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(54) **A HEADER- TANK ASSEMBLY**

(57) The object of the invention is, among others, a header- tank assembly (30) for a fluid, comprising: a header (30) comprising a plurality of openings to receive tubes, a cover (10) configured to be assembled with the header (30) to form a channel for a fluid, a first baffle (20) forming an end wall for the fluid channel at an end of the header (30), a second baffle (40) comprising at least one opening (41) configured to provide a fluidal communication between the header-tank assembly (30) and a fluid loop, a distribution device (70) located between the first baffle (20) and the second baffle (40), the distribution device (70) further comprising open ends, wherein at least one open end of the distribution device (70) is in a contact with the first baffle (20) and the other is fluidly connected with the first opening (41), characterised in that the first baffle (20) comprises a sealing portion (21) configured to be fixed to the open end of the distribution device (70) to form a fluid- tight connection blocking the exit of the fluid from the open end of the distribution device (70).

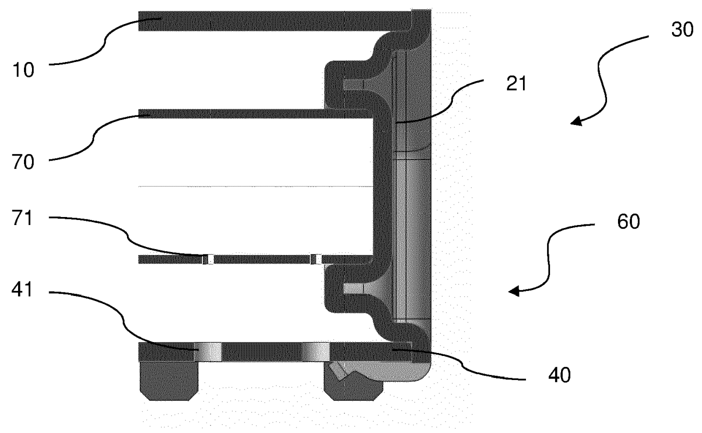

Fig. 4

EP 4 019 881 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a header- tank assembly, in particular to the header- tank assembly for a motor vehicle heat exchanger.

BACKGROUND OF THE INVENTION

[0002] Evaporators look like, and in fact are, similar to radiators, only thicker and smaller in overall size. Like radiators, evaporators consist of a series of internal tubes or flow paths with fins attached to them. Air can pass freely through the fins, just like a radiator. But unlike a radiator, where the internal tubes carry moving engine coolant, the passages in the evaporator carry moving refrigerant.

[0003] In an automotive air conditioning system (further referred to as A/C system), cold, low-pressure liquid refrigerant enters the evaporator. Warm air from the interior of the vehicle passes through the evaporator by action of the blower fan. Since it's a fact of nature that heat always travels from a warmer area to a cooler area, the cooler refrigerant flowing inside the evaporator's absorbs heat from the warm air. At the same time, humidity in the air condenses on the cool evaporator's surface, then eventually drips out of a drain tube to the outside. After the initially warmed refrigerant has completed its path through the evaporator, it moves on to the compressor.

[0004] Known evaporators usually comprise a pair of tubular manifolds located on both ends of the stack of tubes. The manifolds are usually sealed on both ends of the tubular body by, for example, caps which are brazed with the open ends of the manifold. The body comprises slots for receiving the stack of tubes. Alternatively, the manifolds are made of the tank fixed to the header, which comprises slots for receiving tubes. The header and the tank are brazed together forming a channel which is, similarly to tubular manifold, open on both ends. The openings need to be sealed by, for example, caps brazed onto the open ends of the assembly.

[0005] It is also known to provide a distribution device in order to provide homogenous distribution of refrigerant fluid through the heat exchanger. The distribution device may be located within the intake manifold so that one end of the distribution device is fluidly connected to the inlet of the heat exchanger. The other open end is usually brazed to the manifold or is sealed by sealing means. This requires additional step in production process and the tools/ materials which would provide sufficient fluid distribution by the distribution device. Further, the distribution device is prone to pressure loss due to e.g. leakage. This may seriously impede the overall performance of the heat exchanger.

[0006] It would be desired to reduce the number of operations and tools required to form a fluid-tight connection between the distribution device and the manifold without impeding the performance thereof. Another aim of the invention is to reduce the time and cost needed for creating at least one unit of the heat exchanger, which would significantly improve feasibility of production process.

SUMMARY OF THE INVENTION

[0007] The object of the invention is, among others, a header- tank assembly for a fluid, comprising: a header comprising a plurality of openings to receive tubes, a cover configured to be assembled with the header to form a channel for a fluid a first baffle forming an end wall for the fluid channel at an end of the header, a second baffle comprising at least one opening configured to provide a fluidal communication between the header-tank assembly and a fluid loop, a distribution device located between the first baffle and the second baffle, the distribution device further comprising open ends, wherein at least one open end of the distribution device is in a contact with the first baffle and the other is fluidly connected with the first opening, characterised in that the first baffle comprises a sealing portion configured to be fixed to the open end of the distribution device to form a fluid- tight connection blocking the exit of the fluid from the open end of the distribution device.

[0008] Advantageously, the distribution device is of essentially tubular shape.

[0009] Advantageously, the sealing portion surrounds an outer perimeter of the open end of the distribution device.

[0010] Advantageously, the open end of the distribution device surrounds an outline of the sealing portion.

[0011] Advantageously, the distribution device comprises plurality of orifices configured to distribute the fluid.

[0012] Advantageously, the distribution device comprises a dent configured to facilitate insertion the distribution device to the first baffle.

