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(54) HEADER STIFFENING OUTER INSERT

(57) A header-tank assembly (100) includes a tank (110), a header (120a) and at least one reinforcement insert (120b). The header (120a) includes a first faceplate (120) with first apertures (122a) formed thereon, each of the first apertures (122a) includes a first peripheral wall (124a) extending from a first base portion (126a). The at least one reinforcement insert (120b) includes a second faceplate (140) with at least one second aperture (122b) formed thereon. The second aperture (122b) includes a second peripheral wall (124b) disposed along at least a portion of a periphery thereof and extending from a second base portion (126b). The reinforcement insert (120b) and the header (120a) are so arranged that the respective first and the second base portions (126a) and (126b) are connected to each other, while the first peripheral walls (124a) and the corresponding second peripheral walls (124b) are aligned and extend opposite to each other.

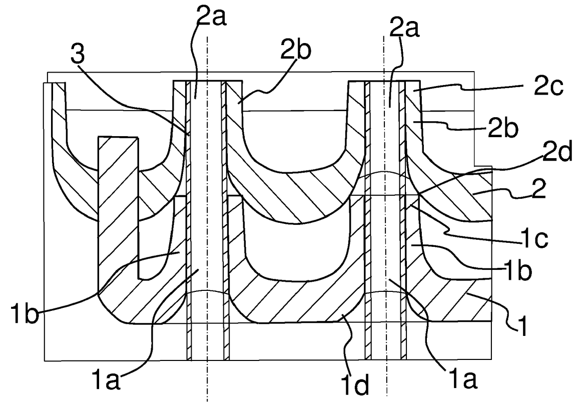

FIG. 1
(PRIOR ART)

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Description

[0001] The present invention relates to a header-tank assembly, more particularly, the present invention relates to a reinforcement insert for a header-tank assembly of a heat exchanger.

[0002] Generally, a heat exchanger, for example, a radiator or a Charge Air Cooler (CAC) for use in a vehicle includes at least one header-tank assembly. The at least one header tank assembly includes a header and a tank that are crimped to each other to form an enclosure for receiving and holding a first heat exchange fluid therein. The at least one header-tank assembly is in fluid communication with a plurality of heat exchange tubes. Specifically, the header includes a plurality of apertures to receive heat exchange tubes and configure fluid communication between the enclosure formed by the at least one header-tank assembly and the plurality of heat exchange tubes. Generally, there are two header tank assemblies spaced away from each other and connected by the plurality of heat exchange tubes. A first header tank assembly distributes the first heat exchange fluid to the plurality of heat exchange tubes and the second header tank assembly collects the first heat exchange fluid from the plurality of heat exchange tubes. Also, instead of two header-tank assemblies disposed at opposite ends of the heat exchange tubes to configure U-flow through the heat exchange tubes, a single header-tank assembly with partition dividing tank interior can be disposed at one side of the heat exchange tubes to configure I-flow through the heat exchange tubes. As the first heat exchange fluid flows through the heat exchange tubes, the first heat exchange fluid rejects heat to a second heat exchange fluid flowing across the heat exchanger tubes and gets cooled in the process.

[0003] As the heat exchange tubes are constantly in contact with the first heat exchange fluid flowing there through, the heat exchange tubes are subjected to thermal expansion. Due to thermal expansion of the heat exchange tubes, the connections between the heat exchange tubes and apertures formed on the header for receiving the heat exchange tubes are subjected to thermal shock i.e. thermal stresses. The thermal stresses are detrimental for the connection between the heat exchange tubes and header as they may cause leakage and mechanical failures, thereby reducing the service life, efficiency and performance of the heat exchanger.

[0004] Accordingly, it is desirable that the connection between the header and the heat exchange tubes possess thermal shock robustness, i.e. the connection should be able to withstand high thermal stresses. One way of improving thermal shock robustness of the connection between the heat exchange tubes and the header is to enhance strength of the connection by selecting appropriate material of heat exchange tubes and the header that can withstand thermal stresses. However, such materials are expensive and increase the overall cost of the heat exchanger. Other way of improving thermal shock robustness by enhancing strength of the connection is to increase material thickness of the heat exchange tubes at the interface between the heat exchange tubes and the header. However, increasing material thickness of the heat exchange tubes at the interface increases internal coolant pressure drop at entrance of the heat exchange tubes, thereby hindering coolant flow through the heat exchange tubes and deteriorating efficiency and performance of the heat exchanger.

[0005] Another way of improving thermal shock robustness of the connection between the heat exchange tubes and the header is by using reinforcement insert **1** secured to a header **2** in an aligned arrangement as illustrated in **FIG. 1.** The reinforcement insert **1** includes a first face plate and a plurality of first apertures **1a** formed on the first face plate. Similarly, the header **2** includes a second face plate and a plurality of second apertures **2a** formed on the second face plate that are corresponding to the plurality of first apertures **1a** formed on the first face plate of the reinforcement insert **1.** The reinforcement insert **1** and the header **2** are so arranged with respect to each other that first peripheral walls **1b** disposed along the first apertures **1a** and second peripheral walls **2b** disposed along the second apertures **2a** are aligned with respect to each other to configure tubular passages to receive the respective heat exchange tubes **3** therein. However, the reinforcement insert **1** and the header **2** are so arranged with respect to each other that a top portion **1c** of each of the first peripherals walls **1b** is in contact with a base portion **2d** of each of the second peripheral walls **2b.** The reinforcement insert **1** and the header **2** are connected to each other in the aligned configuration along the contact between the first peripheral walls **1b** and second peripheral walls **2b** by brazing. Such configuration of the reinforcement insert **1** attempts to provide sufficient reinforcement and improve thermal shock robustness of the connection between the heat exchange tubes **3** and header **2.** More specifically, referring to the **FIG. 1,** the first peripheral walls **1b** and the second peripheral walls **2b** around the first apertures **1a** and the second apertures **2a** are extending in same direction. Further, contact between the top portion **1c** of each of the first peripherals walls **1b** and the base portion **2d** of each of the second peripheral walls **2b** provides surface contact for brazing between the first peripheral walls **1b** and the corresponding second peripheral walls **2b.** However, such surface contacts between the first peripherals walls **1b** and the corresponding second peripheral walls **2b** is insufficient and fails to configure a robust brazing joint between the reinforcement insert **1** and the header **2.** Further, such configuration of the first peripheral walls **1b** and the second peripheral wall **2b** fails to provide satisfactory thermal shock robustness.

[0006] Accordingly, there is a need for a header tank assembly that includes header and at least one reinforcement insert, wherein the reinforcement insert is so arranged and aligned with respect to the header that there is sufficient surface contact for forming a robust brazing joint between the reinforcement insert and the header. Further, there is a need for a header tank assembly that includes a header and at least one reinforcement insert that provides thermal shock robustness to the connection between the heat exchange tubes and the header without decreasing internal coolant pressure drop. Further, there is a need for a header tank assembly that prevents use of heat exchange tubes and headers of costly material and connection between the header and the heat exchange tubes thereof exhibit strength and can withstand thermal shock or thermal stresses to achieve thermal shock robustness.

[0007] An object of the present invention is to provide a header tank assembly that includes a header and at least one reinforcement insert that obviates the drawbacks associated with conventional unsuccessful ways to improve thermal shock robustness of the connection between heat exchanger tubes and header.

[0008] Another object of the present invention is to provide a header tank assembly that includes a header and at least one reinforcement insert that provides thermal shock robustness to the connection between the heat exchange tubes and the header without decreasing internal coolant pressure drop.

[0009] Yet another object of the present invention is to provide a header tank assembly that includes a header and at least one reinforcement insert that are so arranged with respect to each other to provide sufficient surface contact for forming a robust brazing joint between the reinforcement insert and the header.

