the second pass 100B.

[0046] Fig. 4 shows a standalone plate 10 with apertures which in combination with other plates 10 may form the channels 111A, 111B, 111C or conduits 102A, 102B, depending on the location of the plate 10 in the heat exchanger 1, or else, in which of the section 100A, 100B or 100C said aperture is located.

[0047] In order to control the fluid flow in the first section 100A even more effectively, the fluid may be directed through said section 100A partially. It means that one of the conduits, for example the first conduit 102A may extend through all the plates 10 forming the first section 100A, whereas the other conduit, for example the second conduit 102B may extend only through some of the plates 10 forming the first section 100A. In other words, the first conduit 102A may be longer than the second conduit 102B, wherein the length of said conduits 102A, 102B is measured in parallel with respect to the stacking direction of the plates 10.

[0048] As shown in figures, the egress pass 100C is not connected directly with the middle pass 100B so that the middle pass 100B is configured to convey the first fluid, wherein the egress pass 100C is configured to convey the second fluid, as explained in previous paragraphs. The second fluid may be different from the first fluid which means one fluid may be of different properties than the other. For instance, viscosity, pressure or phase of one fluid may different from the same parameter of other fluid. In In case the AUX device is the bottle, the egress pass 100C will be in fact the sub-cooling sections of the heat exchanger 1.

[0049] It is preferable that the first fluid in the middle pass 100B flows in the opposite direction with respect to the second fluid flowing in the egress pass 1 00C. This allows the greater heat exchange between the fluids flowing in respective passes 100B, 100C. Alternatively, the first fluid in the middle pass 100B may flow in the same direction with respect to the second fluid flowing in the egress pass 100C.

[0050] Accordingly, the heat exchanger 1 may comprise a loop for a coolant. Therefore, the heat exchanger 1 may further comprise a fourth section 100D called coolant section. The coolant section may be configured for circulation of the third fluid therein. The coolant section 100D extends across the entire heat exchanger 1, so that the fourth section 100D may exchange the heat with all other sections 100A, 100B, 100C. The fourth section 100D and the fluid path for the third fluid in general is fluidly insulated from the first, second and third sections 100A, 100B, 100C, accordingly. The fluidly insulated means that mixing of the third fluid, i.e. coolant, with any other fluid is not allowed.

[0051] Naturally, the coolant section may also be divided into one or several substantially U-shaped sections. However, so-called I-flow of the coolant is also envisaged, although not shown in the figures. It should be noted that the number and location of U-shaped sections may determine the location and arrangement of the inlet and outlet spigots for the coolant. The spigots are required to connect the coolant flow path with the rest of the coolant loop in the vehicle. It is also envisaged that the coolant lines are directly brazed to the heat exchanger 1.

[0052] In conclusion to the paragraphs above, the first and the second fluid is may be a refrigerant, such as classical refrigerants such as R134a, R1234yf. The third fluid may be a coolant or a water.

[0053] The heat exchanger 1 may be connected to at least the refrigerant loop and the coolant loop. In order to facilitate the connection or to meet the customer's requirements, the heat exchanger 1 may comprise connection blocks. In particular, the core 100 may be fluidly connected with an ingress block 700. In terms of hydraulic diameter the ingress block 700 may be complementary to the first channel 111A. It means that the cavity in the ingress block 700 and the first channel 111A are configured to provide continuous channel for the first fluid.

[0054] Further, the ingress block 700 may comprise at least one ingress block opening 700a, and a third ingress block opening 700c. The first ingress block openings 700a may be associated with the first pass 100A. and the second conduit 102B, respectively, and the third ingress block opening 700c is configured to be fixed to a jumper line 750, as shown in figs 1 and 2. The jumper line 750 may be fixed directly to the refrigerant loop or it may comprise an interface block 760 at the end opposite to the ingress block 700, as shown in figs 1 and 2.

[0055] In order to separate, or in other words: fluidly insulate, the ingress pass 100A from the middle pass 100B, the ingress pass 100A and the middle pass 100B may be divided by a first baffle plate 99A. The first baffle plate 99A may be configured to block the flow of the first fluid through the first channel 111A and direct it in-between the plates 10 of the core 100 through the first pass 100A towards the second channel 111B. Referring back to Fig. 4, the baffle plates 99A may comprise less apertures than the plates 10 shown in Fig.4.

