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(54) A PLATE FOR A HEAT EXACHANGER

(57) A plate (10, 20) for a heat exchanger (100) includes a peripheral rib (12, 22), a plurality of corrugations (14, 24), a first set of inlet and outlet holes (16a, 26a) and (16b, 26b), a second set of inlet and outlet holes (18a, 28a) and (18b, 28b) and at least one blocking element (12a, 14a, 10a, 20a, 22a, 24a). The corrugations (14, 24) formed on the plate (10, 20) in conjunction with corrugations (14, 24) formed on adjacent overlapping plates (10, 20) define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate (10, 20). The blocking element (12a, 14a, 10a, 20a, 22a, 24a) at least partially blocks gap between at least one corrugation (14, 24) and the corresponding peripheral rib (12, 22).

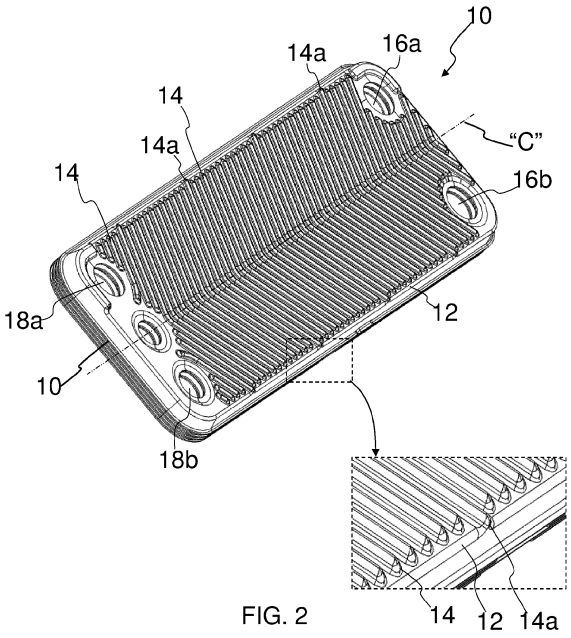

FIG. 2

EP 4 166 880 A1

Description

[0001] The present invention relates to a plate. In particular, this invention relates to a plate for a heat exchanger.

[0002] A heat exchanger 1, for example, a water cooled condenser, generally includes a plurality of heat exchange plates, particularly, a first set of plates 2 simply referred to as first plates 2 and second set of plates 3, simply referred to as second plates 3. FIG. 1a of the accompanying drawings, depicts the plate 2 of the first set of plates. The plates 2, 3 also includes corrugations 2a, 3a and peripheral ribs 2b, 3b circumscribing the corrugations 2a, 3a formed on the plates 2, 3. Generally, the first set of plates 2 and the second set of plates 3 with corresponding corrugations 2a and 3a formed thereon are stacked adjacent with respect to each other as illustrated in FIG. 1b to form a plurality of adjacent first and second fluid flow passages "a" and "b" respectively. The first and second heat exchange fluid, flows through the first and second fluid flow passages "a" and "b" respectively to cause heat exchange there-between. The first fluid flow passages "a" are in fluid communication with a first set of inlet and outlet defined by apertures 2c and 2d formed on the first set of plates 2 for ingress and egress of the first fluid with respect to the heat exchanger 1. More specifically, the first fluid enters at least one of the first fluid flow passages "a" through the first inlet and after flowing through at least one of the first fluid flow passages "a" and after undergoing heat exchange with second heat exchange fluid flowing through second fluid flow passages "b", the first fluid egresses at least one of the first fluid flow passages "a" through the first outlet. Similarly, the second fluid flow passages "b" are in fluid communication with a second set of inlet and outlet defined by apertures 3c and 3d formed on the second plates 3 for ingress and egress of the second fluid with respect to the heat exchanger 1. More specifically, the second fluid enters at least one of the second fluid flow passages "b" through the second inlet and after flowing through at least one of the second fluid flow passages "b" and after undergoing heat exchange with the first fluid, the second fluid egresses at least one of the second fluid flow passages "b" through the second outlet. The first plate 2 is configured with apertures 2e and 2f that are aligned to apertures 3c and 3d formed on the adjacent plates 3 to define the second inlet and outlet. In case the heat exchanger 1 is a water cooled, a refrigerant flows through the first fluid flow passages "a" and the coolant, particularly water flows through the second fluid flow passages "b".

