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(54) **A HYBRID HEAT EXCHANGER**

(57) A hybrid heat exchanger includes a hybrid core that includes a first core formed of a first heat exchange elements and a second core disposed adjacent to the first core and formed of a second heat exchange elements, pair of headers disposed on opposite sides of hybrid core is common for first and second core and pair of tanks common for first and second core. Each header is configured with first and second slots to receive first and second heat exchange elements respectively. Each tank is crimped to corresponding header and is divided into first chamber that along with first slots facilitate distribution of first heat exchange fluid to and collection of first heat exchange fluid from corresponding first core and second chamber that along with second set of slots facilitates distribution of second heat exchange fluid to and collection of second heat exchange fluid from corresponding second core.

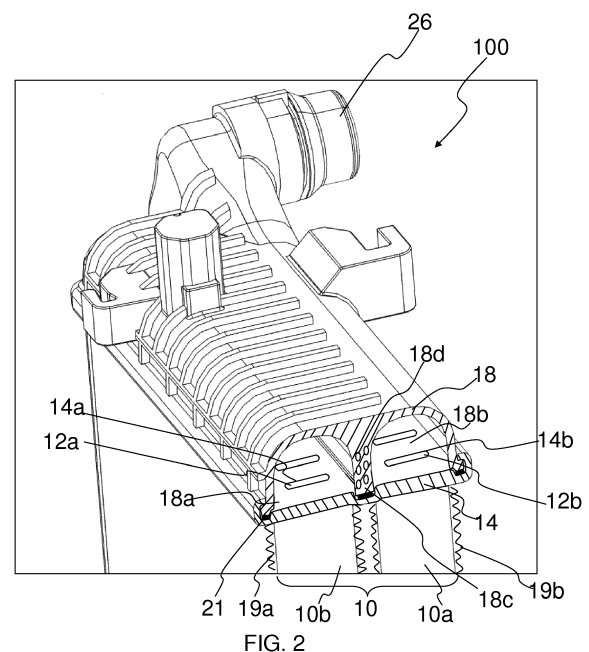


FIG. 2

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Description

[0001] The present invention relates to a heat exchanger, particularly, the present invention relates to a hybrid multi-core heat exchanger.

[0002] Generally, a vehicle may include several heat exchangers. For example, a conventional engine cooling system of a vehicle includes a radiator to facilitate cooling of an engine of the vehicle. Specifically, a coolant in form of glycol or water-glycol mixture is passed through the engine, from where the coolant absorbs heat and becomes hot. The hot coolant is then fed into an inlet tank of the radiator that is located preferably on top of the radiator, or along one side of the radiator, from the inlet tank the hot coolant is distributed across a radiator core through radiator tubes to another tank on an opposite side of the radiator. As the hot coolant passes through the radiator tubes to the opposite tank, the coolant transfers heat to tubes of the radiator core, the radiator tubes transfers the heat to fins that are lodged between each row of radiator tubes. The fins then releases heat to the ambient air that flows across the radiator core. Similarly, there are other heat exchangers used in a vehicle, such as for example, a condenser, an evaporator used in Heating Ventilation and Air-Conditioning system of the vehicle, a chiller for battery cooling and a Charged Air Cooler (CAC) for cooling compressed air delivered to a turbo-charged engine. The various heat-exchangers are disposed either alone or in series adjacent to each other to form a heat exchanger module. Generally, the adjacently disposed heat exchangers are connected by engagements elements such as for example, clips formed on respective tanks of the adjacent heat exchangers. In case of such heat exchanger module is formed by connecting the adjacent heat exchangers, each of the heat exchanger has independent headers or tube collectors and independent tanks. As such the heat exchanger module formed by connecting independent heat exchangers are bulkier and packaging thereof in limited space is difficult. Further, such heat exchanger modules involve more number of parts, as such more inventories are required to be maintained and higher inventory costs are involved. Furthermore, such heat exchanger modules involve more number of manufacturing steps for manufacturing and assembly thereof as tanks and the headers of the individual heat exchangers are manufactured separately, thereby causing the manufacturing and assembly of the heat exchanger modules complex and inconvenient. Few prior art suggest heat exchanger module with tanks corresponding to a first heat exchanger core and a second adjacent heat exchanger core formed in a single step molding process. However, none of the prior art provide solution for preventing direct or indirect heat exchange between respective heat exchange media flowing through the adjacent heat exchange cores.

[0003] Accordingly, there is a need for a hybrid multi-core heat exchanger that configures multiple heat exchanger cores connected by common elements to impart

compact configuration thereto and enable packaging thereof in limited available space. Furthermore, there is a need for a hybrid multi-core heat exchanger that involves fewer steps for manufacturing and assembly thereof as compared to conventional heat exchanger module formed by connecting adjacent independent cores. Furthermore there is a need for a hybrid heat exchanger with multiple cores that involves fewer parts and eliminates use of connecting elements such as clips, and as such involves comparatively lesser inventory and inventory costs. Still further, there is a hybrid heat exchanger with multiple cores that can handle different heat exchange media for heat exchange while still preventing direct or indirect heat exchange between heat exchange media flowing through the different cores or the common elements connecting the heat exchanger cores.

[0004] An object of the present invention is to provide a hybrid heat exchanger that configures multiple heat exchanger cores and connected by common elements, thereby reducing size and imparting compact configuration to the hybrid heat exchanger.

[0005] Another object of the present invention is to provide a hybrid heat exchanger with multiple cores that is compact in configuration and that can be conveniently packaged in a limited space.

[0006] Still another object of the present invention is to provide a hybrid heat exchanger with multiple cores that involves fewer parts and eliminates use of connecting elements such as clips, as such involves comparatively lesser inventory and inventory costs.

[0007] Yet another object of the present invention is to provide a hybrid heat exchanger with multiple cores that involves fewer steps for manufacturing and assembly thereof as compared to conventional heat exchanger module formed by connecting adjacent independent cores.

[0008] Still another object of the present invention is to provide a hybrid heat exchanger with multiple cores that can handle different heat exchange media for heat exchange while still preventing direct or indirect heat exchange between heat exchange media flowing through the different cores.

[0009] In the present description, some elements or parameters may be indexed, such as a first element and a second element. In this case, unless stated otherwise, this indexation is only meant to differentiate and name elements which are similar but not identical. No idea of priority should be inferred from such indexation, as these terms may be switched without betraying the invention. Additionally, this indexation does not imply any order in mounting or use of the elements of the invention.