[0056] Similarly, the egress pass 100C and the middle pass 100B may be divided by a second baffle plate 99B. The second baffle plate 99B may be configured to block the flow of the first fluid through the second channel 111B and direct it in-between the plates 10 of the core 100 through the second pass 100B towards the second channel 111B. The second baffle plated 99B may be further configured to block the flow of the first fluid through a fifth channel 111E and direct it in-between the plates 10 of the core 100 through the egress pass 100C towards a sixth channel 111F.

[0057] The invention further discloses a motor vehicle comprising at least one heat exchanger 1 according to any of the preceding claims. The term motor vehicle should not be limiting and the heat exchanger may be applied on motor vehicles comprising internal combustion engine, hybrid vehicles, and electric vehicles.

[0058] Fig. 5 shows an exemplary third fluid flow path. In the simples embodiment, the coolant may flow from one spigot to the other, in so-called I-flow pattern. It should be noted that the most effective heat exchange is when the third fluid flows in opposite direction with respect to the first and/or the second fluid. Other flow patterns for the third fluid are also envisaged.

[0059] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of drawings, the disclosure, and the appended claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to the advantage.

Claims

1. A heat exchanger (1) for a heat exchange between a first fluid and at least second fluid comprising:

   - a plurality of flat plates (10) stacked together to form a core (100) for circulation of the first fluid therein, wherein the core (100) comprises a first pass (100A) called ingress pass, at least one second section (100B) called middle pass, wherein the middle pass is fluidly connected directly to the ingress pass, wherein the first section (100A) comprises at least a first channel (111A) adapted to distribute the first fluid in the first section (100A), a second channel (111B) at least partially fluidly connecting the second section (100B) and the first section (100A), and at least a third channel (111C) fluidly connected at least to the second section (100B), wherein the second channel (111B) further comprises a first conduit (102A) and a second conduit (102B), the conduits (102A, 102B) extending substantially in the stacking direction of the plates (10), wherein the second conduit (102B) comprises a flow restrictor (105) configured to at least partially block the intended first fluid flow between the first section (100A) and the second section (100B).

2. The heat exchanger (1) according to claim 1, wherein the flow restrictor (105) is arranged at the frontier of the first pass (100A) and the second pass (100B) so that it is part of the first pass (100A) only.

3. The heat exchanger (1) according to any of the preceding claims, wherein the first pass (100A) further comprises an unrestricted zone (100Z) and a restricted zone (100X) wherein the unrestricted zone (100Z) is fluidly communicated with the second pass (100B) at least by the first conduit (102A) and the second conduit (102B), and the restricted zone (100X) is fluidly communicated with the second pass (100B) only via the first conduit (100A).

4. The heat exchanger (1) according to claim 3, wherein the flow restrictor (105) is fluidly connected with portion of the first pass (100A) being at least partially distanced from the second pass (100B) by the means of the restricted zone (100X).

5. The heat exchanger (1) according to any of claims 3 or 4, wherein the second conduit (102B) being associated with the restricted zone (100X) is fluidly insulated form the second pass (100B).

6. The heat exchanger according to any of the preceding claims wherein the first conduit (102A) and a second conduit (102B) comprise a substantially circular cross-section, wherein the hydraulic diameter of the first conduit (102A) is equal to the hydraulic diameter of the second conduit (102B).

7. The heat exchanger according to any of the preceding claims, wherein the first conduit (102A) and a second conduit (102B) comprise a substantially circular cross-section, wherein the hydraulic diameter of the first conduit (102A) is greater than the hydraulic diameter of the second conduit (102B).

8. The heat exchanger (1) according to any of the preceding claims, wherein the core (100) further comprises an egress pass (100C) called a third pass, wherein the egress pass (100C) remains in indirect fluidal communication with the middle pass (100B) so that the middle pass (100B) is configured to convey the first fluid, wherein the egress pass (100C) is configured to convey the second fluid, the second fluid being different from the first fluid.