[0003] Further referring to the FIG. 1b, each of the plates 2 and 3 include a plurality of corrugations 2a and 3a respectively formed thereon. The corrugations 2a formed on the plate 2 are arranged with respect to the corrugations 3a formed on the adjacent plate 3 to define the heat exchange passages "a" and "b" by the adjacent plates 2 and 3. Based on the profile of the corrugations 2a and 3a formed on the adjacent plates 2 and 3 respectively, the heat exchange passages form torturous fluid flow path between the respective adjacent plates 2 and 3 to improve heat exchange between the first and the second heat exchange fluid flowing along different sides of the plate. Generally, the corrugations 2a and 3a are formed on the plates 2 and 3 by stamping operation and are in form of depressions that are generally V-shaped. The corrugations 2a and 3a cover a major portion of the plates 2 and 3 respectively. However, due to limitation of the manufacturing process, particularly, due to limitation of the stamping operation, the corrugation 2a, 3a terminates at a distance from the peripheral rib 2b, 3b. Accordingly, the plates 2 and 3 of such configuration assembled to configure the heat exchanger 1 includes escape routes for the heat exchange fluid inherently formed thereon due to gap between extreme ends of the corrugations 2a, 3a and the peripheral rib 2b, 3b. More specifically, the escape routes cause the heat exchange fluids to bypass the first and second heat exchange passages "a" and "b" defined between the plates 2 and 3 by the corrugations 2a and 3b formed on the plates 2, 3. Accordingly, the heat exchange fluids escape through the outlets without flowing through the first and second fluid flow passages "a" and "b", thereby hampering heat exchange between the first and the second fluid flowing through the adjacent first and second fluid flow passages "a" and "b" defined by the plates 2 and 3 respectively, thereby reducing the efficiency and performance of the heat exchanger 1.

[0004] Accordingly, there is a need for a plate for a heat exchanger that improves the efficiency and performance of the heat exchanger by preventing the heat exchange fluids from bypassing the first and the second fluid flow passages and escaping through the outlets, without undergoing heat exchange. Furthermore, there is a need for a plate that directs first and second heat exchange fluids to and uniform distribution of the heat exchange fluid to the respective fluid flow passages. Further, there is a need for a heat exchange plate that is simple in construction and that improves efficiency and performance of the heat exchanger.

[0005] An object of the present invention is to provide a plate for a heat exchanger that obviates the problems arising due to heat exchange fluids bypassing the first and the second fluid flow passages and escaping though the outlets without undergoing heat exchange.

[0006] Another object of the present invention is to provide a plate for heat exchanger that is simple in construction.

[0007] Still another object of the present invention is to provide a plate for a heat exchanger that improves heat exchange between the heat exchange fluids by enhancing contact area and contact time between the heat exchanging fluids, thereby improving efficiency and performance of the heat exchanger.

[0008] 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.

[0009] A plate for a heat exchanger is disclosed in accordance with an embodiment of the present invention. The plate includes a peripheral rib, a plurality of corrugations, a first set of inlet and outlet holes and a second set of inlet and outlet holes. The peripheral rib defines the boundary of the plate. The plurality of corrugations formed within the peripheral rib of the corresponding plate. The corrugations in conjunction with corrugations formed on adjacent overlapping plates define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate, the second fluid flow passages "B" being adjacent to the first fluid flow passages "A". The first set of inlet and outlet holes define a first inlet and outlet that are in fluid communication with the first fluid passages "A" and the second set of inlet and outlet holes defining a second inlet and outlet are in fluid communication with the second fluid passages "B". At least one of the plates includes at least one blocking element formed thereon to at least partially block gap between at least one corrugation and the corresponding peripheral rib.

[0010] The corrugations formed on the plates are angular corrugations that are diverging from an axis "C" of the plate towards the corresponding peripheral rib.

[0011] In accordance with an embodiment of the present invention, the blocking element is extending from at least one of peripheral rib and extreme end of at least one corrugation.

[0012] Generally, the blocking element is extending from peripheral rib till extreme end of at least one corrugation.

[0013] Alternatively, the blocking element is extending from extreme end of at least one corrugation till the corresponding peripheral rib.

[0014] In accordance with still another embodiment of the present invention, the blocking element is extending from at least one of the adjacent overlapping plates and at least partially blocks gap between extreme end of at least one corrugation and the corresponding peripheral rib.

[0015] More specifically, the blocking element is inclined towards the corrugations and direct fluid to the fluid flow passages defined by the corrugations.