[0013] Advantageously, the distribution device comprises a beveled end configured to facilitate fixing the distribution device to the first baffle.

[0014] Advantageously, the sealing portion is made integral with the first baffle.

[0015] Advantageously, the header comprises two parallel rows of slots configured to receive tubes.

[0016] Advantageously, the header- tank assembly comprises two pairs of baffles, each pair for a cover, the baffles of a pair are configured to be located at the opposite ends of the cover.

[0017] Advantageously, the first baffle comprises a portion being substantially perpendicular the general axis of elongation of the distribution device.

[0018] Advantageously, the sealing portion comprises a sloping portion configured to form an additional orifice at least in-line with the outline of the sealing portion.

[0019] Advantageously, the sealing portion comprises a semi- spherical portion configured to form an additional orifice at least in-line with the outline of the sealing portion.

[0020] Advantageously, the baffle is made of the same material as the header, for instance in aluminum.

[0021] Advantageously, the baffles comprise at least one locking protrusion configured to immobilize the tank with respect to the header in an outward direction.

[0022] Advantageously, the header comprises a dividing portion located between the two rows of tubes.

[0023] Advantageously, the dividing portion comprises cavities adapted to partially receive the cover.

[0024] Advantageously, cavities are arranged alternately and in two parallel series.

[0025] Advantageously, the header comprises at least one side wall protruding in perpendicular with respect to the general plane of the header, the side wall further comprising notches configured to immobilize at least one side of the cover.

[0026] Advantageously, the cover is essentially U-shaped.

[0027] Advantageously, the cover comprises projections located on at least one terminal portion forming a U-shape, the projections being configured to be introduced into corresponding cavities of the header.

[0028] Advantageously, the cover comprises a plurality of U-shaped ribs arcading in series from one end of the cover to the other.

BRIEF DESCRITPTION OF DRAWINGS

[0029] Examples of the invention will be apparent from and described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic view of the heat exchanger comprising single stack of tubes.

Fig. 2 shows a perspective view of header- tank assembly configured to receive two stacks of tubes.

Fig. 3 shows a perspective view of the header- baffle-distribution device assembly.

Fig. 4 shows a cross-section view of the header- tank assembly, according to embodiment of invention.

Fig. 5 shows a cross-section view of the header- tank assembly, according to another embodiment of invention.

Fig. 6 shows a cross-section view of the header- tank assembly, wherein the baffle penetrates the distribution device.

Fig. 7 shows a cross-section view of the header- tank assembly with enhanced fluid distribution.

Fig. 7 shows an alternative design presented in Fig. 7.

DETAILED DESCRIPTION OF EMBODIMENTS

[0030] The invention refers to an assembly of mainly two sub-components: a manifold and a distribution device. The assembly may be used in particular in an evaporator for motor vehicles. The main sub-components of the evaporator are depicted by Fig. 1 and briefly described in further paragraphs.

[0031] Fig. 1 shows the perspective view of a heat exchanger 1 comprising main sub-components, i.e. plurality of tubes 2 comprising open ends, and a header- tank assemblies 30 located on each side of the open ends of the tubes 2. The header- tank assemblies 30 may comprise minor differences, depending on what role does each one of them play for the heat exchanger 1.

[0032] The heat exchanger 1 enables the heat exchange between two fluids, wherein one fluid (e.g. refrigerant) circulates within the heat exchanger 1 and the other (e.g. air) flows across the sub-components of the heat exchanger 1.

[0033] The tubes 2 may be in form of elongated, flattened channels stacked between two header- tank assemblies 30, wherein all tubes 2 are oriented in the same direction, so that the fluid (e.g. air) may flow through the stack. The tubes 2 may provide a fluidal communication between the header- tank assemblies 30. The tubes 2 actively participate in the heat transfer process, so the flattened shape of the tubes 2 not only enables the fluid to flow through the stack, but also increases the heat transfer surface. However, the specific dimensions of the tubes 2 should be calculated respecting the characteristics of other sub-components.

[0034] In order to further facilitate the heat transfer process, the tubes 2 may be interlaced with so-called fins. Fins may be in a form of corrugated sheet of material of relatively high thermal conductivity, e.g. aluminum. The corrugations form ridges which may be in contact with the surface of two adjacent tubes 2. Usually, the fins are initially squeezed to increase the number of possible corrugations and then brazed to the surface of the tubes 2, so that the fins are immobilized with respect to the tubes 2. Depending on the operational mode of the heat exchanger 1, the fins along with the tubes 2 may receive the heat from the fluid e.g. refrigerant circulating through the tubes 2 in order to facilitate cooling it down. This phenomena may also be used in heat exchange devices such as radiators or condensers.

[0035] Alternatively, the fins and the tubes 2 may receive the heat from the other fluid, e.g. hot air, in order to receive the heat therefrom, so that the other fluid, e. g. hot air, is cooled down. This phenomena may be used in heat exchange devices such as evaporators.

[0036] The tubes 2 may be formed, for example, in the process of extrusion. This process enables to create the tubes 2 comprising one, or many channels within the single tube 2. Alternatively, the tubes 2 may be made of out of single, folded sheet of metal.

[0037] Fig. 1 further shows the heat exchanger 1 comprising two the header- tank assemblies 30, wherein each of the assemblies comprises a single channel for the fluid. This allows to arrange the fluid flow in several ways.

[0038] The first arrangement may include one header-tank assembly 30 comprising an inlet configured to deliver the fluid thereto. The fluid fills completely the channel formed by the header- tank assembly 30 and it is directed into the tubes 2. The tubes 2 are fluidly connected with the other header- tank assembly 30 which comprise an outlet configured to collect the fluid therefrom. Based on the flow pattern, such arrangement of flow may be called I-flow.