[0010] A hybrid heat exchanger is disclosed in accordance with an embodiment of the present invention. The hybrid heat exchanger includes a hybrid heat exchange core, a pair of headers and a pair of tanks. The hybrid heat exchange core includes a first heat exchanger core and a second heat exchanger core. The first heat exchanger core is formed of a first set of heat exchange

elements. The second heat exchanger core is disposed adjacent to the first heat exchanger core and is formed of a second set of heat exchange elements. The pair of headers is disposed on opposite sides of the hybrid core and is common for the first heat exchanger core and the second heat exchanger core. Each header is configured with a first set of slots to receive the first set of heat exchange elements and a second set of slots to receive the second set of heat exchange elements. The pair of tanks is common for the first heat exchanger core and the second heat exchanger core, wherein each tank is crimped to the corresponding header and is divided into a first chamber and a second chamber. The first chamber along with the first set of slots facilitate distribution of first heat exchange fluid to and collection of first heat exchange fluid from the corresponding first heat exchanger core. The second chamber along with the second set of slots facilitates distribution of second heat exchange fluid to and collection of second heat exchange fluid from the corresponding second heat exchanger core.

[0011] Generally, the first heat exchanger core is at least one of a radiator core, a condenser core, a Charger Air Cooler (CAC) core, an evaporator core and a heater core.

[0012] Similarly, the second heat exchanger core is at least one of a radiator core, a condenser core, a Charger Air Cooler (CAC) core, an evaporator core and a heater core.

[0013] Generally, the first heat exchange elements and the second heat exchange elements are either one of tubes and plates.

[0014] Further, the hybrid heat exchanger includes a first set of corrugated fins lodged between the adjacent heat exchange elements of the first set of heat exchange elements and a second set of corrugated fins lodged between the adjacent heat exchange elements of the second set of heat exchange elements.

[0015] Specifically, the first set of slots receives the first set of heat exchange elements and the second set of slots receives the second set of heat exchange elements.

[0016] Alternatively, the at least one of the header and the tank includes a partition wall to divide interior of the tank into the first chamber and the second chamber when the tank is assembled on the corresponding header.

[0017] Specifically, the partition wall is positioned inside the at least one of the tanks based on the number and dimension of the corresponding heat exchanger cores.

[0018] Generally, the partition wall is of polymer material.

[0019] Specifically, the partition wall is of plastic material.

[0020] In a preferred embodiment of the present invention, the partition wall is configured with pockets and provides insulation and prevents heat exchange between the heat exchange media flowing through the adjacent chambers.

[0021] Further, the hybrid heat exchanger includes gaskets disposed between the tanks and the corresponding headers to configure sealing connection between the tanks and the corresponding headers.

[0022] Specifically, the gaskets are of either one of rubber and silicon material.

[0023] Further, the at least one of the tanks includes at least one first inlet configured on the first chamber and at least one second inlet configured on the second chamber, the at least one first inlet delivers first heat exchange fluid into the first chamber and the at least one second inlet delivers second heat exchange fluid into the second chamber.

[0024] Similarly, the at least one of the tanks includes at least one first outlet configured on the first chamber and at least one second outlet configured on the second chamber, the at least one first outlet deliver first heat exchange fluid out of the first chamber and the at least one second outlet delivers second heat exchange fluid out of the second chamber.

[0025] Other characteristics, details and advantages of the invention can be inferred from the description of the invention hereunder. A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying figures, wherein:

FIG. 1a illustrates an isometric view of a hybrid heat exchanger in accordance with an embodiment of the present invention;

FIG. 1b illustrates a front view of a hybrid heat exchanger of **FIG. 1a**;

FIG. 2 illustrates a sectional isometric view of the hybrid heat exchanger of **FIG. 1b** along section line A-A';

FIG. 3 illustrates a sectional isometric view of the hybrid heat exchanger of **FIG. 1b** along section line B-B';

FIG. 4 illustrates a sectional isometric view of a hybrid heat exchanger in accordance with still another embodiment of the present invention; and

FIG. 5 illustrates a sectional isometric view of a hybrid heat exchanger in accordance with yet another embodiment of the present invention.

[0026] Generally, a combination of heat exchangers, particularly, those used in a vehicle are required to be packaged in a limited space inside the vehicle. The heat exchangers are generally connected to form a heat exchanger module, specifically, elements of such heat exchangers are manufactured separately and assembled

together configure separate heat exchangers. The separate heat exchangers are then assembled close to each other using separate connecting elements to configure the heat exchanger module. However, such conventional heat exchanger modules involve more number of parts as such higher inventories and also more number of manufacturing steps for manufacturing and assembly thereof as tanks and the headers of the individual heat exchangers are manufactured separately.

[0027] To overcome the drawback of the conventional heat exchanger module, the present invention suggests a hybrid multi-core heat exchanger that configures multiple heat exchanger cores connected by common elements, thereby imparting compact configuration to the heat exchanger module to enable packaging thereof in limited available space. Although, heat exchanger module of the subject specification explains configuration and operation of a heat exchanger module having multiple heat exchanger cores connected by common elements to impart compact configuration thereto and use in limited space inside a vehicle. However, present invention is also applicable and can be extended to any application in vehicular or non-vehicular environment, where the heat exchanger cores are required to be connected closely using common elements to impart compactness and reduce number of parts, inventory costs, inventory and manufacturing steps for manufacturing / assembly thereof.

[0028] FIG. 1a illustrates an isometric view of a hybrid heat exchanger 100 in accordance with an embodiment of the present invention. FIG. 1b illustrates a front view of the hybrid heat exchanger 100. FIG. 2 illustrates a sectional isometric view of the hybrid heat exchanger 100 along section line A-A' depicted in FIG. 1b. As illustrated in the accompanying FIGS._[JP1], the hybrid heat exchanger 100 includes a hybrid heat exchange core 10, a pair of headers, referred to as first and second headers 14, 16 and a pair of tanks, referred to as first and second tanks 18, 20. The hybrid heat exchanger core 10 includes at least two heat exchanger cores, particularly a first heat exchanger core 10a and a second heat exchanger core 10b disposed adjacent to each other. Although the forthcoming description and the accompanying drawings explain configuration and operation of the hybrid heat exchange core 10 having only two heat exchange cores, however, the hybrid heat exchange core 10 can have any number of heat exchange cores and any type of heat exchange cores such as plate type or tube type heat exchange core, particularly, the hybrid heat exchanger core 10 can have any number of heat exchange cores arranged in any sequence. The first and second headers 14, 16 are configured on opposite sides the of the hybrid heat exchange core 10. The first and second tanks 18, 20 are crimped to the respective first and second headers 14, 16.

[0029] As the first tank 18 and the second tank 20 are functionally and structurally similar, also, as the first header 14 and the second header 16 are functionally and

structurally similar, every embodiment disclosed henceforth for the first tank 18 and the first header 14, internal configuration of the first tank 18, connection between the first tank 18 and the first header 14 is also applicable for the second tank 20 and the second header 16, the internal configuration of the second tank 20 and the connection between the second tank 20 and the second header 16 and for sake of brevity of present document, only the first tank 18, internal configuration of the first tank 18 and connection of the first tank 18 with the first header 14 is illustrated in the Figures and described in the description.