[0016] A heat exchanger is disclosed in accordance with an embodiment of the present invention. The heat exchanger includes a plurality of plates, a first inlet and outlet, a second inlet and outlet. The plates are stacked overlapping with respect to each other. Each of the plates includes a peripheral rib, a plurality of corrugations, a first set of inlet and outlet holes and a second set of inlet and outlet holes. The peripheral rib defines boundary of the plate. The plurality of corrugations formed on the plate in conjunction with corrugations on adjacent overlapping plate define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate, the second fluid flow passages being adjacent to the first fluid flow passages. The first inlet and outlet are defined by the first set of inlet and outlet holes. The first inlet and outlet are in fluid communication with the first fluid flow passages for ingress and egress of first fluid with respect to the first fluid passages "A". The second inlet and outlet is defined by the second set of inlet and outlet holes. The second inlet and outlet being in fluid communication with the second fluid flow passages for ingress and egress of second fluid with respect to the second fluid passages "B". At least one of the plates includes at least one blocking element formed thereon to at least partially block gap between extreme end of at least one corrugation and the corresponding peripheral rib.

[0017] Generally, the first set of inlet and outlet is defined by aligning a first set of inlet and outlet holes formed on the respective adjacent plates.

[0018] Similarly, the second set of inlet and outlet is defined by aligning a second set of inlet and outlet holes formed on the respective adjacent plates.

[0019] 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 a conventional plate of a first set of plates of a conventional heat exchanger;

FIG. 1b illustrates a schematic representation of the first set of plates and a second set of plates with corrugations formed thereon stacked with respect to each other to define first and second fluid flow passages of the heat exchanger of FIG. 1a;

FIG. 2 illustrates a schematic representation of a plate for a heat exchanger in accordance with an embodiment of the present invention, also is illustrated an enlarged view depicting at least one corrugation formed with a blocking element;

FIG. 3 illustrates a schematic representation of the first set of plates and a second set of plates in accordance with an embodiment of the present invention stacked with respect to each other to define first and second fluid flow passages, wherein gap between corrugations and corresponding peripheral rib formed on the plate is blocked by blocking elements; and

FIG. 4 illustrates an isometric view of a heat exchang-

er, particularly, a water-cooled condenser configured by assembling a plurality of plates, at least one plate being the plate of FIG. 2, the water-cooled condenser is illustrated without a top cover and a top plate to depict the plate of FIG. 2.

[0020] 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.

[0021] Although, the present invention is explained in the forthcoming description and accompanying drawings with example of a water cooled condenser used in vehicular environment, however, the present invention is not limited to any particular heat exchanger and is applicable to any other heat exchangers such as chillers, oil coolers used in vehicular or non-vehicular environments, wherein the efficiency and performance of the heat exchanger is required to be improved by improving the heat exchange between the heat exchange fluids and preventing the escape of the heat exchange fluid through the gap between extreme ends of the corrugations and the peripheral rib without undergoing heat exchange.

[0022] FIG. 1a of the accompanying drawings, depicts a plate 2 of plurality of plates of a heat exchanger 1, for example, a water-cooled condenser 1. Referring to FIG. 1b, plates 2 and 3 of the heat exchanger 1 are arranged with respect to each other to define heat exchange passages "a" and "b" on opposite sides of each of the plates 2 and 3. Particularly, corrugations 2a and 3a are formed on the central portion of the respective plates 2 and 3 of the heat exchanger 1 to define a corrugated section of the plates 2 and 3 respectively. Also respective peripheral rib 2b and 3b defines boundary of the plates 2 and 3, the peripheral rib 2b and 3b circumscribes the corrugations 2a and 3a, particularly, the corrugated section of the plates 2 and 3 respectively. The corrugations 2a and 3a and the peripheral ribs 2b and 3b are formed by the stamping operation. Due to limitation of the stamping process, the corrugations 2a and 3a terminate at a distance from the peripheral rib 2b and 3b formed on the corresponding plates 2 and 3, accordingly, a peripheral channel "c" is inherently formed around the corrugated section of each of the plates 2 and 3 between the peripheral rib 2b, 3b and the corrugated section of the plate 2, 3. More specifically, the peripheral channel "c" is formed between the corrugated section of the plates 2, 3 and the peripheral wall of the plates 2, 3. The peripheral channel "c", due to its inherent configuration, prompts flow there through, causing the heat exchange fluid to escape without flowing through the first and second fluid flow passages "a" and "b" formed by the plates 2 and 3. Particularly, velocity of flow through the peripheral channel "c" is high due to the capillary action. Accordingly, the peripheral channel "c" not only causes a major proportion of the heat exchange fluids to bypass the fluid flow passages "a" and "b" defined by the corrugations 2a and 3a formed on the adjacent plates 2 and 3, but also causes the heat exchange fluids to quickly flow there through, thereby reducing the amount of the first and second heat exchange fluids flowing through the adjacent first and second fluid flow passages "a" and "b" and hampering the heat exchange there-between. More specifically, due to the inherently formed peripheral channel "c" formed on the plate, the first fluid is not properly distributed to the first fluid flow passages "a" and the first heat exchange fluid escapes through the bypass passage formed by the peripheral channel "c" without exchanging heat with the second heat exchange fluid. Similarly, the inherently formed peripheral channel "c" prevents the second fluid from being properly distributed to the second fluid passages "b" and the second heat exchange fluid escapes through the bypass passage formed by the peripheral channel "c" without exchanging heat with the first heat exchange fluid. Particularly, the first fluid escapes through the bypass passage formed by the peripheral channel "c" inherently formed on the plates 2 instead of being distributed to the first fluid flow passages "a" for heat exchange with the second fluid flowing through second fluid flow passages "b". Similarly, the second fluid escapes through the bypass passage formed by the peripheral channel "c" inherently formed on the adjacent plates 3 instead of being distributed to the second fluid flow passages "b" for heat exchange with the first fluid flowing through first fluid flow passages "a", thereby hampering heat exchange between the first and the second fluid and reducing the efficiency and performance of the heat exchanger 1.