[0039] Next arrangement may include one header-tank assembly 30 comprising both inlet and outlet, so it is configured to deliver and collect the fluid from the heat exchanger 1. In order to arrange the fluid flow, the header- tank assemblies 30 may comprise e.g. baffles. The fluid fills partially the channel formed by one header- tank assembly 30 and it is directed into the portion of tubes 2. The tubes 2 are fluidly connected with the other header- tank assembly 30 which may also comprise baffles. The fluid is directed through the channel formed in the other header- tank assembly 30 into the other portion of tubes 2, so that the fluid is reversed. Based on the flow pattern, such arrangement of flow may be called U-flow.

[0040] In the last, but not least arrangement of fluid flow, the heat exchanger 1 may comprise the header-tank assemblies 30 wherein each one of them comprises at least two channels for the fluid. In this arrangement, one header- tank assembly 30 comprises inlet fluidly connected to one of its channels and the outlet fluidly connected with the other channel, and the other header- tank assembly 30 is configured to and the outlet the fluid fills all channels completely, yet the U-turn is formed between the adjacent channels thereof. The heat exchanger 1 comprising upper-mentioned flow arrangement may be used as evaporator for A/C loop. The exemplary arrangement of such header- tank assembly 30 and its sub- components is shown in Figs. 2 and 3.

[0041] Fig. 2 shows a perspective view of the standalone header- tank assembly 30 comprising two channels for the fluid. The header- tank assembly 30 may comprise, inter alia, a cover 50 which may form one or more than one channels for the fluid. The cover 50 may be in a form of one or more half-cylindrical portions, depending on the desired number of channels to be formed. Further, the cover 50 may be a unitary element or several elements which are connected to each other in such way, to ensure a fluid- tight connection (e.g. by brazing).

[0042] As shown in Fig. 2 the first channel may be formed by one part of the cover 50, wherein the first channel is responsible for delivering fluid to the tubes which are fluidly connected with the header 40. The second channel may be formed by other part of the cover 50, wherein the second channel may be responsible for collecting the fluid from the tubes which are fluidly connected with the header 40. In such embodiment, an inlet 71 which is usually responsible for delivering the fluid from the loop to the heat exchanger 1 may be fluidly connected with the first channel, and an outlet 72 which is usually responsible for collecting the fluid from the heat exchanger 1 may be fluidly connected with the second channel. As further shown in Fig. 2, the inlet 71 and/or the outlet 72 may be fixed to the same baffle 60, however, other deployment of these sub-components is also envisaged, depending on the flow arrangement through the heat exchanger 1.

[0043] The cover 50 is essentially U-shaped and it may comprise projections located on at least one terminal portion forming U-shape. The cover 50 may further comprise a plurality of U-shaped ribs arcading in series from one end of the cover 50 to the other, in order to increase robustness of the tank 50.

[0044] The header- tank assembly may comprise two baffles 60 fixed on both shorter sides of the header 40. Depending on the location of the baffle 60 and its desired function, one baffle 60 may play the same or different role than the other. For example, one baffle 60 may provide a fluidal communication with the loop, and the other one may provide an end wall of the fluid channel at an end of the header 40, as shown in Fig. 3. The baffle 60 adapted to provide a fluidal communication with the loop may comprise openings to receive inlet 71 and/or outlet 72 connection spigots or other components which are able to provide a fluid-tight communication between the loop and the header-tank assembly 30.

[0045] The header 40 may comprise cavities adapted to partially receive the cover 50, wherein the cavities are arranged alternately and in two parallel series between the two rows of slots 41. The projections located on the thank 50 may be configured to be introduced into corresponding cavities of the header 40.

[0046] The header 40 may comprise plurality of openings adapted to receive tubes 2 which are further referred to as slots 41. The slots 41 may comprise collars to facilitate forming fluid- tight connection with the tubes 2 by increasing the contact area between these sub-components, wherein the shape of the opening of the slot 41 may correspond to the shape of the received tube 2. The slots 41 may be arranged in two parallel rows. This enables receiving two stacks of tubes 2 into the same header 40. As shown in Fig. 1, other applications comprising only one row of slots 41 configured to receive one stack of tubes 2 are also envisaged.

[0047] Fig. 3 shows the perspective view of header-tank assembly 30, wherein the tank 50 is not shown for the sake of clarity. The header 40 shown in Fig.3 is depicted in the post-assembly mode, i.e. the header 40 is ready to receive the cover 50 (not shown) and tubes 2 and the baffle 60 configured in the post- assembly mode to keep the cover 50 (not shown).

[0048] Figs. 3-8 show also a distribution device 70 being is fixed to the baffle 60. The distribution device 70 may be fixed to the baffle 60 to provide a fluid-tight connection on at least one open end of the distribution device 70. It is to be noted that the distribution device 70 and the baffle 60 are engaged directly i.e. no additional elements are required to fix these two sub-components. The exemplary ways to carry out such connection are described in further paragraphs, referring to Figs 4-8.

[0049] . The baffle 60 may comprise a first baffle 20 which is configured to close the inlet channel of the header- tank assembly 30. Analogically, the baffle 60 may further comprise a second baffle which is responsible for closing the outlet channel of the header- tank assembly 30. The location of the first baffle 20 and the second baffle may be dependent on the architecture of the heat exchanger.