9. The heat exchanger (1) according to claim 8, wherein the first fluid in the middle pass (100B) flows in the opposite direction with respect to the second fluid flowing in the egress pass (100C).

10. The heat exchanger (1) according to any of the preceding claims, wherein said heat exchanger comprises a fourth section (100D) called coolant section, said coolant section being configured for circulation of a third fluid therein, wherein the coolant section extends across the entire heat exchanger (1), so that the fourth section (100D) may exchange the heat with all other sections (100A, 100B, 100C).

11. The heat exchanger (1) according to claim 10, wherein the coolant section (100D) is divided into several substantially U-shaped sections.

12. The heat exchanger (1) according to any of the claims 10 or 11, wherein the first and the second fluid is a refrigerant, whereas the third fluid is a coolant.

13. The heat exchanger (1) according to any of the preceding claims, wherein the core (100) is fluidly connected with the ingress block (700), wherein in terms of hydraulic diameter the ingress block (700) is complementary to the first channel (111A).

14. The heat exchanger (1) according to any of the preceding claims, wherein the ingress pass (1 00A) and the middle pass (100B) are divided by a first baffle plate (99A), the first baffle plate (99A) being configured to block the flow of the first fluid through the first channel (111A) and direct it in-between the plates (10) of the core (100) through the first pass (100A) towards the second channel (111B).

15. The heat exchanger (1) according to any of the preceding claims, wherein the egress pass (100C) and the middle pass (100B) are divided by a second baffle plate (99B), the second baffle plate (99B) being configured to block the flow of the first fluid through the second channel (111B) and direct it in-between the plates (10) of the core (100) through the second pass (100B) towards the third channel (111C), the second baffle plated (99B) being further configured to block the flow of the first fluid through a fifth channel (111E) and direct it in-between the plates (10) of the core (100) through the egress pass (100C) towards a sixth channel (111F).