[0010] Still another object of the present invention is to provide a header tank assembly that includes a header and at least one reinforcement insert that improves efficiency and performance of the heat exchanger by preventing mechanical failures caused by thermal stresses at the interface between the heat exchanger tubes and the header.

[0011] Another object of the present invention is to provide a header tank assembly that includes a header and at least one reinforcement insert that enhances the service life and reduces the maintenance of the heat exchanger.

[0012] Still another object of the present invention is to provide a header tank assembly that includes a header and at least one reinforcement insert that is easy to assemble.

[0013] 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.

[0014] A header-tank assembly is disclosed in accordance with an embodiment of the present invention. The at least one header-tank assembly includes a tank, a header and at least one reinforcement insert. The header includes a first face plate with a plurality of first apertures formed thereon, wherein each of the first apertures includes a first peripheral wall disposed along a periphery thereof and extending away from the header. The first peripheral walls extend from a first base portion. The at least one reinforcement insert includes a second face plate with at least one second aperture formed thereon complementary to the corresponding first apertures, wherein the second aperture includes a second peripheral wall disposed along at least a portion of a periphery thereof and extending away from the reinforcement insert. The second peripheral wall extends from a second base portion. The reinforcement insert is arranged with respect to the header such that the respective first and second base portions are connected to each other, while the first peripheral walls and the corresponding second peripheral walls are aligned and extend opposite to each other in fluid flow direction to form continuous tubular passages to receive corresponding heat exchange tubes therein.

[0015] Particularly, the at least one reinforcement insert is complementary to at least a portion of the header.

[0016] In accordance with an embodiment, the header tank assembly includes a multiple spaced apart reinforcement inserts connected to the header, the second face plate of each of the reinforcement inserts includes different number of the second apertures formed thereon.

[0017] Preferably, the header tank assembly includes a pair of reinforcement inserts that are disposed at extreme ends of the header and connected to the header.

[0018] Alternatively, the header tank assembly includes a single reinforcement insert is disposed with respect to, extending and connected along length of the header.

[0019] Also, the at least one reinforcement insert includes a pair of side rails disposed along longitudinal sides thereof. The pair of side rails are complementary to and secured to longitudinal sides of the header.

[0020] Generally, the first peripheral walls and the corresponding second peripheral walls are of same height.

[0021] Alternatively, the first peripheral walls and the corresponding second peripheral walls are of different heights, ratio of heights of the first peripheral walls and the corresponding second peripheral walls is in the range of 4:1 to 1:4.

[0022] In some cases, the second peripheral walls extend along entire periphery of the respective second apertures.

[0023] Alternatively, the second peripheral walls extend along extreme ends of the respective second apertures.

[0024] There is also disclosed a heat exchanger in accordance with an embodiment of the present invention. The heat exchanger includes the header-tank assembly as disclosed hereinabove.

[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. 1 illustrates a sectional view depicting conventional arrangement of a header and a reinforcement insert of a heat exchanger arranged with respect to each other;

FIG. 2 illustrates a schematic representation of a heat exchanger in accordance with an embodiment of the present invention;

FIG. 3a illustrates a schematic representation of a header tank assembly and a reinforcement insert thereof in accordance with an embodiment of the present invention, also is depicted a schematic representation of the header and the reinforcement insert in the assembled configuration;

FIG. 3b illustrates a sectional view depicting an arrangement of the header and the reinforcement insert of **FIG. 3a** arranged with respect to each other;

FIG 4a illustrates an isometric view of the header of the header tank assembly of **FIG. 3a,** there is also illustrated an enlarged view of a portion of the header;

FIG. 4b illustrates an exploded view of the reinforcement inserts and the header of **FIG. 3a** to which the reinforcement inserts are to be attached;

FIG. 4c illustrates an assembled view of the reinforcement inserts connected to the header of **FIG. 4a;**

FIG. 5a illustrates an isometric view of the reinforcement insert in accordance with an embodiment of the present invention;

FIG. 5b illustrates isometric view of the reinforcement insert in accordance with another embodiment of the present invention;

FIG. 6a illustrates an isometric view of a reinforcement insert with a single second aperture formed on a face plate thereof; and

FIG. 6b illustrates another isometric view of a reinforcement insert of the **FIG. 6a.**

[0026] 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.

[0027] A header tank assembly is disclosed in accordance with an embodiment of the present invention. Generally, there are two header-tank assembly for a heat exchanger. Each header-tank assembly includes a tank, a header and at least one reinforcement insert. The header includes a plurality of first apertures formed on a first face plate of the header, wherein each of the first apertures includes a first peripheral wall disposed along a periphery thereof and extending away from the header. The first peripheral wall is extending from a first base portion. The at least one reinforcement insert includes a plurality of second apertures complementary to the corresponding first apertures. The second apertures are configured on a second face plate of the at least one reinforcement insert, wherein each of the second apertures includes a second peripheral wall disposed along at least a portion of a periphery thereof and extending away from the reinforcement insert. The second peripheral wall is extending from a second base portion. The at least one reinforcement insert is arranged with respect to the header such that the respective first and second base portions are connected to each other, while the first peripheral walls and the corresponding second peripheral walls are aligned and extend opposite to each other in fluid flow direction. The first and the second peripheral walls connected to each other in aligned configuration form continuous tubular passages to receive corresponding heat exchange tubes therein. Such configuration of the heat exchanger with header and at least one reinforcement insert connected to each other in an aligned manner provides thermal shock robustness to the connection between heat exchange tubes and the header without decreasing internal coolant pressure drop at the entrance of the heat exchange tubes. Further, such configuration of the heat exchanger with header and at least one reinforcement insert connected to each other in an aligned manner provides sufficient contact for forming a robust brazing connection between the header and the reinforcement insert.

[0028] **FIG. 1** illustrates a sectional view depicting conventional arrangement of a reinforcement insert **1** and a header **2** of a heat exchanger arranged with respect to each other. The arrangement is aimed at improving thermal shock robustness of the connection between the heat exchange tubes **3** and the header **2** by using reinforcement insert **1** secured to the header **2** in an aligned arrangement as illustrated in **FIG. 1.** The reinforcement insert **1** includes a first face plate and a plurality of first apertures **1a** formed on the first face plate. Similarly, the header **2** includes a second face plate and a plurality of second apertures **2a** formed on the second face plate that are corresponding to the plurality of first apertures **1a** formed on the first face plate of the reinforcement insert **1.** The reinforcement insert **1** and the header **2** are so arranged with respect to each other that first peripheral walls **1b** disposed along the first apertures **1a** and second peripheral walls **2b** disposed along the second apertures **2a** are aligned with respect to each other to configure tubular passages to receive the respective heat exchange tubes **3** therein. However, the reinforcement insert **1** and the header **2** are so arranged with respect to each other that a top portion **1c** of each of the first peripherals walls **1b** is in contact with a base portion **2d** of each of the second peripheral walls **2b.** The reinforcement insert **1** and the header **2** are securely connected to each other in the aligned configuration along the contact between the first peripheral walls **1b** and the second peripheral walls **2b** by brazing. Such configuration of the reinforcement insert **1** tries to provide sufficient reinforcement and is aimed at improving thermal shock robustness of the connection between the heat exchange tubes **3** and header **2.** More specifically, referring to the **FIG. 1,** the first peripheral walls **1b** and the second peripheral walls **2b** around the first apertures **1a** and the second apertures **2a** are extending in same direction. Further, contact between the top portion **1c** of each of the first peripherals walls **1b** and the base portion **2d** of each of the second peripheral walls **2b** provides surface contact for brazing between the first peripheral walls **1b** and the corresponding second peripheral walls **2b.** However, such surface contacts between the first peripherals walls **1b** and the corresponding second peripheral walls **2b** is insufficient and fails to configure a robust brazing joint between the reinforcement insert **1** and the header **2.** Further, such configuration of the first peripheral walls **1b** and the second peripheral wall **2b** fails to provide thermal shock robustness.