[0030] Again referring to FIG. 2, the hybrid heat exchange core 10 includes the first heat exchange core 10a and the second heat exchange core 10b. The first heat exchange core 10a is at least one of a radiator core, a condenser core, a Charger Air Cooler (CAC) core, an evaporator core and a heater core. Similarly, the second heat exchange core 10b is at least one of a radiator core, a condenser core, a Charger Air Cooler (CAC) core, an evaporator core and a heater core. The first heat exchange core 10a is formed of a first set of heat exchange elements 12a. The second heat exchange core 10b is disposed adjacent to the first heat exchange core 10a and is formed of a second set of heat exchange elements 12b. Generally, the first heat exchange elements 12a and the second heat exchange elements 12b are either one of tubes and plates. The first heat exchange core 10a further includes a first set of corrugated fins 19a lodged between the adjacent heat exchange elements 12a of the first set of heat exchange elements 12a. The second heat exchange core 10b further includes a second set of corrugated fins 19b lodged between the adjacent heat exchange elements 12b of the second set of heat exchange elements 12b.

[0031] The first header 14 is common for the first heat exchange core 10a and the second heat exchange core 10b. The first header 14 is configured with a first set of slots 14a to receive the first set of heat exchange elements 12a and a second set of slots 14b to receive the second set of heat exchange elements 12b. The slots 14a and 14b are complimentary to the cross section of the first set of heat exchange elements 12a and the second set of heat exchange elements 12b respectively.

[0032] The first tank 18 is common for the first heat exchange core 10a and the second heat exchange core 10b. The first tank 18 is crimped to the corresponding header 14 and is divided into a first chamber 18a and a second chamber 18b. At least one of the first tank 18 and the first header 14 includes a partition wall 18c, 14c to divide the interior of the first tank 18 into the first chamber 18a and the second chamber 18b. More specifically, in accordance with a preferred embodiment of the present invention as illustrated in FIG. 2 and FIG. 3 of the accompanying drawings, the first tank 18 includes a partition wall 18c to divide an interior of the first tank 18 into the first chamber 18a and the second chamber 18b when the first tank 18 is assembled on the corresponding first header 14. Alternatively as per another embodiment of

the present invention illustrated in **FIG. 4**, the first header **14** includes the partition wall **14c** to divide the interior of the first tank **18** into the first chamber **18a** and the second chamber **18b**, when the first tank **18** is assembled on the corresponding first header **14**. In accordance with yet another embodiment of the present invention as illustrated in **FIG. 5**, the partition wall is partially configured on the first tank **18** and partially configured on the first header **14**, and the portions of the partition walls **18c**, **14c** configured on the first tank **18** and the first header **14** are aligned and sealed with respect to each other at the interface as illustrated in **FIG. 5** to configure separate sealed first and second chambers **18a** and **18b** respectively. In accordance with an embodiment of the present invention, section of the first chamber **18a** and the second chamber **18b** along at least one section plane passing through the first tank **18** are symmetrical to each other about the partition wall **18c**, **14c** as illustrated in **FIG. 4**. In another embodiment, at least a portion of the first chamber **18a** is different in shape and non-symmetrical with respect to the corresponding portion of the second chamber **18b**, as such the section of the first chamber **18a** and the second chamber **18b** along at least one section plane passing through the first tank **18** are non-symmetrical to each other about the partition wall **18c**, **14c** as illustrated in **FIG. 3**.

[0033] The first chamber **18a** and the second chamber **18b** are so configured that fluid leakage from and /or between the first chamber **18a** and the second chamber **18b** is prevented. More specifically, gaskets **21** are disposed at the interface between the first tank **18** and the corresponding first header **14** to configure sealing connection at the interface between the first tank **18** and the corresponding first header **14**. The gasket **21** is of either one of rubber and silicon material. However, the present invention is not limited to any particular configuration and material of the gasket **21**, as far as the gasket **21** is capable of configuring sealed connection at the interface between the first tank **18** and the corresponding first header **14**.

[0034] Further, the partition wall **18c**, **14c** configuring the first chamber **18a** and the second chamber **18b** is so configured that the partition wall **18c**, **14c** provides insulation to prevent heat exchange between the heat exchange media flowing through the adjacent first and second chambers **18a** and **18b** respectively. Generally, the partition wall **18c**, **14c** is of a polymer material. Specifically, the partition wall **18c**, **14c** is of a plastic material. In accordance with an embodiment of the present invention, the partition wall **18c**, **14c** is configured with pockets **18d**, **14d** filled with air to provide insulation between the first and the second chambers **18a** and **18b** respectively and prevent heat exchange between the heat exchange media flowing through the adjacent first and second chambers **18a** and **18b** respectively. In one embodiment, instead of air any other insulative material can be filled in the pockets **18d**, **14d** to enable the partition wall **18c**, **14c** to provide insulation between the first and second

chambers **18a** and **18b** respectively and prevent heat exchange between the heat exchange media flowing through the adjacent first and second chambers **18a** and **18b** respectively. However, the present invention is not limited to any particular configuration of the partition wall **18c**, **14c** any particular material of the partition wall as long as the partition wall **18c**, **14c** provide insulation between the first and the second chambers **18a** and **18b** respectively and prevent heat exchange between the heat exchange media flowing through the adjacent first and the second chambers **18a** and **18b** respectively.

[0035] The position and number of the partition walls **18c**, **14c** to divide the interior of the first tank **18** is based on the number and dimension of the corresponding first heat exchange core **10a** and the second heat exchange core **10b**. For example, in case the hybrid heat exchange core **10** includes two heat exchange cores **10a** and **10b**, a single partition wall is sufficient to define two chambers **18a** and **18b** corresponding to the first heat exchanger core and the second heat exchange cores **10a** and **10b** respectively. In case the hybrid heat exchange core **10** includes two heat exchanger cores, the number of partition walls is increased to define more than two chambers corresponding to the more than two heat exchanger cores.

[0036] The tank first **18** further includes at least one first inlet **24** configured on the first chamber **18a** to deliver a first heat exchange fluid into the first chamber **18a**. The first chamber **18a** along with the first set of slots **14a** configured on the first header **14** collectively facilitates distribution of the first heat exchange fluid received thereby to the corresponding first heat exchange core **10a**. The first tank **18** still further includes at least one second inlet **26** configured on the second chamber **18b** to deliver a second heat exchange fluid into the second chamber **18b**. The second chamber **18b** along with the second set of slots **14b** configured on the first header **14** facilitates distribution of the second heat exchange fluid received thereby to the corresponding second heat exchange core **10b**.