[0050] Fig. 4 shows the cross section of the header-tank assembly 30 shown in Fig. 3

The first baffle 20 may comprise a sealing portion 21 configured to be fixed to the open end of the distribution device 70 to form a fluid- tight connection blocking the exit of the fluid from the open end of the distribution device 70. The distribution device 70 may have an essentially tubular shape, however, other shapes of distribution device 70 such as oval or cuboid are also envisaged, yet not preferred. The sealing portion 21 may be configured to surround an outer perimeter of the open end of the distribution device 70. The connection between the sealing portion 21 and the open end of the distribution device may a tight connection. As shown in Figs 4 and 5, the distribution device 70 is entered entirely into the sealing portion 21, i.e. the end portion of the distribution device is in contact with the portion of the sealing portion 21 being substantially perpendicular to a main axis of elongation of the distribution device 70. The sealing portion 21 may be made integral with the first baffle 20.

[0051] Alternatively, the end portion of the distribution device 70 may be distanced from the potion of sealing portion 21 which substantially perpendicular to a main axis of elongation of the distribution device 70 so that the gap between the two portions is formed. Such configuration is possible as long as the sealing portion 21 and the open end of the distribution device 70 form the fluid-tight connection.

[0052] The distribution device 70 may comprise a plurality of orifices 71 configured to deliver the fluid towards the tubes 2. The orifices 71 may be disposed in regular intervals with respect to each other. Alternatively, the orifices 71 may be disposed irregularly.

[0053] Fig. 5 shows an alternative design of aforementioned invention. Contrary to the embodiment presented in Fig. 4, wherein the outline of the distribution device 70 is fixed, the distribution device 70 shown in Fig. 5 comprises a beveled end 51b configured to facilitate fixing the distribution device 70 to the first sealing portion 21. Further, the beveled end 51b allows using the distribution device 70 of bigger cross-section, so that the efficiency of the heat exchanger may be increased. It is to be noted, that the beveled 51b corresponds to the shape of the first sealing potion 21 to enable proper penetration of the brazing material.

[0054] Fig. 6 shows another embodiment of the invention, wherein the open end of the distribution device 70 surrounds an outline of the sealing portion 21. In this embodiment the sealing portion 21 may penetrate into the distribution device 70 providing the sealing thereof. Analogically to the embodiments shown in previous figures, the distribution device 70 may be distanced from the potion of sealing portion 21 which substantially perpendicular to a main axis of elongation of the distribution device 70 so that the gap between the two portions is formed. Such configuration is possible as long as the sealing portion 21 and the open end of the distribution device 70 form the fluid-tight connection.

[0055] Figs 7 and 8 show an alternative design described in previous paragraphs. In some applications it would be desired to deliver the fluid through the distribution device 70 to the terminal tubes 2 of the stack. This may significantly improve thermal performance of the heat exchanger in that area.

[0056] Fig. 7 shows one of possible solutions to improve the thermal performance. The first sealing portion 21 may comprise a sloping portion 21a located on the portion which penetrates the distribution device 70. The sloping portion 21a enables forming an additional orifice 71 in the vicinity of the terminal tubes 2 of the stack. The additional orifice 71 may thus be located at least in-line with the outline of the penetrating portion of the sealing portion 21.

[0057] Alternatively, Fig. 8 shows a semi-spherical portion 21b which may serve the same purpose as the sloping portion 21a. The advantage of the semi- spherical portion 21b is that it directs fluid to the orifice 71 by the shorter path than the sloping portion 21a.

[0058] Both alternative designs shown in Figs 7 and 8 may be formed by e.g. stamping during the formation of the baffle 60.

[0059] The variations of the embodiments depicted by Figs 1-8 are allowed.

[0060] 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 header- tank assembly (30) for a fluid, comprising:

- a header (30) comprising a plurality of openings to receive tubes,
- a cover (10) configured to be assembled with the header (30) to form a channel for a fluid,
- a first baffle (20) forming an end wall for the fluid channel at an end of the header (30),
- a second baffle (40) comprising at least one

opening (41) configured to provide a fluidal communication between the header-tank assembly (30) and a fluid loop,

- a distribution device (70) located between the first baffle (20) and the second baffle (40), the distribution device (70) further comprising open ends, wherein at least one open end of the distribution device (70) is in a contact with the first baffle (20) and the other is fluidly connected with the first opening (41),

characterised in that

the first baffle (20) comprises a sealing portion (21) configured to be fixed to the open end of the distribution device (70) to form a fluid- tight connection blocking the exit of the fluid from the open end of the distribution device (70).

2. The header- tank assembly (30) according to claim 1, wherein the distribution device (70) is of essentially tubular shape.

3. The header- tank assembly (30) according to claim 1 or 2, wherein the sealing portion (21) surrounds an outer perimeter of the open end of the distribution device (70).

4. The header- tank assembly (30) according to claim 1 or 2, wherein the open end of the distribution device (70) surrounds an outline of the sealing portion (21).

5. The header- tank assembly (30) according to any of the preceding claims, wherein the distribution device (70) comprises plurality of orifices (71) configured to distribute the fluid.

6. The header- tank assembly (30) according to any of preceding claims, wherein the distribution device (70) comprises a dent (51a) configured to facilitate insertion the distribution device (70) to the first baffle (21).

7. The header- tank assembly (30) according to any of claims 1-4, wherein the distribution device (70) comprises a bevelled end (51b) configured to facilitate fixing the distribution device (70) to the first baffle (21).

8. The header- tank assembly (30) according to any of preceding claims, wherein the sealing portion (21) is made integral with the first baffle (20).