[0029] **FIG. 2** illustrates a heat exchanger **200** in accordance with an embodiment of the present invention. The heat exchanger **200** includes at least one header-tank assembly **100.** The at least one header tank assembly **100** includes a tank **110** and a header **120a** that are crimped to each other to form an enclosure for receiving and holding a first heat exchange fluid therein. The at least one header-tank assembly **100** is in fluid communication with a plurality of heat exchange tubes **130.** Specifically, the header **120a** includes a plurality of apertures to receive the heat exchange tubes **130** and configure fluid communication between the enclosure formed by the at least one header-tank assembly **100** and the plurality of heat exchange tubes **130.** Generally, there are two header tank assemblies spaced away from each other as illustrated in **FIG. 2,** the two header tank assemblies are connected by the plurality of heat exchange tubes **130.** A first header tank assembly distributes the first heat exchange fluid to the plurality of heat exchange tubes **130** and the second header tank assembly collects the first heat exchange fluid from the plurality of heat exchange tubes **130.** As the first heat exchange fluid flows through the heat exchange tubes **130,** the first heat exchange fluid rejects heat to a second heat exchange fluid flowing across the heat exchanger tubes **130** and gets cooled in the process. The second heat exchange fluid is for example air, while the first heat exchange fluid may be a coolant.

[0030] **FIG. 3a** illustrates a schematic representation of the header tank assembly **100** and a reinforcement insert **120b** of the heat exchanger **200** in accordance with an embodiment of the present invention. There is also depicted a schematic representation of the header **120a** and the reinforcement insert **120b** in the assembled configuration. In case of the heat exchanger **200,** the reinforcement insert **120b** is arranged, i.e. aligned and secured with respect to the header **120a** as illustrated in a sectional view depicted in **FIG. 3b.**

[0031] **FIG 4a** illustrates an isometric view of the header **120a** of the header tank assembly **100.** The header **120a** includes a first face plate **120** with a plurality of first apertures **122a** configured thereon. The first apertures **122a** are uniformly spaced with respect to each other. Generally, the first apertures **122a** are formed on the first face plate **120** of the header **120a** by stamping operation. However, the present invention is not limited to any particular method of forming the first apertures on the first face plate of the header or the placement and distribution of the first apertures on the first face plate of the header. Each of the first apertures **122a** includes a first peripheral wall **124a** disposed along a periphery thereof and extending away from the header **120a.** The header **120a** includes crimping tabs disposed along longitudinal sides **127a** and lateral sides **129a** thereof.

[0032] **FIG. 4b** illustrates an exploded view of the reinforcement inserts **120b** and the header **120a** to which the reinforcement inserts **120b** are connected to. **FIG. 4c** illustrates an assembled view of the reinforcement inserts **120b** connected to the header **120a.** Generally, the at least one reinforcement insert **120b** is disposed with respect to the header **120a** and is complementary to at least a portion of the header **120a.** By complementary it is meant that at least one dimension, particularly, width of the at least one reinforcement insert **120b** matches with width of the corresponding header **120a.** More specifically, as the at least one reinforcement insert **120b** is complementary to the header **120a,** the reinforcement insert **120b** fits over the header **120a.** The at least one reinforcement insert **120b** includes a second face plate **140** with a plurality of second apertures **122b** configured thereon. The plurality of second apertures **122b** are complementary to the corresponding first apertures **122a.** More specifically, due to the at least one reinforcement insert **120b** being complementary to the header **120a,** the second apertures **122b** formed on the at least one reinforcement insert **120b** are aligned with the first apertures **122a** formed on the header **120a** without any effort. Each of the second apertures **122b** includes a second peripheral wall **124b** disposed along at least a portion of a periphery thereof and extending away from the reinforcement insert **120b.** Generally, the second peripheral walls **124b** extend along entire periphery of the respective second apertures **122b** as illustrated in **FIG. 5a.** Alternatively, the second peripheral walls **124b** extend only along extreme ends of the respective second apertures

122b as illustrated in **FIG. 5b.** The at least one reinforcement insert **120b** may further include a pair of side rails **127b** disposed along longitudinal sides thereof. The pair of side rails **127b** of the at least one reinforcement insert **120b** are complementary to and secured to the longitudinal sides **127a** of the header **120a** for positioning of the at least one reinforcement insert **120b** with respect to the header **120a.** The side rails **127b** further facilitate in connecting and positioning the reinforcement inserts **120b** in case there are multiple reinforcement inserts. Generally, multiple reinforcement inserts **120b** are placed with respect the header **120a.** The multiple reinforcement inserts **120b** are spaced apart from each other with some gap there between, accordingly, when such multiple reinforcement inserts **120b** are arranged with respect to the header **120a,** there are portions of the header **120a** that is not reinforced by the reinforcement inserts **120b.** Further, the number and spacing between the second apertures **122b** formed on each of the reinforcement inserts **120b** is different from the number and spacing of the second apertures **122b** formed on the other reinforcement insert **120b.** Alternatively, a pair of reinforcement inserts **120b** are disposed at extreme ends of the header **120a.** In accordance with another embodiment, a single reinforcement insert **120b** is disposed with respect to and extends along length of the header **120a.** In some cases as illustrated in the **FIG. 6a** and **FIG. 6b,** the second face plate **140** of the reinforcement insert **120b** includes a single second aperture **122b** formed thereon that is complementary to one of the corresponding first apertures **122a.** The single second aperture **122b** formed on the second face plate **140** receives a single heat exchange tube **130** therein. The single second aperture **122b** formed on the second face plate **140** includes the second peripheral wall **124b** disposed along at least a portion of a periphery thereof and extending away from the reinforcement insert **120b.** The second peripheral wall **124b** extends from a second base portion **126b.** The reinforcement inserts **120b** are generally disposed at those regions of the header **120a** that are more likely subjected to the thermal stresses and are more prone to failure due to the thermal stresses.

[0033] The at least one reinforcement insert **120b** is so arranged with respect to the header **120a** such that the first peripheral walls **124a** and the corresponding second peripheral walls **124b** are aligned and connected to each other at the respective first and the second base portions **126a** and **126b** thereof and extend opposite to each other in fluid flow direction. Further, during the brazing between the header **120a** and the reinforcement insert **120b,** the first faceplate **120** of the header **120a** and the second face plate **140** of the reinforcement insert **120b** are maintained pressed against each other using jigs and fixtures, specially clips. The pressing of the first faceplate **120** against the second face plate **140** ensures sufficient contact between the header **120a** and the reinforcement insert **120b,** thereby leading to robust brazing joint at the first and the second base portions **126a** and **126b.** The first peripheral walls **124a** and the corresponding second peripheral walls **124b** are aligned and connected to each other to form continuous tubular passages, when the header **120a** and the at least one reinforcement insert **120b** are connected to each other. More specifically, the at least one reinforcement insert **120b** and the header **120a** are so arranged with respect to each other that the first base portions **126a** of the first peripheral walls **124a** are abutting against the second base portions **126b** of the second peripheral walls **124b.** As the first face plate **120** of the header **120a** and the second face plate **140** of the at least one reinforcement insert **120b** are having curved profiles that are complementary to each other. Such configuration results is better surface contact between the first and the second base portions **126a** and **126b** respectively, thereby leading to robust brazing joint at the first and the second base portions **126a** and **126b.** The first base portions **126a** are connected to and extending from the first face-plate **120** and hence are broader than first top portions **128a** that form free ends of the respective first peripheral walls **124a.** Similarly, the second base portions **126b** are connected to extending from the second face-plate **140** and hence are broader than second top portions **128b** that form free ends of the respective second peripheral walls **124b.** As the first peripheral walls **124a** and the second peripheral walls **124b** are connected to each other along the first base portions **126a** and the second base portions **126b** that both are broadest compared to any other cross section along the length of the thereof. Accordingly, sufficient contact surface is available for forming brazing connections between the first peripheral walls **124a** and the second peripheral walls **124b.** The continuous tubular passages receive the corresponding heat exchange tubes **130** therein. Such configuration provides improved thermal stress robustness to the connection between the heat exchange tubes **130** and the header **120a** without decreasing internal coolant pressure drop at the entrance to the heat exchange tubes **130.** More specifically, with such configuration the connection between the heat exchange tubes **130** and the first apertures **122a** formed on the first face plate **120** the header **120a** for receiving the heat exchange tubes **130** are able to withstand thermal stresses to which the connection is subjected to. This is due to the fact that the heat exchange tubes **130** are also received and supported by the first peripheral walls **124a** and the second peripheral walls **124b** as the heat exchange tubes **130** are received in the first apertures **122a.** With such configuration, the second peripheral walls **124b** bears some of the thermal stresses and the stresses at the connection between the heat exchange tubes **130** and the first apertures **122a** is reduced. Accordingly, leakage and mechanical failures caused due to the thermal stresses at the connection between the heat exchange tubes **130** and the first apertures **122a** is prevented, thereby improving the service life, efficiency and performance of the heat exchanger. Further, such arrangement provides sufficient surface contact between the header **120a** and the reinforcement insert **120b** to form a robust brazing connection between the header **120a** and the reinforcement insert **120b.** Furthermore, the reinforcement inserts **120b** are so formed that there is smooth change of cross section of the inserted heat exchange tubes **130** and lower notch coefficient at the connection between the heat exchange tubes **130** and the header **120a.** More specifically, in order to avoid stress concentration at the connection between the heat exchange tubes **130** and the reinforcement inserts **120b,** sufficient contact is there between the peripheral walls **124b** around the second apertures **122b** and the heat exchange tubes **130.** Such configuration of the reinforcement insert lead to lower stress accumulation at the connection between the heat exchange tubes **130** and the header **120a.**