[0023] To overcome the above problem, the present invention envisages a plate 10, 20 as depicted in FIG. 2. The plate 10, 20 are assembled with respect to each other to configure a heat exchanger 100, for example, a water cooled condenser 100, wherein each plate is formed with at least one blocking element 12a, 14a, 10a, 20a, 22a, 24a. More specifically, the heat exchanger 100 includes a first set of plates 10 and a second set of plates 20 that are stacked alternative to each other as depicted in FIG. 3. The plate 10, 20 for the heat exchanger 100 includes a corresponding peripheral rib 12, 22, corrugations 14, 24 formed within the peripheral rib 12, 22 of the corresponding plate 10, 20, a first set of inlet and outlet holes 16a, 26a and 16b, 26b, a second set of inlet and outlet holes 18a, 28a and 18b, 28b and the blocking element 12a, 14a, 10a, 20a, 22a, 24a. The blocking element 12a, 14a, 10a, 20a, 22a, 24a, at least partially blocks gap between at least one corrugation 14, 24 and the corresponding peripheral rib 12, 22 formed on the corresponding plate 10, 20. In a preferred embodiment of the present invention, the blocking element 12a, 14a, 10a, 20a, 22a, 24a substantially blocks the gap between at least one corrugation 14, 24 and the corresponding peripheral rib 12, 22 formed on the corresponding plate 10, 20. This way, the blocking element 12a, 14a, 10a, 20a, 22a, 24a prevents first and second heat exchange fluid from by-passing the first and second fluid flow pas-

sages "A" and "B" formed by the corrugations on the plates 10, 20 and also prevents the first and second heat exchange fluid for escaping out of the heat exchanger 100 through the gap between the corrugation 14, 24 and the corresponding peripheral rib 12, 22 of the corresponding plates 10, 20 and without undergoing heat exchange in the first and second fluid flow passages "A" and "B". Also, the blocking element 12a, 14a, 10a, 20a, 22a, 24a guides the first and second heat exchange fluid to pass through first and second fluid flow passages "A" and "B", thereby enhancing surface contact and contact time between the first and the second heat exchange fluid and improving the heat exchange between the first and the second heat exchange fluids. With such configuration of the plate 10, 20 with at least one blocking element 12a, 14a, 10a, 20a, 22a, 24a formed thereon, the efficiency and performance of the heat exchanger 100 is improved.

[0024] The peripheral rib 12, 22 defines boundary of the corresponding plate 10, 20. The peripheral rib 12, 22 extends along the periphery of the corresponding plate 10, 20. The peripheral rib 12, 22 facilitates stacking of the plates in overlapping and aligned configuration with respect to each other and also prevents any leakage of the fluid. The peripheral rib 12, 22 is formed by stamping operation.

[0025] The plurality of corrugations 14, 24 are formed on the corresponding plate 10, 20 and within the peripheral rib 12, 22 of the corresponding plate 10, 20 to define the corrugated section of the plate 10, 20. The corrugations 14, 24 formed on the plate 10, 20 in conjunction with the corrugations 14, 24 formed on adjacent overlapping plates 10, 20 define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate 10, 20, the second fluid flow passages "B" being adjacent to the first fluid flow passages "A to cause heat exchange between first and second heat exchange fluid flowing through the first flow passages "A" and the second flow passages "B" sandwiched between subsequent first floe passages. More specifically, the corrugations 14 formed on the plate 10 in conjunction with the corrugations 24 formed on the plate 20