[0037] Similar tank, also referred as the second tank **20** is configured at opposite side of the hybrid heat exchange core **10**. Also, the second header **16** is disposed on the side of the hybrid heat exchange core **10** that is opposite to the first side on which the first header **14** is disposed. The second tank **20** is crimped to the second header **16** and includes a first chamber **20a** and a second chamber **20b**. The second tank **20** is similar to the first tank **18** and the second header **16** is similar to the first header **14**, except that the first chamber **20a** along with the first set of slots **16a** configured on the second header **16** collectively facilitates collection of first heat exchange fluid from the corresponding first heat exchange core **10a** unlike the first chamber **18a** and the first set of slots **14a** on the first header **14** that collectively delivers heat exchange fluid received in the first chamber **18a** to the corresponding first heat exchange core **10a**. Also, at least one first outlet **28** configured on the first chamber **20a**

delivers the first heat exchange fluid received by the first chamber **20a** out of the first chamber **20a**. Similarly, the second chamber **20b** along with the second set of slots **16b** configured on the second header **16** facilitates collection of the second heat exchange fluid from the corresponding second heat exchange core **10b** unlike the second chamber **18b** and the second set of slots **14b** on the first header **14** that collectively delivers second heat exchange fluid received in the second chamber **18b** to the corresponding second heat exchange core **10b**. Also, at least one second outlet **30** configured on the second chamber **20b** delivers the second heat exchange fluid received by the second chamber **20b** from the second heat exchange core **10b** out of the second chamber **20b**. Further, similar to the gasket **21** disposed between the tank **18** and the corresponding header **14** to configure sealing connection between the tank **18** and the corresponding header **14**, there is a corresponding similar gasket **22** disposed between the tanks **20** and the corresponding header **16** to configure sealing connection between the tanks **20** and the corresponding headers **16**. Furthermore, similar to the partition wall **18c**, **14c** to divide the interior of the first tank **18** into the first chamber **18a** and the second chamber **18b**, there is a similar corresponding partition wall **20c**, **16c** to divide the interior of the second tank **20** into the first chamber **20a** and the second chamber **20b**.

[0038] It must be noted that the figures disclose the invention in a detailed enough way to be implemented, said figures helping to better define the invention if needs be. The invention should however not be limited to the embodiment disclosed in the description.

[0039] Several modifications and improvement might be applied by the person skilled in the art to a hybrid heat exchanger as disclosed above and such modifications and improvements will still be considered within the scope and ambit of the present invention, as long as the hybrid heat exchanger includes a hybrid heat exchange core, a pair of headers and a pair of tanks. Wherein, the hybrid heat exchange core includes a first heat exchanger core and a second heat exchanger core. The first heat exchanger core is formed of a first set of heat exchange elements. The second heat exchanger core is disposed adjacent to the first heat exchanger core and is formed of a second set of heat exchange elements. The pair of headers is disposed on opposite sides of the hybrid core and is common for the first heat exchanger core and the second heat exchanger core. Each header is configured with a first set of slots to receive the first set of heat exchange elements and a second set of slots to receive the second set of heat exchange elements. The pair of tanks is common for the first heat exchanger core and the second heat exchanger core, wherein each tank is crimped to the corresponding header and is divided into a first chamber and a second chamber. The first chamber along with the first set of slots facilitate distribution of first heat exchange fluid to and collection of first heat exchange fluid from the corresponding first heat exchanger core.

The second chamber along with the second set of slots facilitates distribution of second heat exchange fluid to and collection of second heat exchange fluid from the corresponding second heat exchanger core.

[0040] In any case, the invention cannot and should not be limited to the embodiments specifically described in this document, as other embodiments might exist. The invention shall spread to any equivalent means and any technically operating combination of means.

Claims

1. A hybrid heat exchanger (100) comprising:

- a hybrid heat exchange core (10) comprising:

- a first heat exchange core (10a) formed of a first set of heat exchange elements (12a); and
- a second heat exchange core (10b) disposed adjacent to the first heat exchange core (10a) and formed of a second set of heat exchange elements (12b);

- a pair of headers (14, 16) disposed on opposite sides of the hybrid heat exchange core (10) and common for the first heat exchange core (10a) and the second heat exchange core (10b), each header (14, 16) configured with a first set of slots (14a, 16a) and a second set of slots (14b, 16b); and

- a pair of tanks (18, 20) common for the first heat exchange core (10a) and the second heat exchange core (10b), wherein each tank (18, 20) is adapted to be crimped to the corresponding header (14, 16) and is divided into a first chamber (18a, 20a) and a second chamber (18b, 20b), the first chamber (18a, 20a) along with the first set of slots (14a, 16a) is adapted to facilitate distribution of first heat exchange fluid to and collection of first heat exchange fluid from the corresponding first heat exchange core (10a) and the second chamber (18b, 20b) along with the second set of slots (14b, 16b) is adapted to facilitate distribution of second heat exchange fluid to and collection of second heat exchange fluid from the corresponding second heat exchange core (10b).

2. The hybrid heat exchanger (100) as claimed in the previous claim, wherein the first heat exchange core (10a) is at least one of a radiator core, a condenser core, a Charger Air Cooler (CAC) core, an evaporator core and a heater core.

3. The hybrid heat exchanger (100) as claimed in any of the preceding claims, wherein the second heat

exchange core (10b) is at least one of a radiator core, a condenser core, a Charger Air Cooler (CAC) core, an evaporator core and a heater core.

4. The hybrid heat exchanger (100) as claimed in any of the preceding claims, wherein the first heat exchange elements (12a) and the second heat exchange elements (12b) are either one of tubes and plates. 5
5. The hybrid heat exchanger (100) as claimed in any of the preceding claims, further comprising a first set of corrugated fins (19a) lodged between the adjacent heat exchange elements (12a) and a second set of corrugated fins (19b) lodged between the adjacent heat exchange elements (12b) of the second set of heat exchange elements (12b). 10 15
6. The hybrid heat exchanger (100) as claimed any of the preceding claims, wherein the first set of slots (14a, 16a) are adapted to receive the first set of heat exchange elements (12a) and the second set of slots (14b, 16b) are adapted to receive the second set of heat exchange elements (12b). 20 25
7. The hybrid heat exchanger (100) as claimed any of the preceding claims, wherein the at least one of the headers (14, 16) and the tanks (18, 20) comprises a partition wall (18c, 20c, 14c, 16c) configured thereon and adapted to divide interior of the tank (18, 20) into the first chamber (18a, 20a) and the second chamber (18b, 20b) when the tank (18, 20) is assembled on the corresponding header (14, 16). 30 35
8. The hybrid heat exchanger (100) as claimed in claim 7, wherein the partition wall (18c, 20c, 14c, 16c) is positioned inside the at least one of the tanks (18, 20) based on the number and dimension of the corresponding heat exchange cores (10a, 10b). 40
9. The hybrid heat exchanger (100) as claimed in claim 7, wherein the partition wall (18c, 20c, 14c, 16c) is of polymer materials. 45
10. The hybrid heat exchanger (100) as claimed in claim 7, wherein the partition wall (18c, 20c, 14c, 16c) is of a plastic material.
11. The hybrid heat exchanger (100) as claimed in claim 7, wherein the partition wall (18c, 20c, 14c, 16c) is configured with pockets (18d, 20d, 14d, 16d) and is adapted to provide insulation and prevent heat exchange between the heat exchange media flowing through the adjacent first and the second chambers (18a, 20a) and (18b, 20b) respectively. 50 55
12. The hybrid heat exchanger (100) as claimed in any

of the preceding claims, further comprising gaskets (21, 22) disposed between the tanks (18, 20) and the corresponding headers (14, 16) to configure sealing connection between the tanks (18, 20) and the corresponding headers (14, 16).