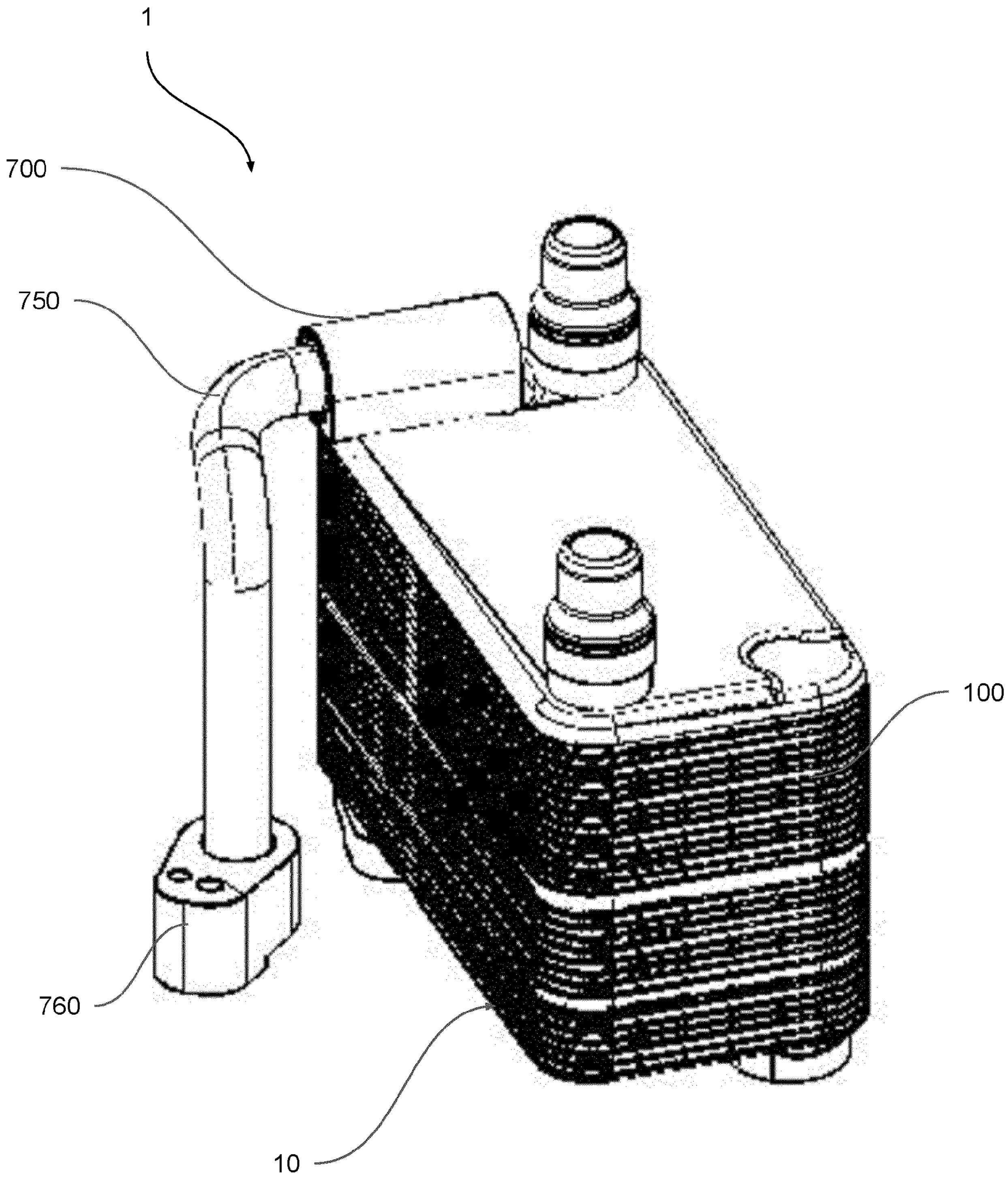