[0026] The corrugations 14, 24 are also formed along with the peripheral rib 12, 22 by stamping operation. However, the present invention is not limited to any particular method for configuring the corrugations and the peripheral rib. The corrugations 14, 24 are angular corrugations that are diverging from an axis "C" of the plate 10, 20 towards the corresponding peripheral rib 12, 22. In accordance with another embodiment, the corrugations 14, 24 are angular corrugations that are converging at an axis "C" of the plate 10, 20 from the corresponding peripheral rib 12, 22. The corrugations 14, 24 are of non-uniform length. Among the corrugations, few corrugations are comparative shorter than other corrugation. The corrugations 14, 24 can be arranged along any other profile on the plates 10, 20 with extreme ends thereof disposed near the peripheral rib 12, 22. More specifically, the present invention is not limited any particular configuration, number, spacing between the corrugations and profile followed, as long as the corrugations formed on the plate 10, 20 in conjunction with the corrugations 14, 24 formed on adjacent overlapping plates 10, 20 define tortuous fluid flow passages "A" and second fluid flow passages "B".

[0027] Each plate 10, 20 further includes the first set of inlet and outlet holes 16a, 26a and 16b, 26b defining a first inlet and outlet that are in fluid communication with the first fluid passages "A" and a second set of inlet and outlet holes 18a, 28a and 18b, 28b defining a second inlet and outlet that are in fluid communication with the second fluid passages "B. More specifically, the first set of inlet and outlet holes 16a and 16b formed on first set of plates 10 in conjunction with holes 26a, 26b formed on the adjacent second set of plates 20 define the first inlet and outlet that are in fluid communication with the first fluid flow passage "A" for ingress and egress of the first heat exchange fluid in and out from the first fluid flow passage "A". The first set of inlet and outlet holes 16a and 16b formed on the first set of plates 10 are aligned to the inlet and outlet holes 26a and 26b formed on the adjacent second set of plates 20 to define the first inlet and outlet. The inlet and outlet can be formed on the same side or on opposite sides of the heat exchanger. The position of the first set of inlet and outlet holes and the second set of inlet and outlet holes formed on the first and the second plate changes based on whether the inlet and outlet are formed on the same side or on opposite sides of the heat exchanger.

[0028] Similarly, the second set of inlet and outlet holes 28a and 28b formed on the second set of plates 20 in conjunction with holes 18a, 18b formed on the adjacent first set of plates 10 define the second inlet and outlet that are in fluid communication with the second fluid flow passage "B" for ingress and egress of the first heat exchange fluid in and out from the second fluid flow passage "B". The holes 18a and 18b formed on the first set of plates 10 are aligned to the second set of inlet and outlet holes 28a and 28b formed on the adjacent second set of plates 20 to define the second inlet and outlet.

[0029] At least one plate of the first and second set of plates 10 and 20 include a blocking element 12a, 14a, 10a, 20a, 22a, 24a formed thereon. The blocking element 12a, 14a, 10a, 20a, 22a, 24a, at least partially blocks gap between at least one corrugation 14, 24 and the corresponding peripheral rib 12, 22 formed on the corresponding plate 10, 20. More specifically, the blocking element 12a, 14a, 10a, 20a, 22a, 24a at least partially blocks gap between terminal end of the corrugation 14, 24 and the corresponding peripheral rib 12, 22 formed on the corresponding plate 10, 20. By blocking the gap between the peripheral rib 12, 22 and the extreme end of the corrugation 14, 24 formed on the corresponding plate 10, 20, the escape of the first and the second heat exchange fluid through the gap between the corrugation and of the peripheral rib 12, 22 is prevented. The blocking element

12a, 14a, 10a, 20a, 22a, 24a not only at least partially blocks the gap between the peripheral rib 12, 22 and the extreme end of the corrugation 14, 24 but also guides the first and the second heat exchange fluid to the respect first and second fluid flow passages "A" and "B" respectively. Accordingly, the plates of the present invention configured with the blocking element improves heat exchange between the heat exchange fluids flowing on opposite sides thereof by enhancing contact area and contact time between the heat exchanging fluids, thereby improving efficiency and performance of the heat exchanger.