[0034] For assembly of the heat exchange tubes **130** to the header **120a,** the heat exchange tubes **130** are first inserted into the second apertures **122b** formed on the second face plate **140** of the reinforcement insert **120b.** Thereafter the reinforcement inserts **120b** with the heat exchange tubes **130** assembled thereto are connected to the header **120a.** Such assembly process ensures tight fit connection between the heat exchange tubes **130** and the first apertures **122a** formed on the first face plate **120** of the header **120a** and the second apertures **122b** formed on the second face plate **140** of the reinforcement insert **120b.**

[0035] Generally, the first peripheral walls **124a** and the corresponding second peripheral walls **124b** are of same height. However, based on test specification and heat exchanger operating conditions, there can be technical advantages of the first peripheral walls **124a** and the corresponding second peripheral walls **124b** being of different heights. More specifically, with the first peripheral walls **124a** and the corresponding second peripheral walls **124b** of different heights, forces are evenly distributed along entire circumference of the heat exchange tubes **130,** thereby resulting in improved heat exchange tube operation and extended service life of the heat exchanger **200.** The reinforcement inserts **120b** provides reinforcement to the heat exchange tubes **130** at critical areas and improve the peripheral stress distribution of the heat exchanger tubes **130** at the heat exchange area. Accordingly, based on the reinforcement requirements along the periphery of the heat exchange tubes **130,** the height of the first peripheral walls **124a** and the corresponding second peripheral walls **124b** is determined. In case the first peripheral walls **124a** and the corresponding second peripheral walls **124b** are of different heights, ratio of heights of the first peripheral walls **124a** and the corresponding second peripheral walls **124b** is in the range of 4:1 to 1:4. More specifically, the first peripheral wall **124a** can be longer or shorter than the second peripheral wall **124b.**

[0036] Several modifications and improvement might be applied by the person skilled in the art to a header-tank assembly as defined above, and such modifications and improvements will still be considered within the scope and ambit of the present invention, as long as the header-tank assembly comprises a tank, a header and at least one reinforcement insert.

Claims

1. A header-tank assembly (100) comprising:

- a tank (110);
- a header (120a) comprising a first face plate (120) with a plurality of first apertures (122a) formed thereon, wherein each of the first apertures (122a) comprises a first peripheral wall (124a) disposed along a periphery thereof and extending away from the header (120a), the first peripheral walls (124a) extending from a first base portion (126a); and
- at least one reinforcement insert (120b) comprising a second face plate (140) with at least one second aperture (122b) formed thereon complementary to the corresponding first apertures (122a), wherein the second aperture (122b) comprises a second peripheral wall (124b) disposed along at least a portion of a periphery thereof and extending away from the reinforcement insert (120b), the second peripheral wall (124b) extending from a second base portion (126b),

characterized in that the reinforcement insert (120b) is arranged with respect to the header (120a) such that the respective first and the second base portions (126a) and (126b) are connected to each other, while the first peripheral walls (124a) and the corresponding second peripheral walls (124b) are aligned and extend opposite to each other in fluid flow direction to form continuous tubular passages to receive corresponding heat exchange tubes (130) therein.

2. The header-tank assembly (100) as claimed in the previous claim, wherein the at least one reinforcement insert (120b) is complementary to at least a portion of the header (120a).

3. The header-tank assembly (100) as claimed in any of the preceding claims, wherein the header-tank assembly comprises multiple spaced apart reinforcement inserts (120b) connected to the header (120a), the second face plate (140) of each of the reinforcement inserts (120b) comprises different number of the second apertures (122b) formed thereon.

4. The header-tank assembly (100) as claimed in any of the preceding claims comprising a pair of reinforcement inserts (120b) disposed at extreme ends of the header (120a) and connected to the header (120a).

5. The header-tank assembly (100) as claimed in any of the preceding claims comprising a single reinforcement insert (120b) disposed with respect to, extending and connected along length of the header (120a).

6. The header-tank assembly (100) as claimed in any of the preceding claims, wherein the at least one reinforcement insert (120b) further comprises a pair of side rails (127b) disposed along longitudinal sides thereof, the pair of side rails (127b) are complementary to and adapted to be secured to longitudinal sides (127a) of the header (120a).

7. The header-tank assembly (100) as claimed in any of the preceding claims, wherein the first peripheral walls (124a) and the corresponding second peripheral walls (124b) are of same height.

8. The header-tank assembly (100) as claimed in any of the preceding claims, wherein the first peripheral walls (124a) and the corresponding second peripheral walls (124b) are of different heights, ratio of heights of the first peripheral walls and the corresponding second peripheral walls is in the range of 4:1 to 1:4.

9. The header-tank assembly (100) as claimed in any of the preceding claims, wherein the second peripheral walls (124b) extend along entire periphery of the respective second apertures (122b).

10. The header-tank assembly (100) as claimed in any of the preceding claims, wherein the second peripheral walls (124b) extend along extreme ends of the respective second apertures (122b).