Fig. 1

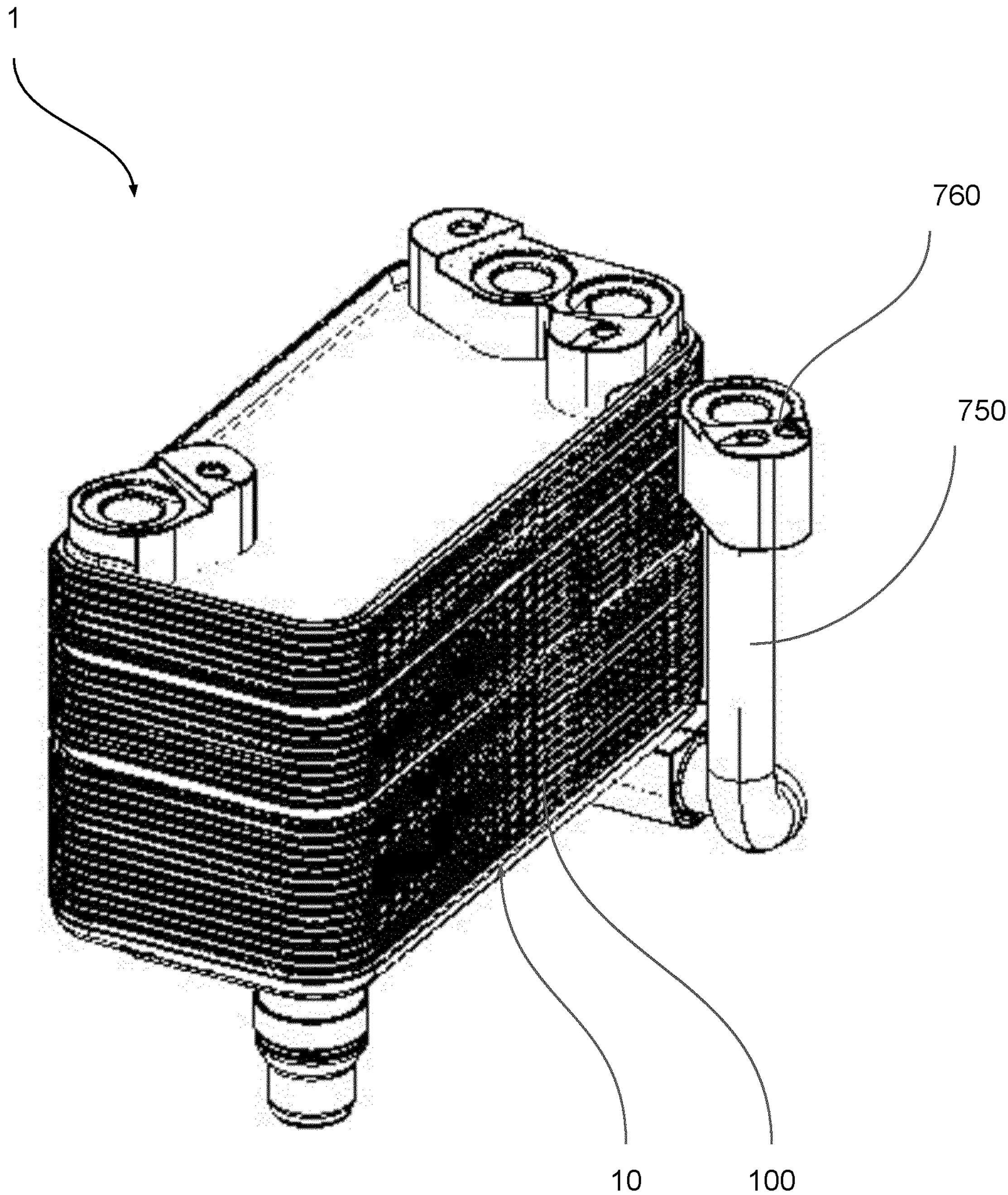