9. The header- tank assembly (30) according to any of the preceding claims, wherein the header (30) comprises two parallel rows of slots (41) configured to receive tubes.

10. The header- tank assembly (30) according to any of the preceding claims, wherein the header- tank assembly (30) comprises two pairs of baffles (60), each pair for a cover (10), the baffles (60) of a pair are configured to be located at the opposite ends of the cover (10).

11. The header- tank assembly (30) according to any of the preceding claims, wherein the first baffle (21) comprises a portion being substantially perpendicular the general axis of elongation of the distribution device (70).

12. The header- tank assembly (30) according to claim 10, wherein the sealing portion (21) comprises a sloping portion (21a) configured to form an additional orifice (71) at least in-line with the outline of the sealing portion (21)

13. The header- tank assembly (30) according to claim 10, wherein the sealing portion (21) comprises a semi- spherical portion (21b) configured to form an additional orifice (71) at least in-line with the outline of the sealing portion (21)

14. The header- tank assembly (30) according to all preceding claims, wherein the baffle (20) is made of the same material as the header (30), for instance in aluminium.

15. A heat exchanger (1) according any of the preceding claims, comprising at least one header- tank assembly (30).

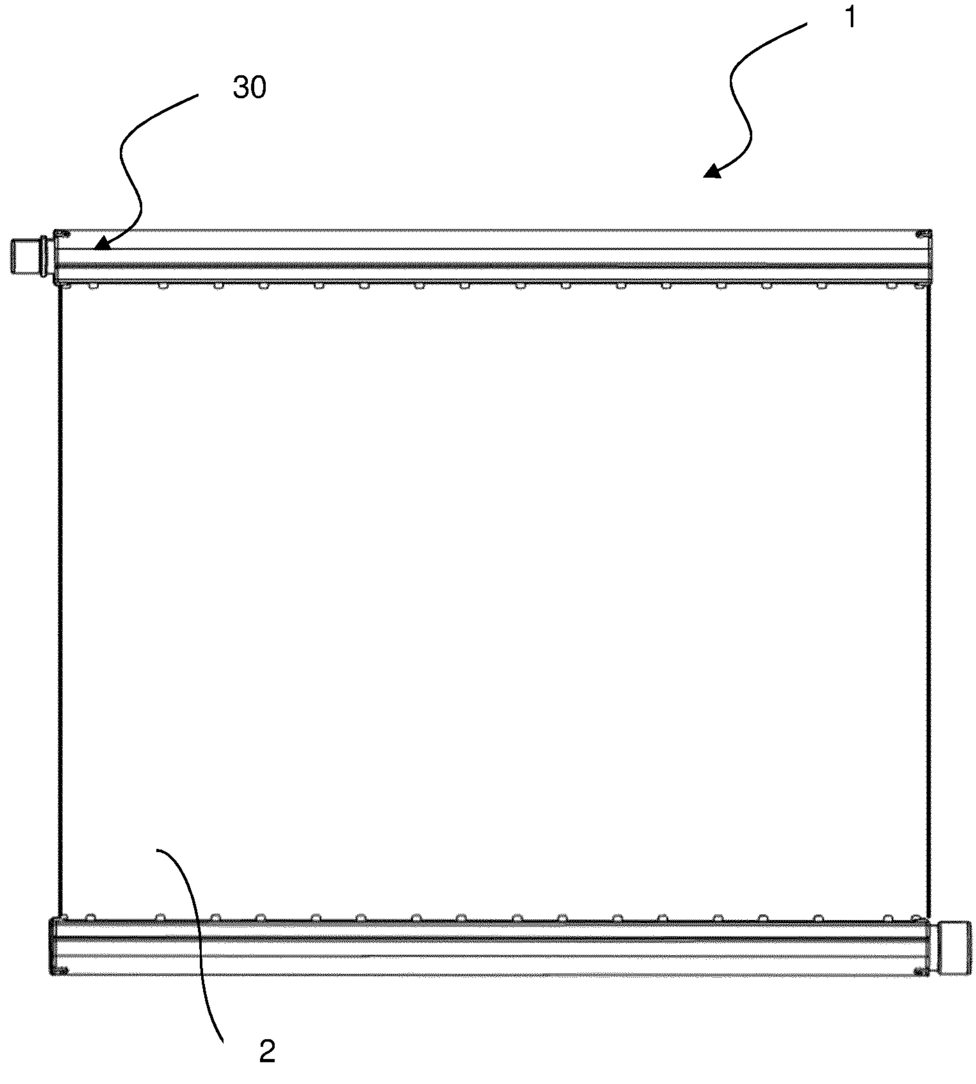