11. A heat exchanger (200) comprising the header-tank assembly (100) according to any of the preceding claims.

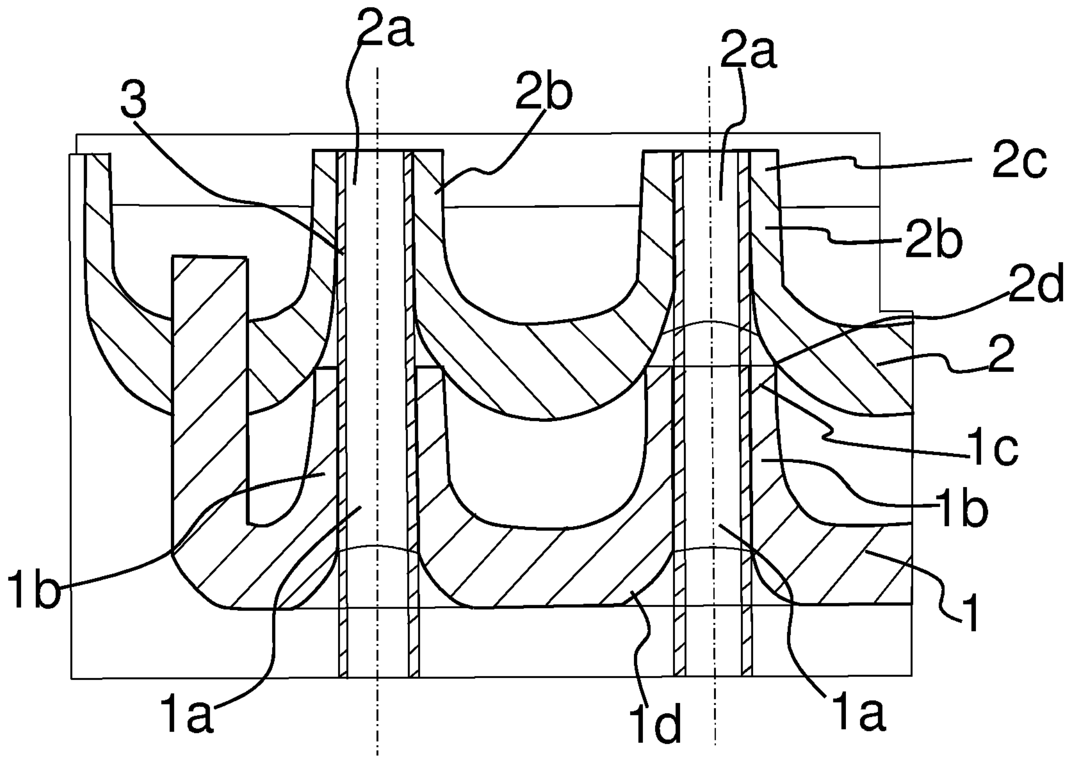

FIG. 1
(PRIOR ART)

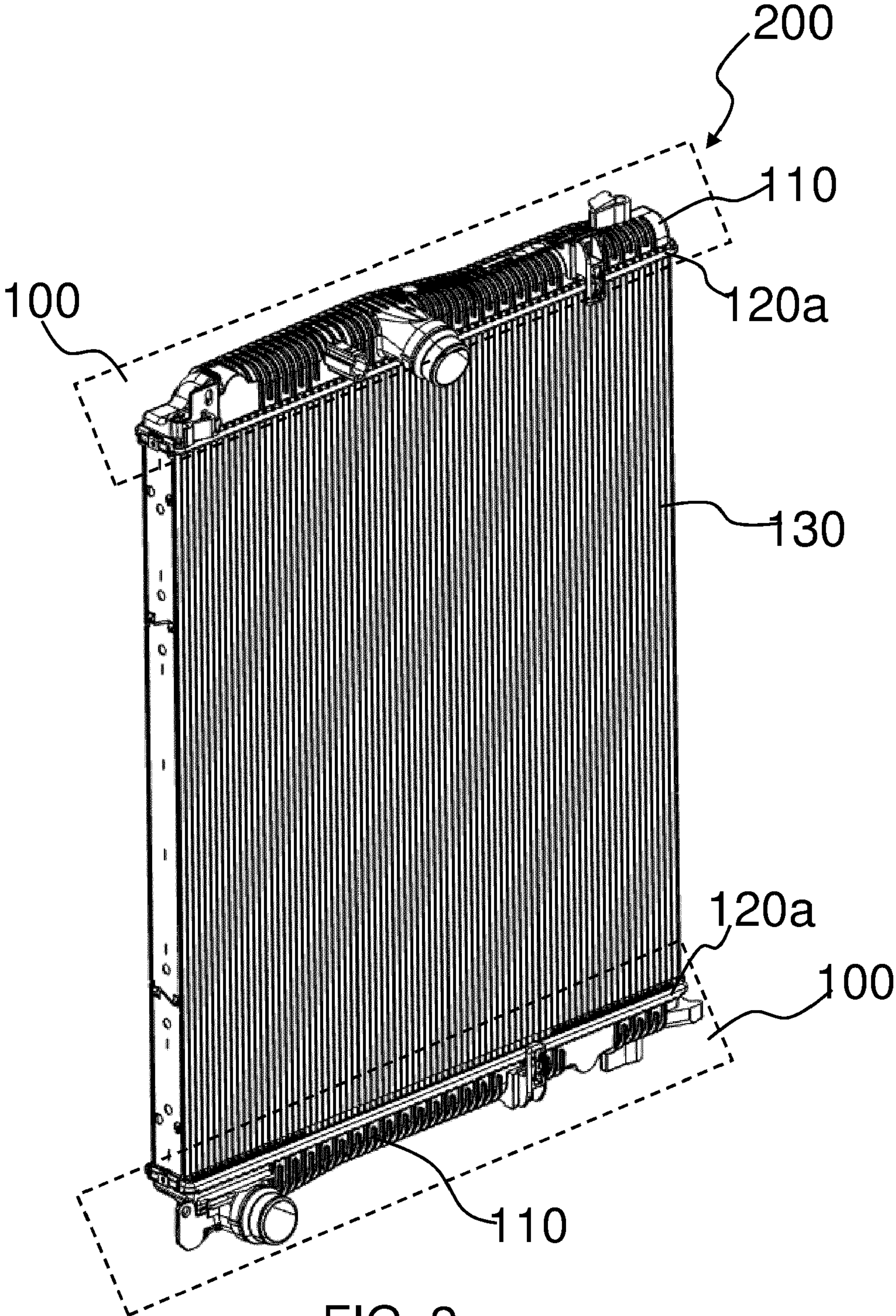

FIG. 2

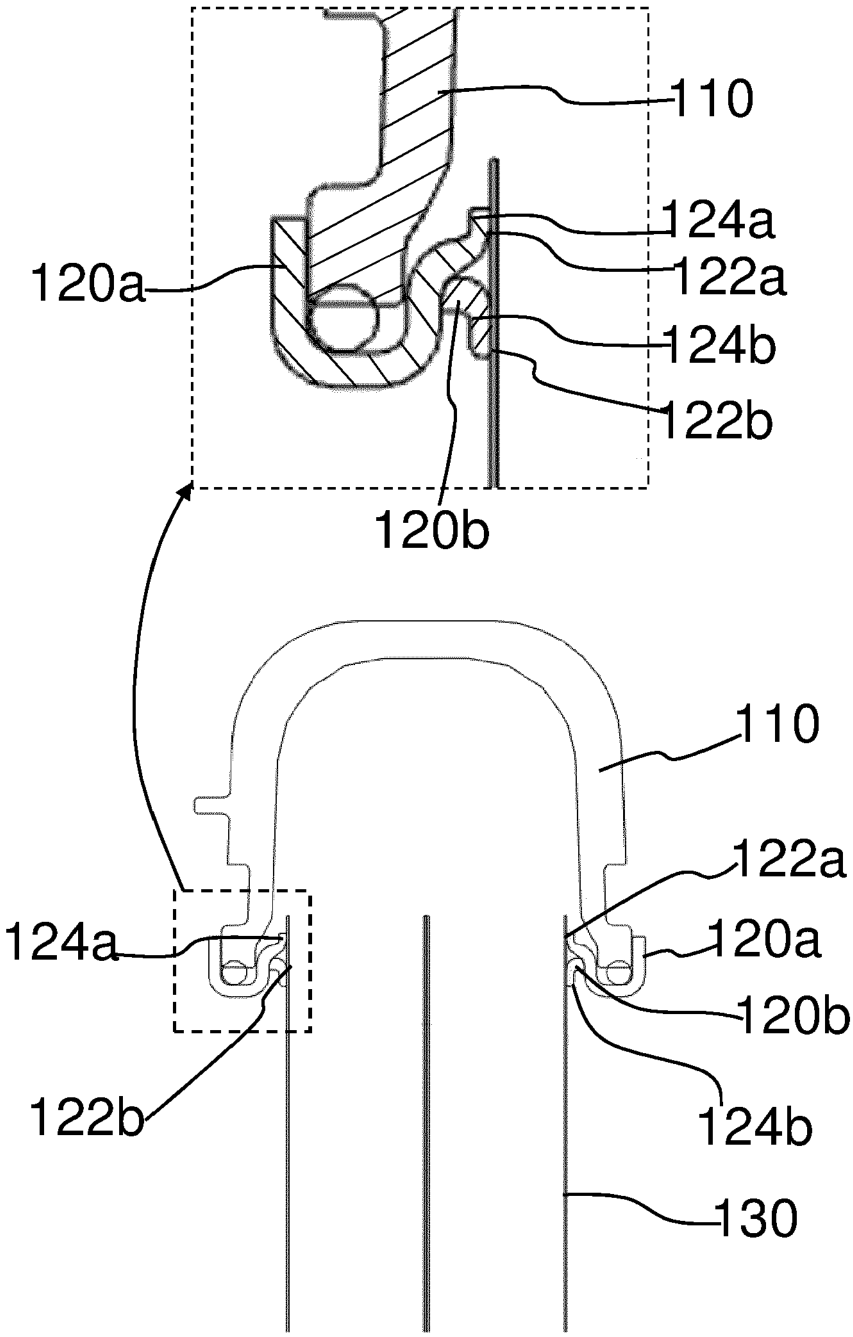
110
124a
122a
120a
124b
122b
120b
110
122a
124a
120a
120b
122b
124b
130