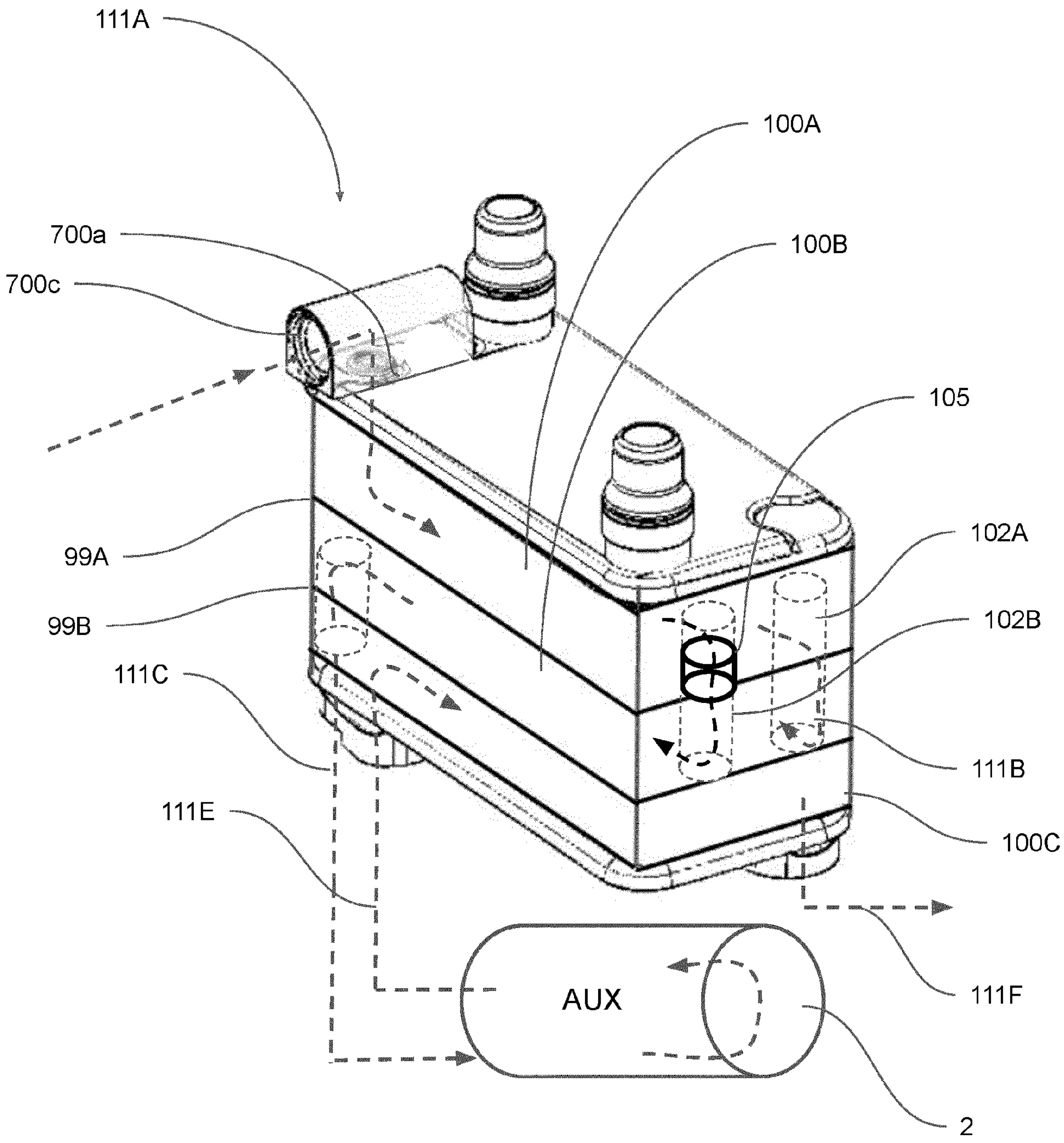