[0030] In accordance with an embodiment of the present invention, the blocking element 12a, 22a is extending from at least one of peripheral rib 12, 22 and extreme end of at least one corrugation 14, 24 formed on the corresponding plate 10, 20. In accordance with one embodiment of the present invention, the blocking element 12a, 22a extends from the peripheral rib 12, 22 till extreme end of at least one corrugation 14, 24 formed on the corresponding plate 10, 20. Preferably, the blocking element 14a, 24a extends from extreme end of at least one corrugation 14, 24 till the corresponding peripheral rib 12, 22. Referring to FIG. 2, the blocking element 14a extends from extreme end of at least one corrugation 14 till the corresponding peripheral rib 12 formed on the plate 10. Also is depicted enlarged view depicting at least one corrugation 14 formed with the blocking element 14a. The blocking element 14a, 24a can extend from corrugations that are disposed at predetermined interval. More specifically, the corrugations 14, 24 configured with the blocking element 14a, 24a can be at uniform or non-uniform interval with respect to each other. In accordance with yet another embodiment of the present invention, the blocking element is formed of two portions, first portion of the blocking element 14a extends from extreme end of at least one corrugation 14 towards the peripheral rib 12 formed on the plate 10 and another portion of the blocking element 12a extends from the peripheral rib 12 towards extreme end of at least one corrugation 14. The first portion and the second portion of the blocking element 14a and 12a are alternatively arranged with respect to each other in order to prevent escape of the heat exchange fluid though the gap between the corrugations 14, 24 and the peripheral rib 12, 22 by configuring a torturous flow path between the corrugated section and the peripheral rib 12, 22 of the corresponding plates 10, 20. In accordance with yet another embodiment of the present invention, the blocking element 10a, 20a is extending from at least one of the adjacent plates 10, 20 towards the adjacent plate 10, 20 to at least partially block gap between extreme end of at least one corrugation 14, 24 and the corresponding peripheral rib 12, 22 formed on the corresponding plate. In one example, the blocking element 10a extends from the plate 10 of the first set of plates 10 towards the plate 20 of the second set of plates 20 or from the corrugate plate 20 to the plate 10 to at least partially block inherently formed gap between the peripheral rib 12 and extreme end of at least one corrugation 14 formed on the plate 10 to direct first heat exchange fluid towards the first fluid flow passages "A", thereby uniformly distributing the first heat exchange fluid in the first flow passages "A". Similarly in another example, the blocking element 20a can extend from the plate 20 of the second set of plates 20 towards the plate 10 of the first set of plates to at least partially block inherently formed gap between the peripheral rib 12 and extreme end of at least one corrugation 14 formed on the plate 10 to direct first heat exchange fluid towards the first fluid flow passages "A". Similarly, the blocking element can be partially formed on the plate 10 and partially formed on the plate 20, more specifically, a portion of the blocking element extends from the plate 10 towards the plate 20 and a remaining portion of the blocking element extends from the plate 20 towards the plate 10 to at least partially block inherently formed gap between the peripheral rib 12 and extreme end of at least one corrugation 14 formed on the plate 10 to direct first heat exchange fluid towards the first fluid flow passages "A". In another embodiment, the blocking element 12a, 14a, 10a, 20a, 22a, 24a is inclined towards the corrugations 14, 24 formed on the plate 10, 20 and direct fluid to the fluid flow passages defined by the corrugations 14, 24. However, the present invention is not limited to any particular configuration, shape, size, placement of the blocking element as far as the blocking element is capable of at least partially blocking the gap between the at least one corrugation 14, 24 and the corresponding peripheral rib 12, 22 formed on the corresponding plate 10, 20. By at least partially blocking the gap between the extreme end of at least one corrugation 14, 24 and peripheral rib 12, 22, the first and the second heat exchange fluid is uniformly distributed to the first and the second fluid flow passages "A" and "B" respectively. With such configuration of the heat exchanger, wherein the plates thereof are configured with at least one blocking element, the pressure drop of first fluid, for example, refrigerant across the first inlet and out is increased, similarly, the pressure drop of second fluid, for example, the coolant is also increased. Accordingly, more time is available for the heat exchange between the first fluid and the second fluid. Further, the mass flow rate of coolant and the refrigerant is increased. Accordingly, the cooling power of the heat exchanger configured with the plates in accordance with the present invention is higher than the heat exchanger configured with conventional plates.

[0031] A heat exchanger 100 is disclosed in accordance with an embodiment of the present invention. The heat exchanger 100 includes a plurality of plates 10, 20, particularly, a first set of plates 10 and a second set of plates 20, a first inlet and outlet and a second inlet and outlet. FIG. 4 illustrates an isometric view of a heat exchanger, particularly, a water-cooled condenser 100 configured by assembling a plurality of plates, at least one plate being configured with blocking element 14a. The blocking element 14a extends from at least one of the