FIG. 3a

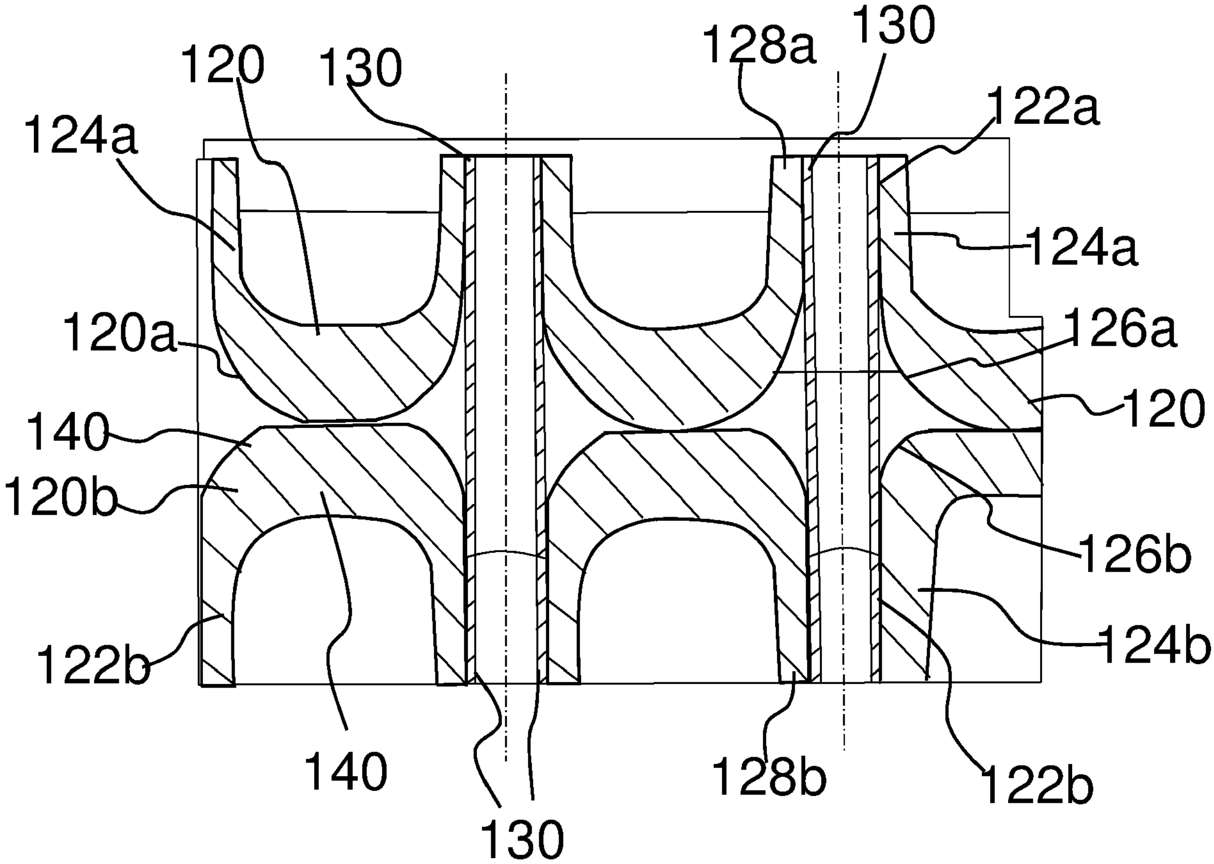
120
130
128a
130
122a
124a
124a
120a
126a
120
140
120b
126b
124b
122b
140
128b
122b
130