13. The hybrid heat exchanger (100) as claimed in claim 12, wherein the gaskets (21, 22) are of either one of rubber and silicon material.
14. The hybrid heat exchanger (100) as claimed in any of the preceding claims, wherein the at least one tank of the pair of tanks (18, 20) further comprises at least one first inlet (24) configured on the first chamber (18a, 20a) and at least one second inlet (26) configured on the second chamber (18b, 20b), the at least one first inlet (24) is adapted to deliver first heat exchange fluid into the first chamber (18a, 20a) and the at least one second inlet is adapted to deliver second heat exchange fluid into the second chamber (18b, 20b).
15. The hybrid heat exchanger (100) as claimed in any of the preceding claims, wherein the at least one of the tanks (18, 20) further comprises at least one first outlet (28) configured on the first chamber (18a, 20a) and at least one second outlet (30) configured on the second chamber (18b, 20b), the at least one first outlet (28) is adapted to deliver first heat exchange fluid out of the first chamber (18a, 20a) and the at least one second outlet (30) is adapted to deliver second heat exchange fluid out of the second chamber (18b, 20b).

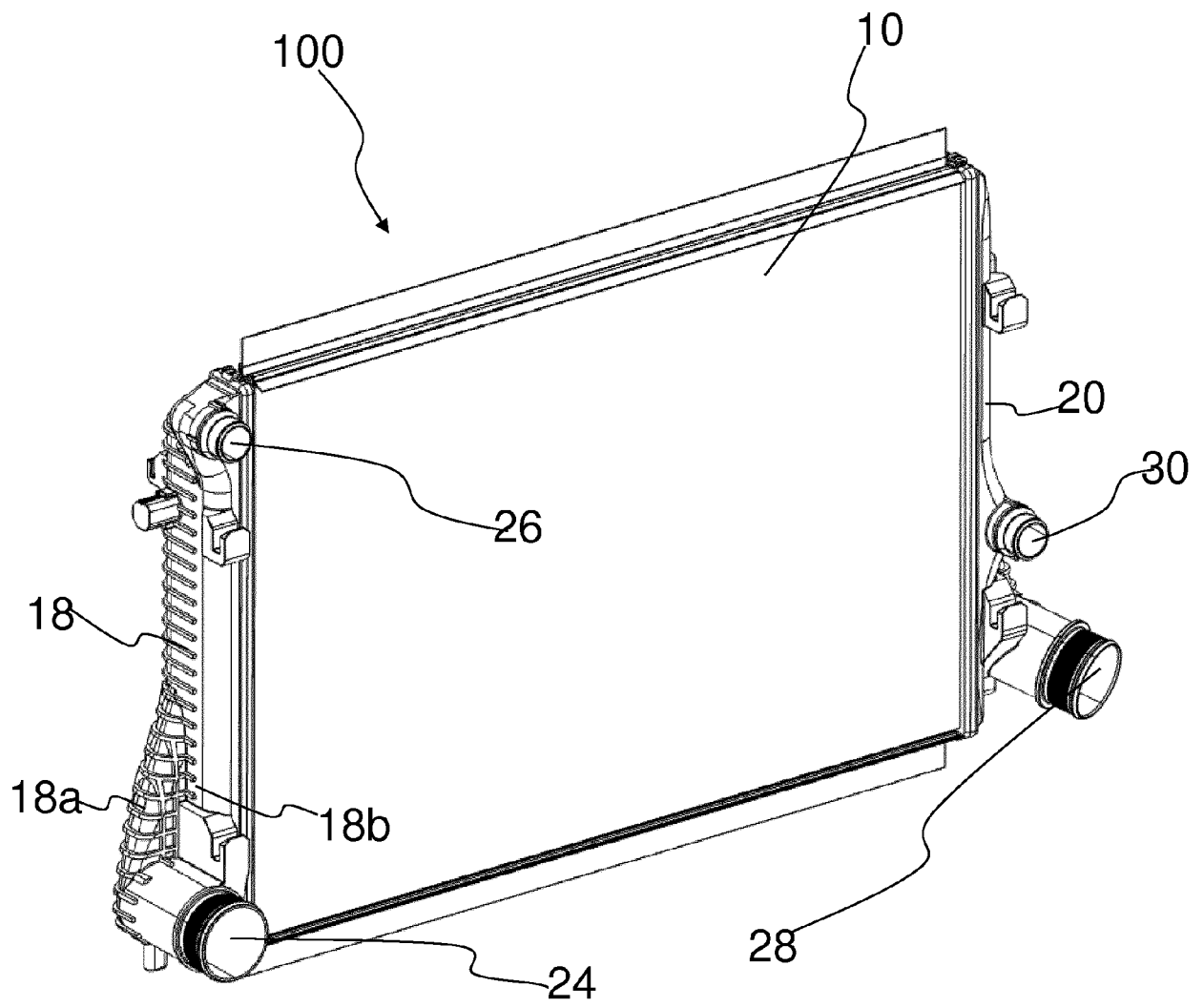
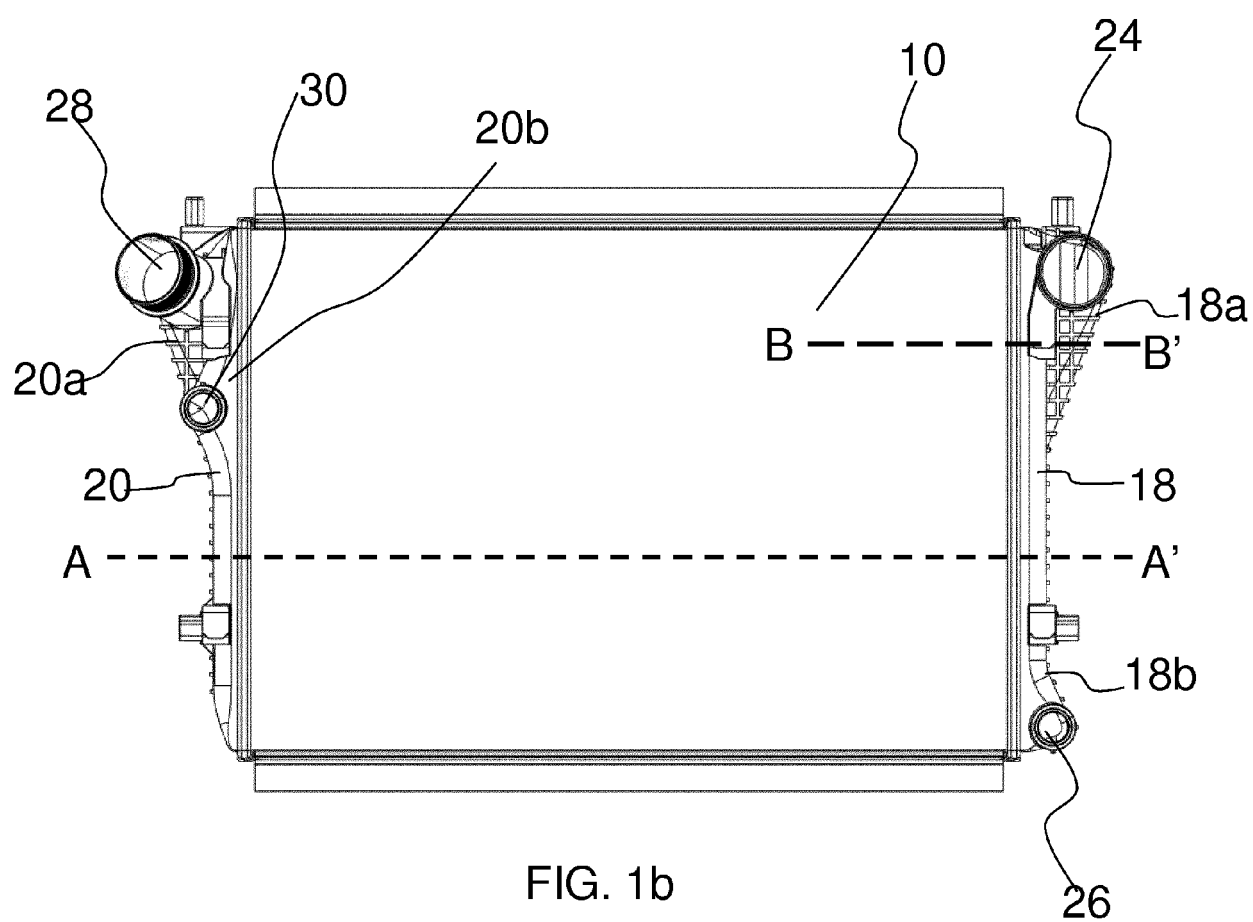