corrugations 14 to the corresponding peripheral rib 12, in order to block the gap between the corrugation 14 and the corresponding peripheral rib 12. Referring to FIG. 4, the water-cooled condenser 100 is illustrated without a top cover and the top plate to depict the plate 10. The first set of plates 10 and the second set of plates 20 are stacked with respect to each other in an aligned and overlapping manner. Each plate 10, 20 includes a peripheral rib 12, 22, a plurality of corrugations 14, 24, a first set of inlet and outlet holes 16a, 26a and 16b, 26b, a second set of inlet and outlet holes 18a, 28a and 18b, 28b. The peripheral rib 12, 22 defines the boundary of the plate 10, 20. The corrugations 14, 24 formed on the plate 10, 20 in conjunction with corrugations 14, 24 on adjacent overlapping plate 10, 20 define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate 10, 20, the second fluid flow passages "B" being adjacent to the first fluid flow passages "A". The first inlet and outlet is defined by the first set of inlet and outlet holes 16a, 26a and 16b, 26b formed on the corresponding plate 10, 20. The first inlet and outlet is in fluid communication with the first fluid flow passages "A" for ingress and egress of first fluid with respect to the first fluid passages "A". The second inlet and outlet is defined by the second set of inlet and outlet holes 18a, 28a and 18b, 28b. The second inlet and outlet is in fluid communication with the second fluid flow passages "B" for ingress and egress of second fluid with respect to the second fluid passages "B"

[0032] The first inlet and outlet is defined by aligning a first set of inlet and outlet holes 16a, 26a and 16b, 26b formed on the respective adjacent plates 10 and 20. More specifically, the first set of inlet and outlet holes 16a and 16b formed on the first set of plates 10 are arranged alternatively with respect to the first set of inlet and outlet holes 26a and 26b formed on the second set of plates 20 to define the first inlet and outlet. The second inlet and outlet is defined by aligning the second set of inlet and outlet holes 18a, 28a and 18b, 28b formed on the respective adjacent plates 10 and 20. More specifically, the second set of inlet and outlet holes 18a and 18b formed on the first set of plates 10 are arranged alternatively with respect to the second set of inlet and outlet holes 28a and 28b formed on the second set of plates 20 to define the first inlet and outlet.

[0033] 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 plate (10, 20) for a heat exchanger (100), the plate (10, 20) comprising:

- a peripheral rib (12, 22) defining boundary of the plate (10, 20); and
- a plurality of corrugations (14, 24) formed within the peripheral rib (12, 22) of the corresponding plate (10, 20), the corrugations (14, 24) formed on the plate (10, 20) in conjunction with corrugations (14, 24) formed on adjacent overlapping plates (10, 20) define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate (10, 20), the second fluid flow passages "B" being adjacent to the first fluid flow passages "A",
- a first set of inlet and outlet holes (16a, 26a) and (16b, 26b) defining a first inlet and outlet that are in fluid communication with the first fluid passages "A" and a second set of inlet and outlet holes (18a, 28a) and (18b, 28b) defining a second inlet and outlet that are in fluid communication with the second fluid passages "B",

characterized in that at least one of the plates (10) and (20) comprises at least one blocking element (12a, 14a, 10a, 20a, 22a, 24a) formed thereon and adapted to at least partially block gap between at least one corrugation (14, 24) and the corresponding peripheral rib (12, 22).

2. The plate (10, 20) as claimed in the previous claim, wherein the corrugations (14, 24) are angular corrugations that are diverging from an axis "C" of the plate (10, 20) towards the corresponding peripheral rib (12, 22).

3. The plate (10, 20) as claimed in any of the preceding claims, wherein the blocking element (12a, 22a) is extending from at least one of peripheral rib (12, 22) and extreme end of at least one corrugation (14, 24).

4. The plate (10, 20) as claimed in any of the preceding claims, wherein the blocking element (12a, 22a) is extending from peripheral rib (12, 22) till extreme end of at least one corrugation (14, 24).

5. The plate (10, 20) as claimed in any of the preceding claims, wherein the blocking element (14a, 24a) is extending from extreme end of at least one corrugation (14, 24) till the corresponding peripheral rib (12, 22).

6. The plate (10, 20) as claimed in any of the preceding claims, wherein the blocking element (10a, 20a) is extending from at least one of the adjacent plates (10, 20) and adapted to at least partially block gap between extreme end of at least one corrugation (14, 24) and the corresponding peripheral rib (12, 22) formed on one of the adjacent plates (10) and (20).

7. The plate (10, 20) as claimed in any of the preceding claims, wherein the blocking element (12a, 14a, 10a,

20a, 22a, 24a) is inclined towards the corrugations (14, 24) and direct fluid to the fluid flow passages defined by the corrugations (14, 24).