FIG. 3b

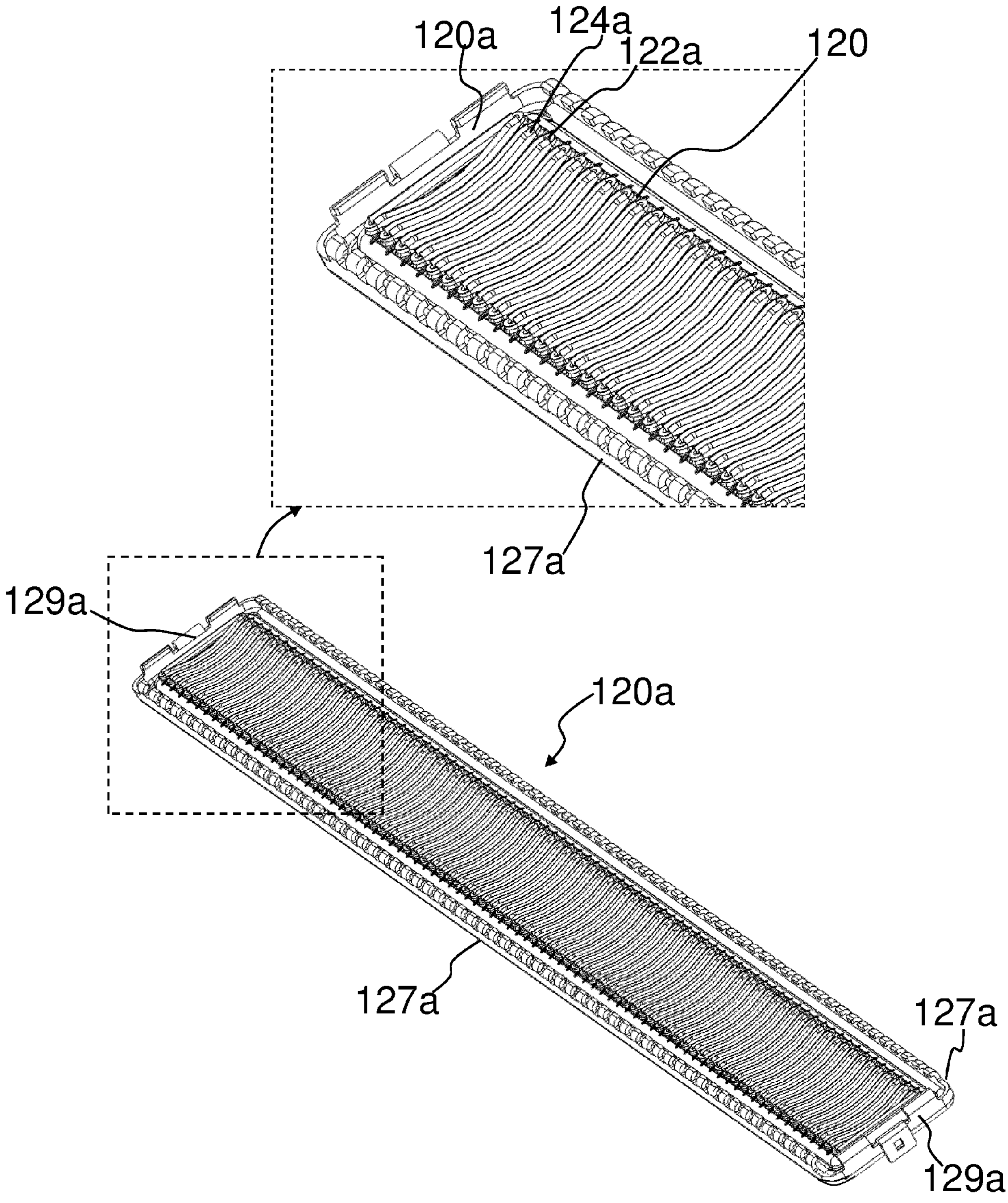

FIG. 4a

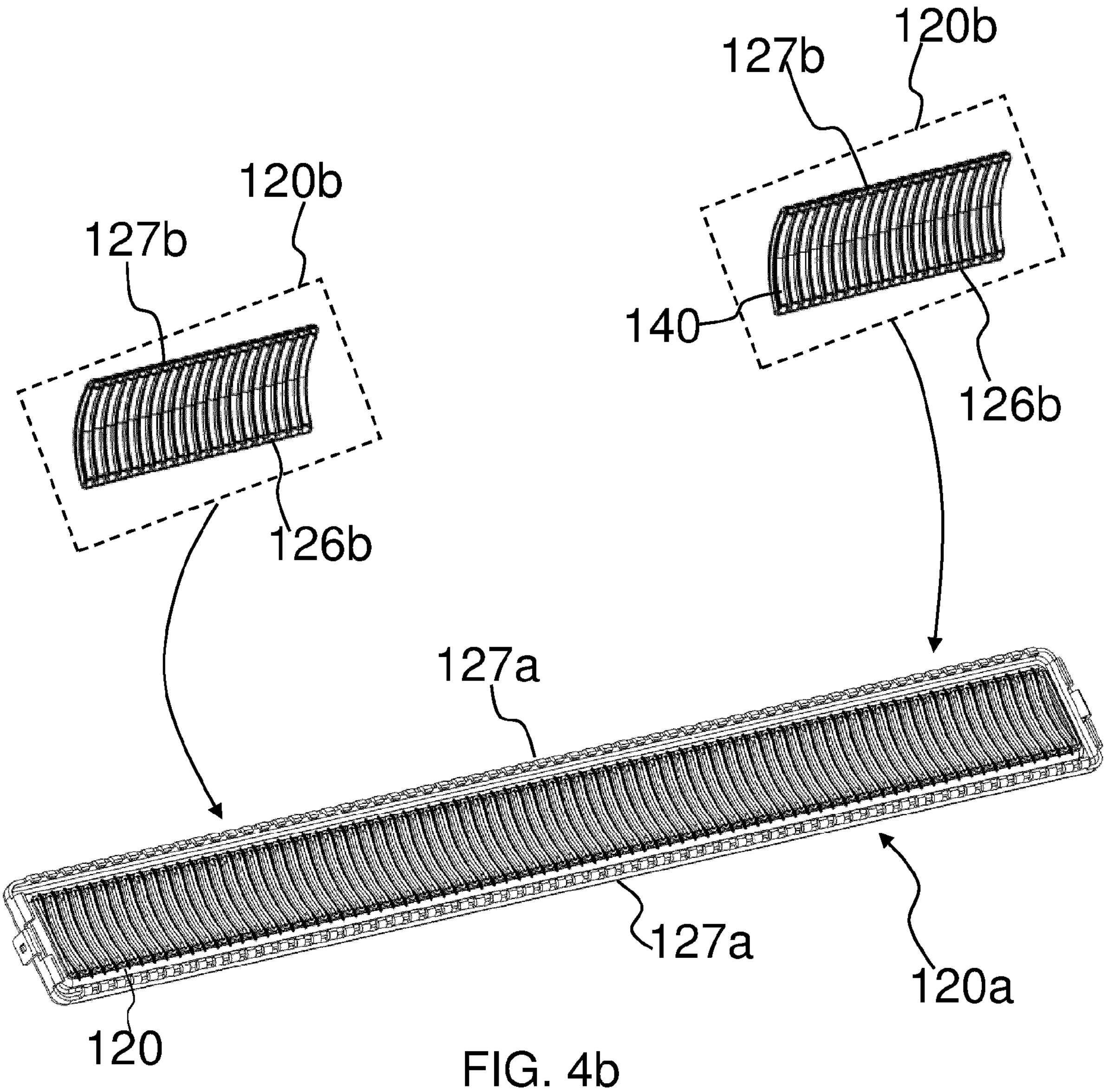
120b
127b
120b
127b
140
126b
126b
127a
127a
120a
120

FIG. 4b

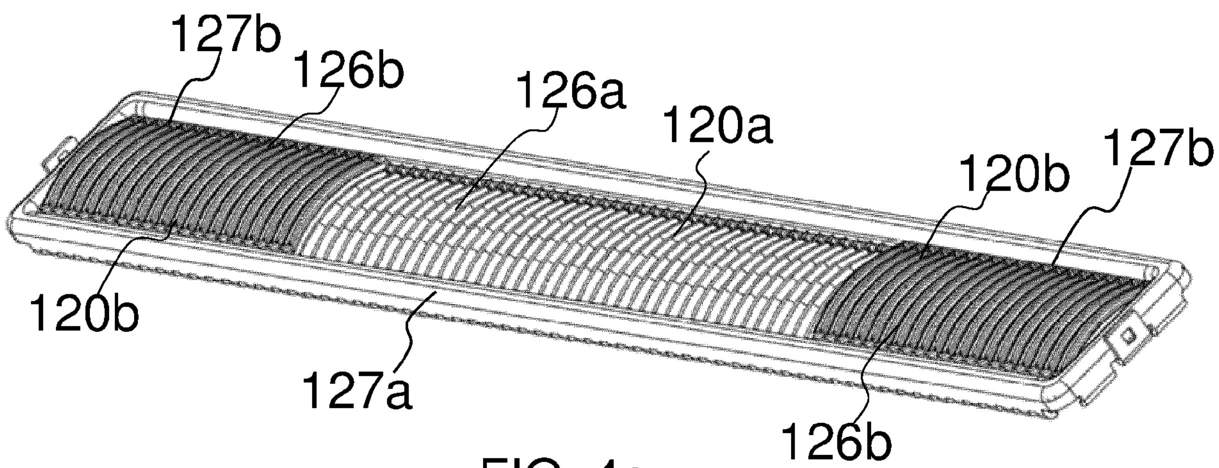
127b
126b
126a
120a
127b
120b
120b
127a
126b