Fig. 1

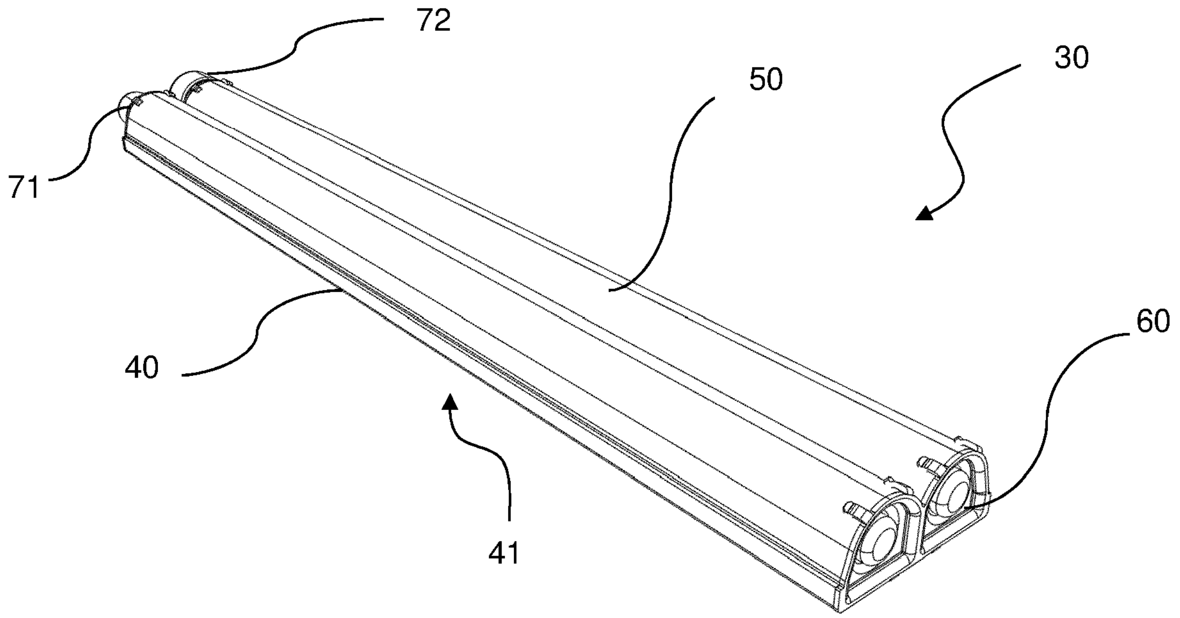

Fig. 2

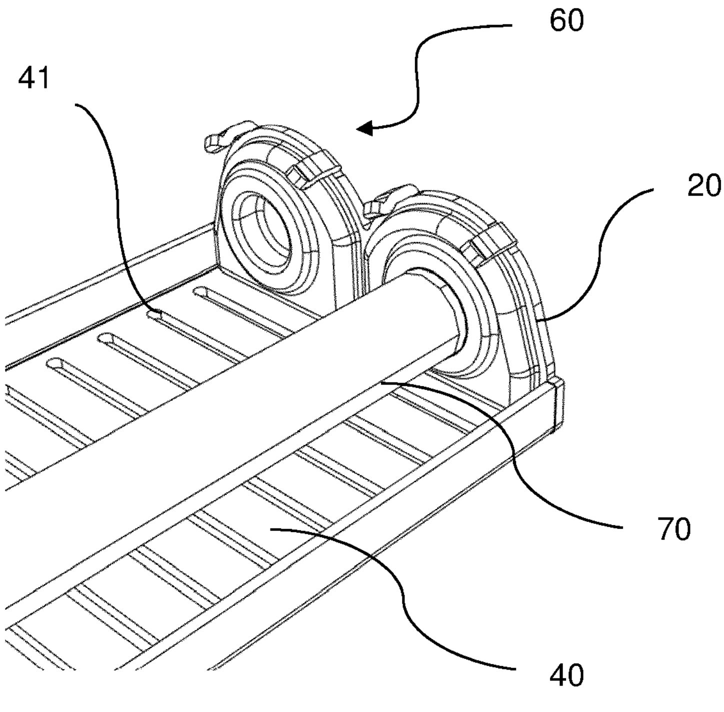

Fig. 3

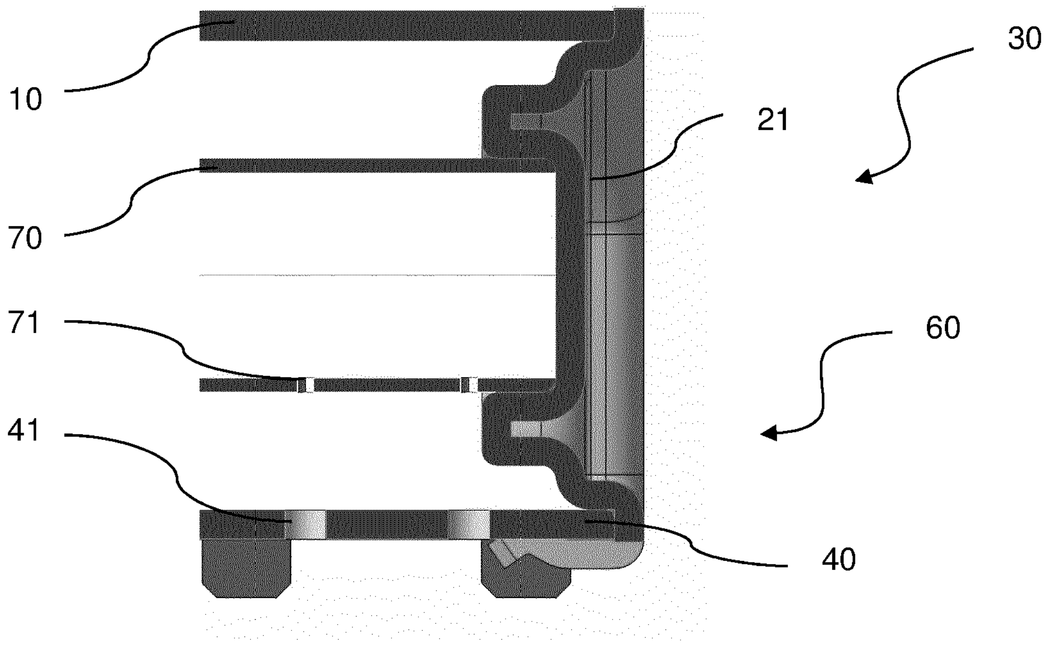

Fig. 4

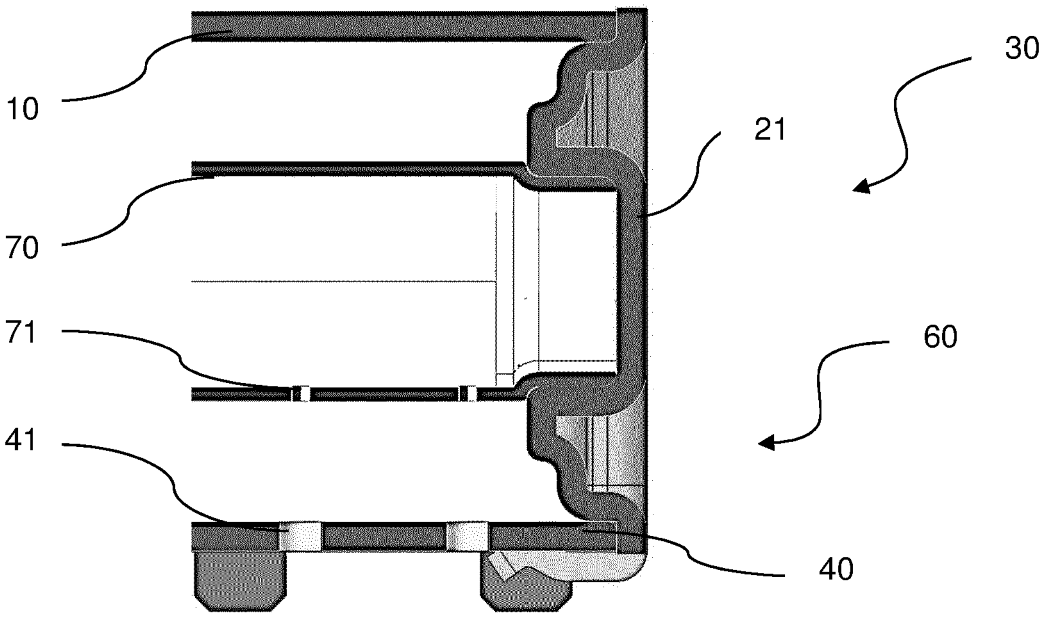

Fig. 5

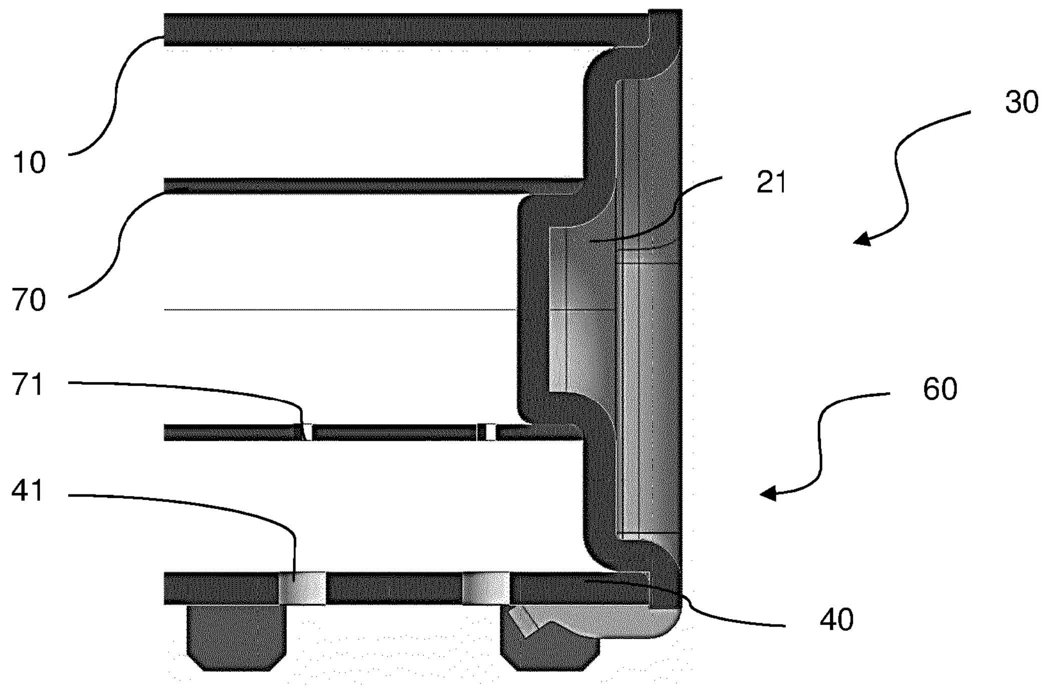

Fig. 6

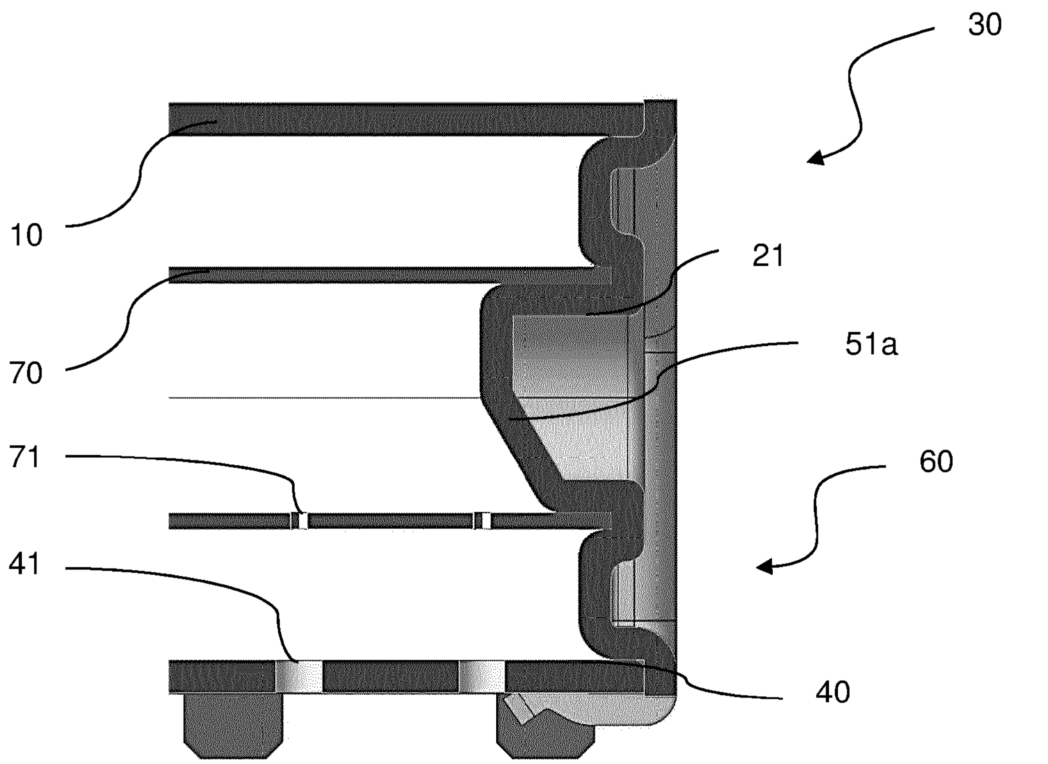

Fig. 7

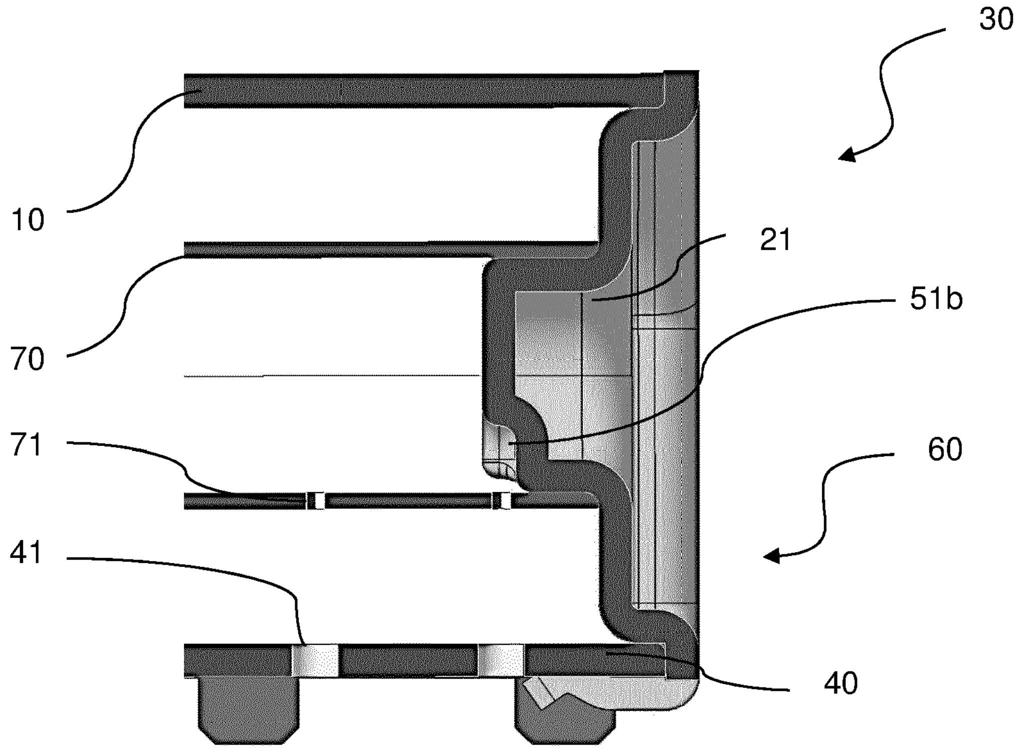

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 20 21 6479

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2019/121557 A1 (VALEO SYSTEMES THERMIQUES [FR]) 27 June 2019 (2019-06-27) * page 14, line 19 - line 27; figure 4 *	1-5,8, 10,11, 14,15	INV. F28F9/02 F28D1/053
X	FR 3 075 349 A1 (VALEO SYSTEMES THERMIQUES [FR]) 21 June 2019 (2019-06-21) * page 16, line 22 - page 18, line 2; figure 3 *	1,2,4,5, 8,10,11, 14,15	
X	DE 197 19 257 A1 (VALEO KLIMATECH GMBH & CO KG [DE]) 12 November 1998 (1998-11-12) * column 6, line 42 - line 52; figure 5 *	1,2,5, 14,15	
X	US 7 921 558 B2 (DELPHI TECH INC [US]) 12 April 2011 (2011-04-12) * column 6, line 25 - line 53; figure 1 *	1	
X	US 2014/096944 A1 (SEO KANG TAE [KR] ET AL) 10 April 2014 (2014-04-10) * paragraph [0078] - paragraph [0110]; figures 1-6 *	1	TECHNICAL FIELDS SEARCHED (IPC) F28D F28F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	27 May 2021	Jessen, Flemming

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 21 6479

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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