FIG. 1a



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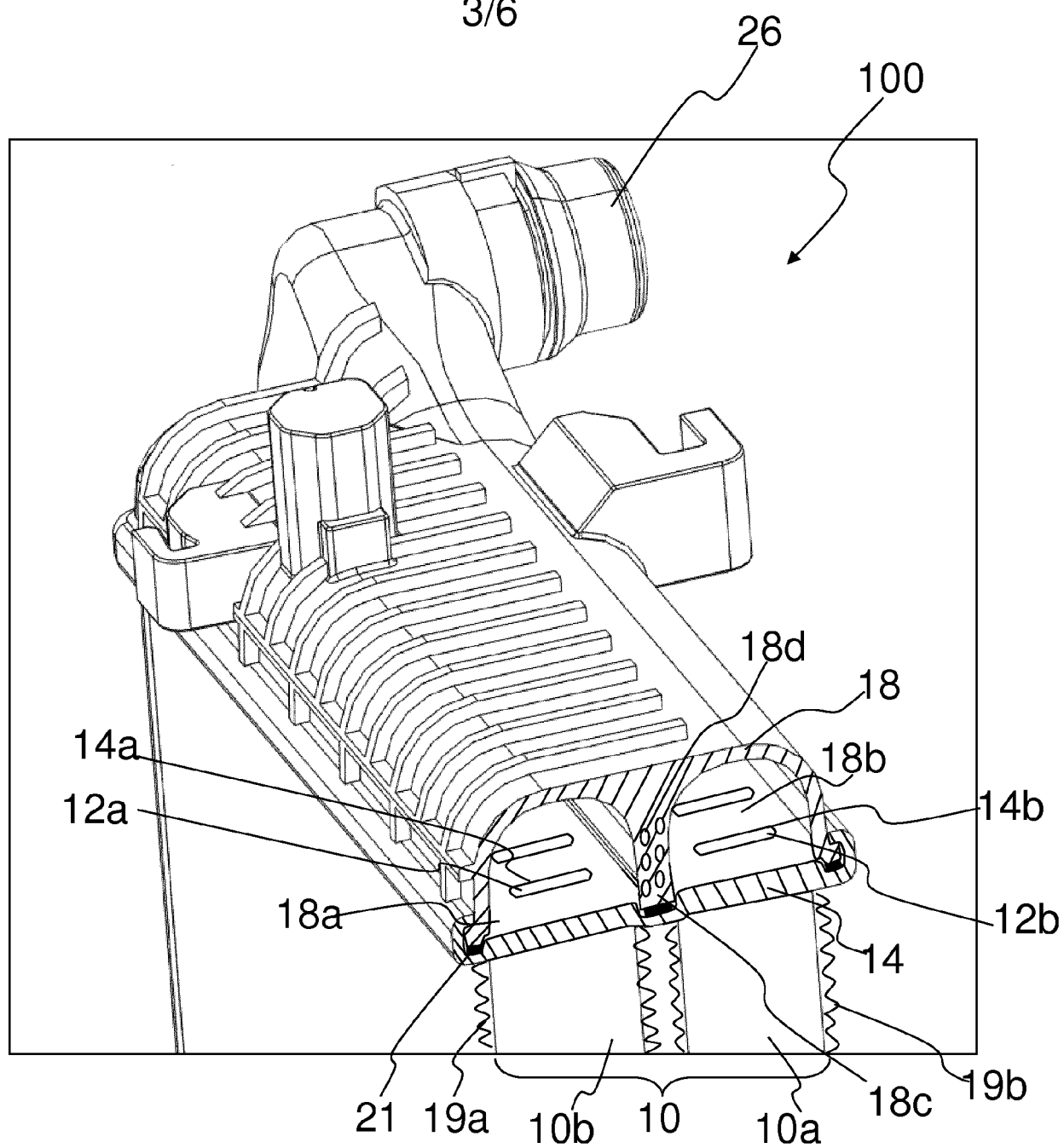