FIG. 4c

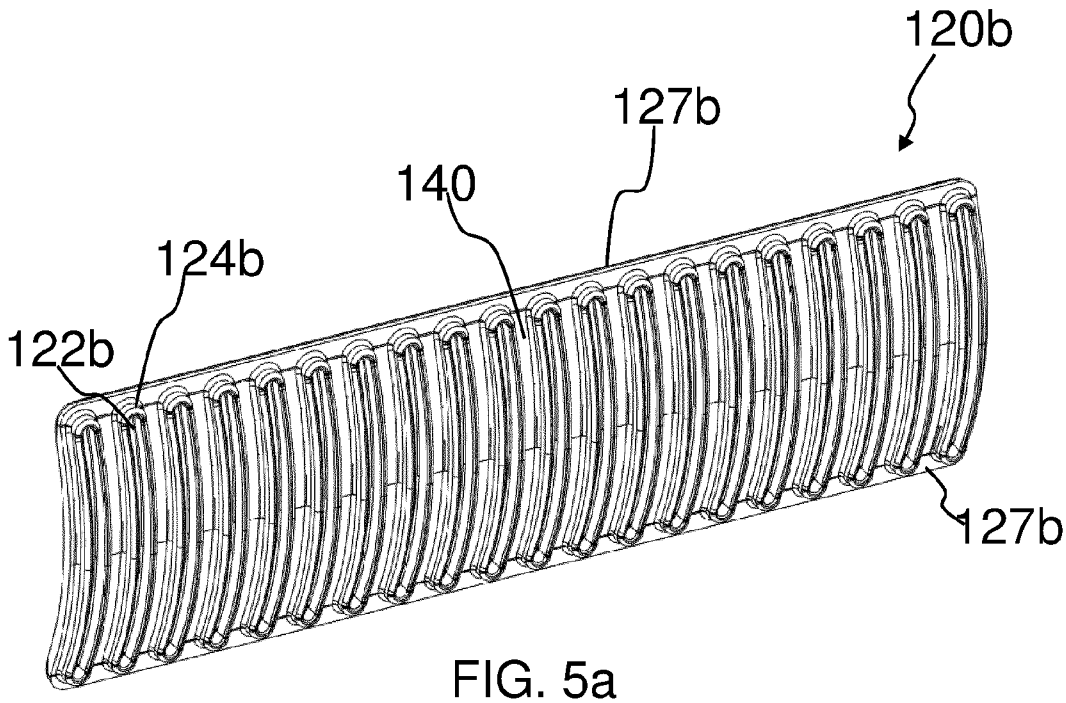

FIG. 5a

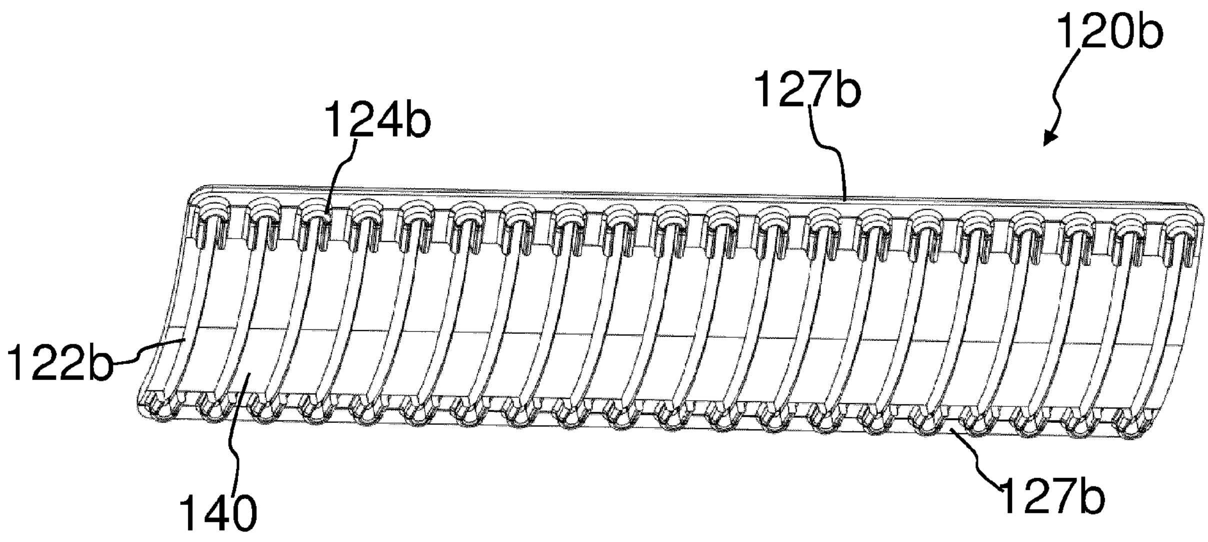

FIG. 5b

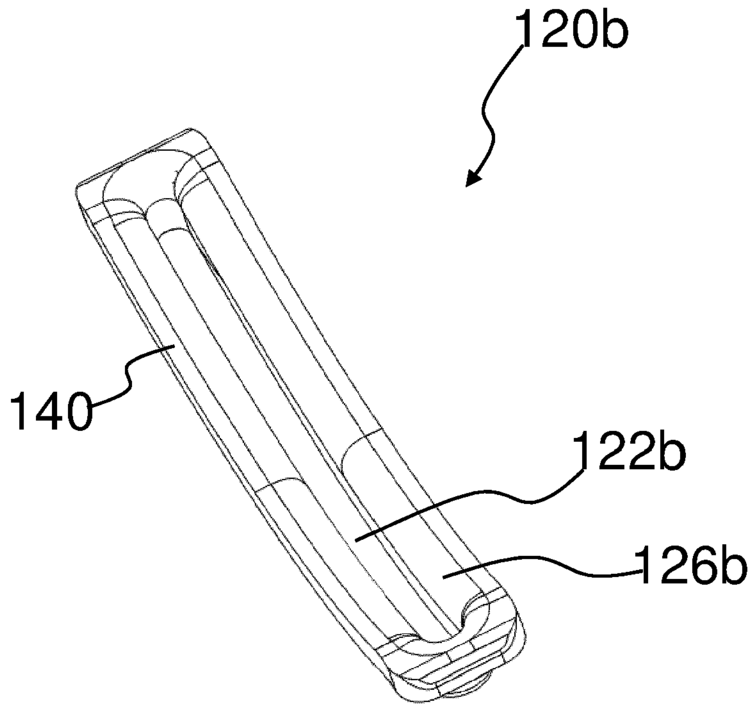

FIG. 6a

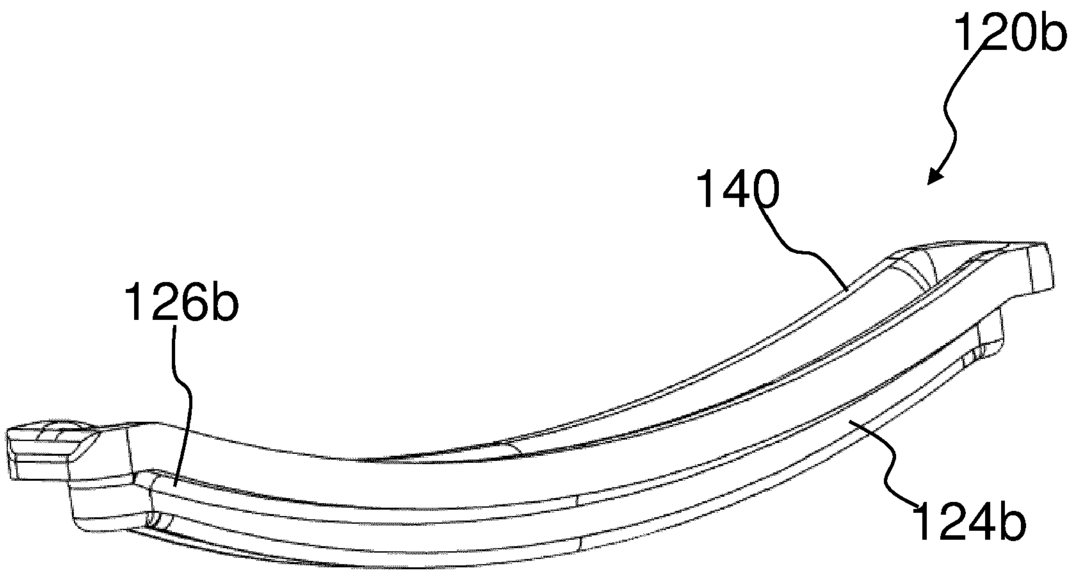

FIG. 6b

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EUROPEAN SEARCH REPORT

Application Number
EP 20 46 1543

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1

Place of search	Date of completion of the search	Examiner
Munich	16 December 2020	Merkt, Andreas

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