Fig. 2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111B
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111F
AUX
2

Fig. 3

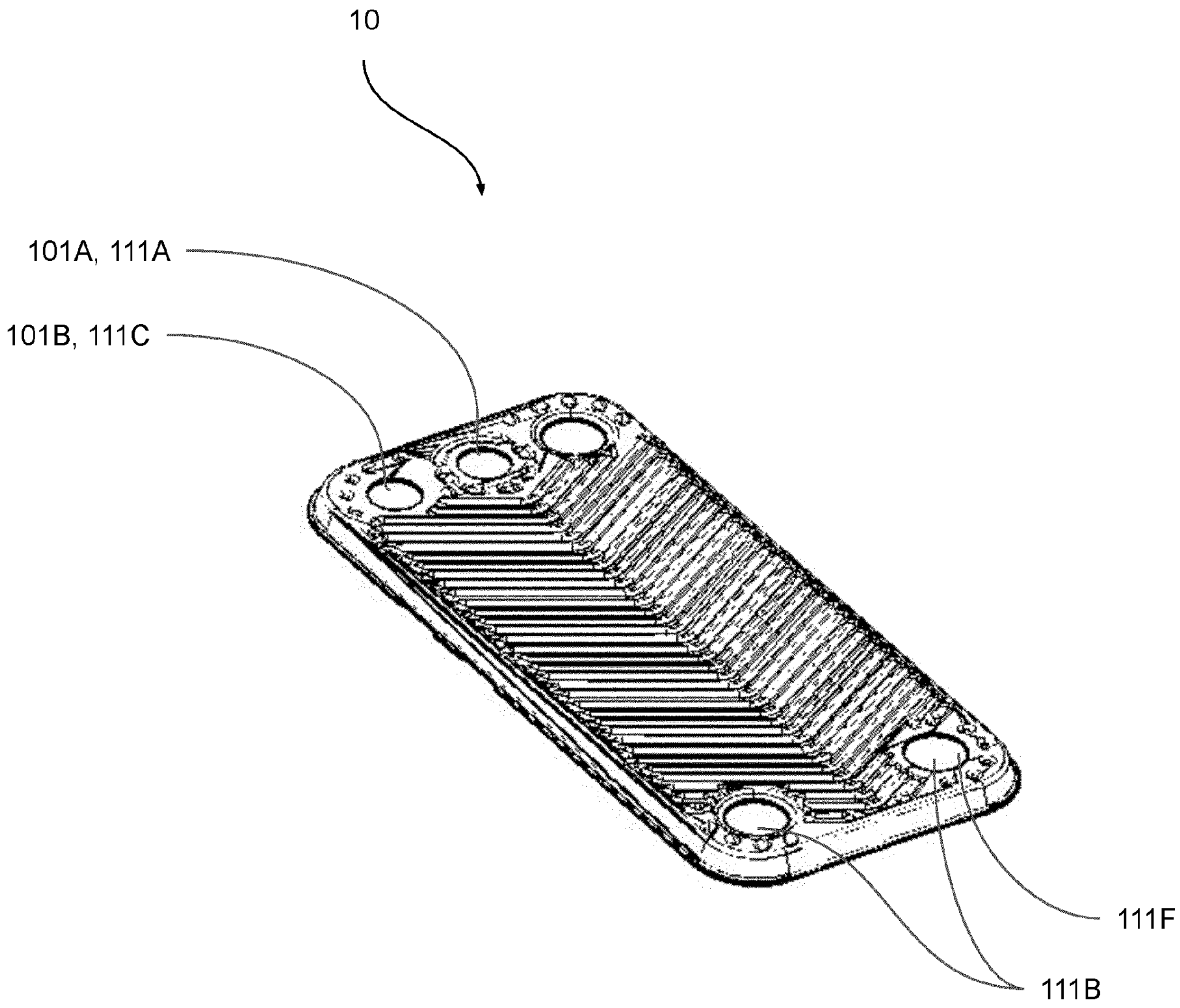

Fig. 4

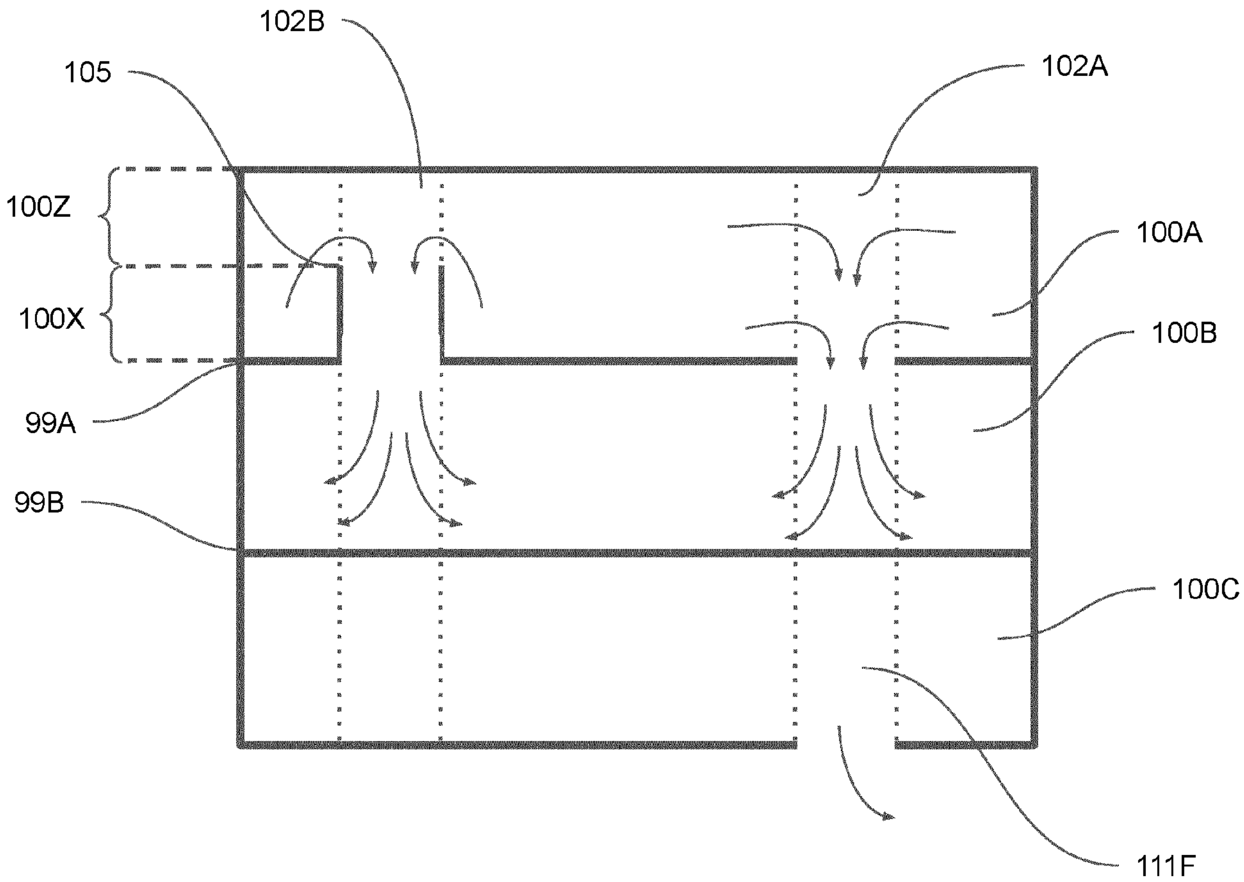

Fig. 5

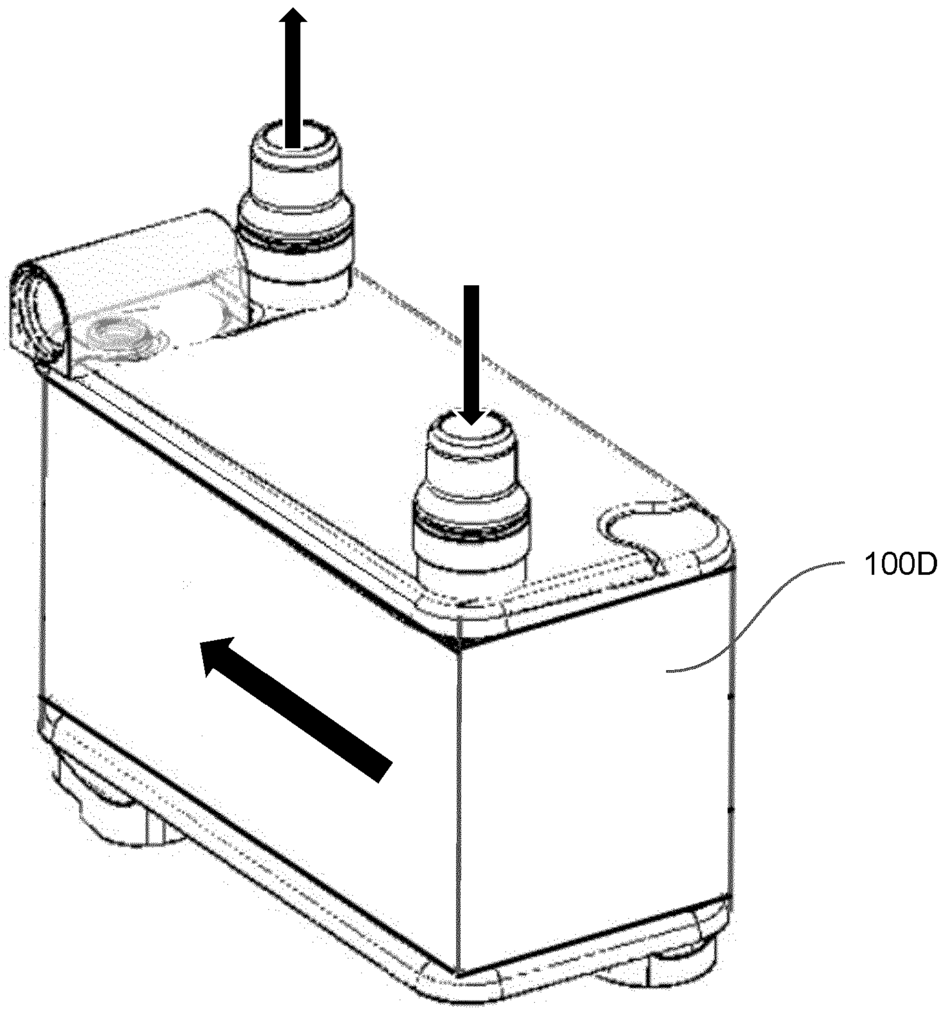

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
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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	15 March 2024	Jessen, Flemming

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