FIG. 2

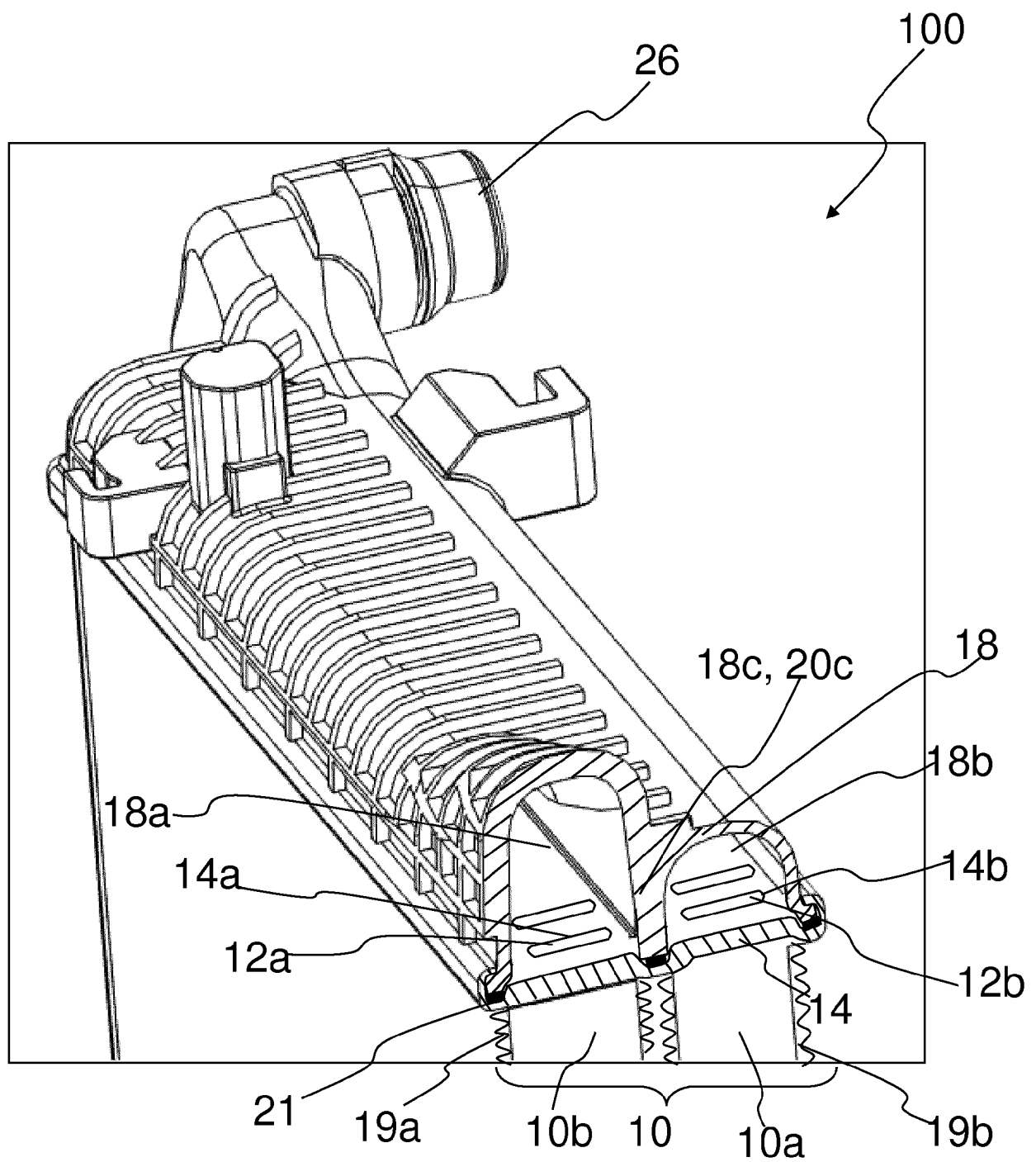


FIG. 3

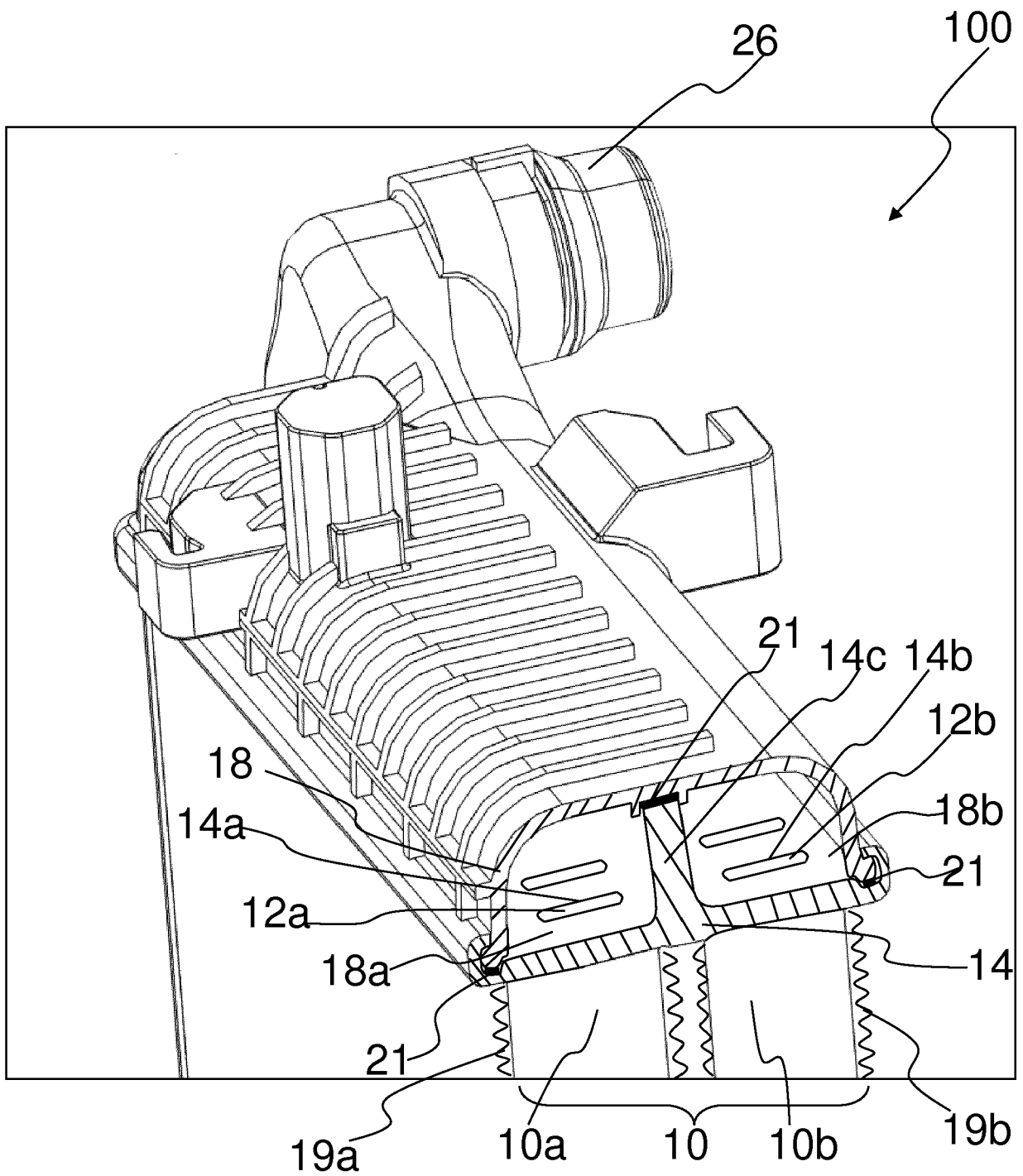


FIG. 4

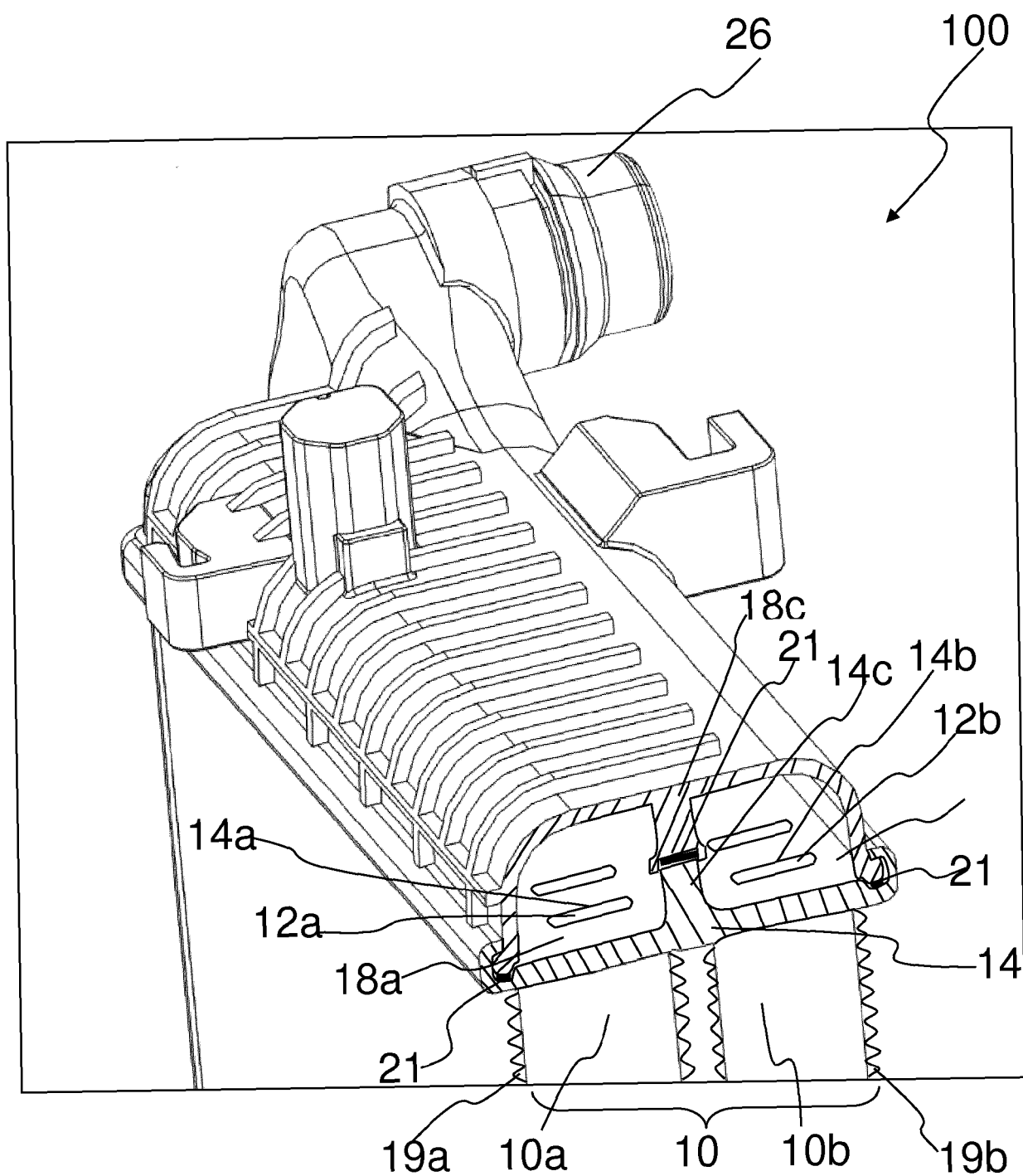


FIG. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 46 1539

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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	US 2008/078537 A1 (DESAI SAMEER [US]) 3 April 2008 (2008-04-03)	1-10, 12-15	INV. F28D1/04 F28F9/02 F28D1/053
Y	* figures 1-3 *	11	
Y	----- US 5 163 507 A (JOSHI SHRIKANT M [US]) 17 November 1992 (1992-11-17) * figures 3,5 *	11	
A	----- WO 2013/084472 A1 (DENSO CORP [JP]) 13 June 2013 (2013-06-13) * the whole document *	1-15	
A	----- US 2007/277956 A1 (BERGMILLER JORG [DE] ET AL) 6 December 2007 (2007-12-06) * the whole document *	1-15	
A	----- DE 10 2010 053478 A1 (MODINE MFG CO [US]) 6 June 2012 (2012-06-06) * figure 14 *	1-15	TECHNICAL FIELDS SEARCHED (IPC)
			F28D F28F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 November 2019	Examiner Schindler, Martin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
 EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 46 1539

5

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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19-11-2019

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008078537 A1	03-04-2008	EP 2074372 A1	01-07-2009
		JP 2010505081 A	18-02-2010
		US 2008078537 A1	03-04-2008
		WO 2008037606 A1	03-04-2008

US 5163507 A	17-11-1992	NONE	

WO 2013084472 A1	13-06-2013	JP 2013139997 A	18-07-2013
		WO 2013084472 A1	13-06-2013

US 2007277956 A1	06-12-2007	DE 102004036022 A1	16-02-2006
		EP 1774243 A1	18-04-2007
		US 2007277956 A1	06-12-2007
		WO 2006010581 A1	02-02-2006

DE 102010053478 A1	06-06-2012	NONE	