8. A heat exchanger (100) comprising:

- a plurality of plates (10) and (20) stacked overlapping with respect to each other, each plate (10, 20) comprising: ;
  - a peripheral rib (12, 22) defining boundary of the plate (10, 20); and
  - a plurality of corrugations (14, 24) formed thereon in conjunction with corrugations (14, 24) on adjacent overlapping plate (10, 20) define first fluid flow passages "A" and second fluid flow passages "B" on opposite sides of the plate (10, 20), the second fluid flow passages "B" being adjacent to the first fluid flow passages "A";
  - a first set of inlet and outlet holes (16a, 26a) and (16b, 26b) and a second set of inlet and outlet holes (18a, 28a) and (18b, 28b),
- a first inlet and outlet defined by the first set of inlet and outlet holes (16a, 26a) and (16b, 26b), the first inlet and outlet being in fluid communication with the first fluid flow passages for ingress and egress of first fluid with respect to the first fluid passages "A";
- a second inlet and outlet defined by the second set of inlet and outlet holes (18a, 28a) and (18b, 28b), the second inlet and outlet being in fluid communication with the second fluid flow passages for ingress and egress of second fluid with respect to the second fluid passages "B",

characterized in that at least one of the plates (10) and (20) comprises at least one blocking element (12a, 14a, 10a, 20a, 22a, 24a) formed thereon and adapted to at least partially block gap between extreme end of at least one corrugation (14, 24) and the corresponding peripheral rib (12, 22).

9. The heat exchanger (100) as claimed in the previous claim, wherein the first inlet and outlet is defined by aligning a first set of inlet and outlet holes (16a, 26a) and (16b, 26b) formed on the respective adjacent plates (10) and (20).

10. The heat exchanger (100) as claimed in any of the preceding claims, the second inlet and outlet is defined by aligning the second set of inlet and outlet holes (18a, 28a) and (18b, 28b) formed on the respective adjacent plates (10) and (20).

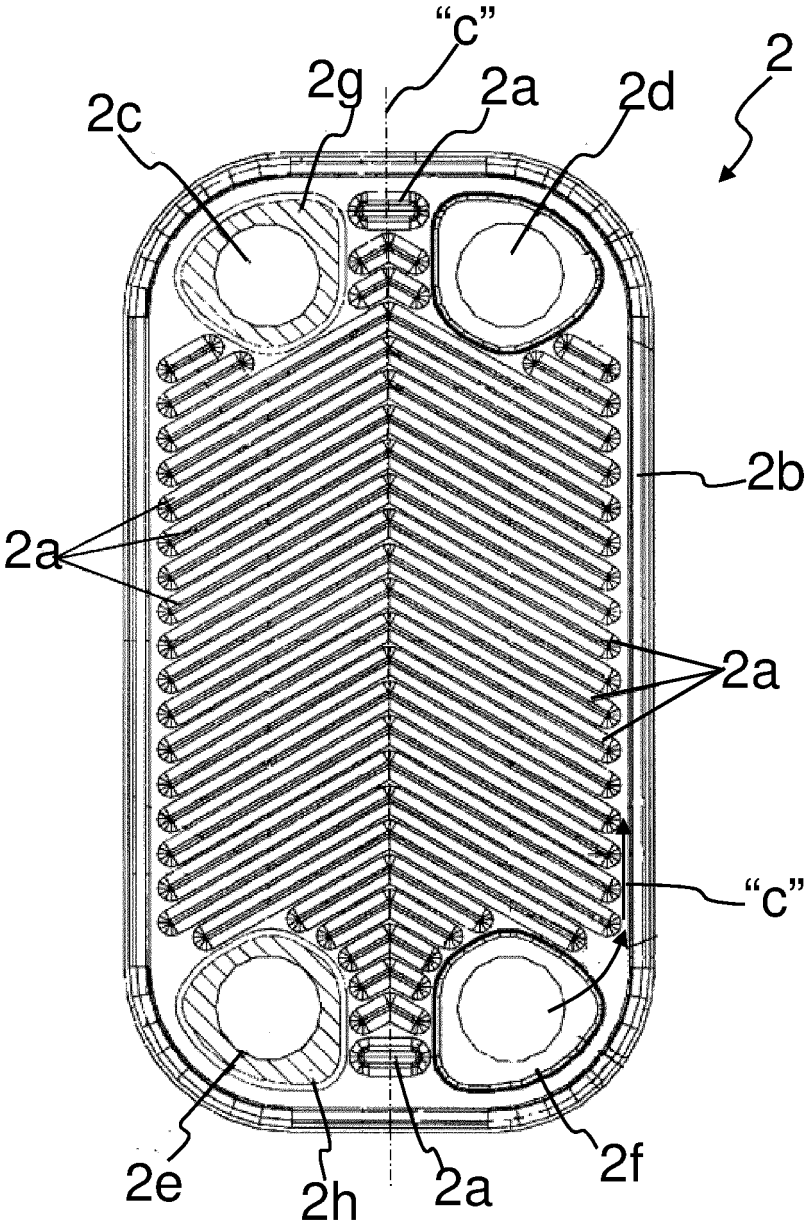

FIG. 1a
(PRIOR ART)

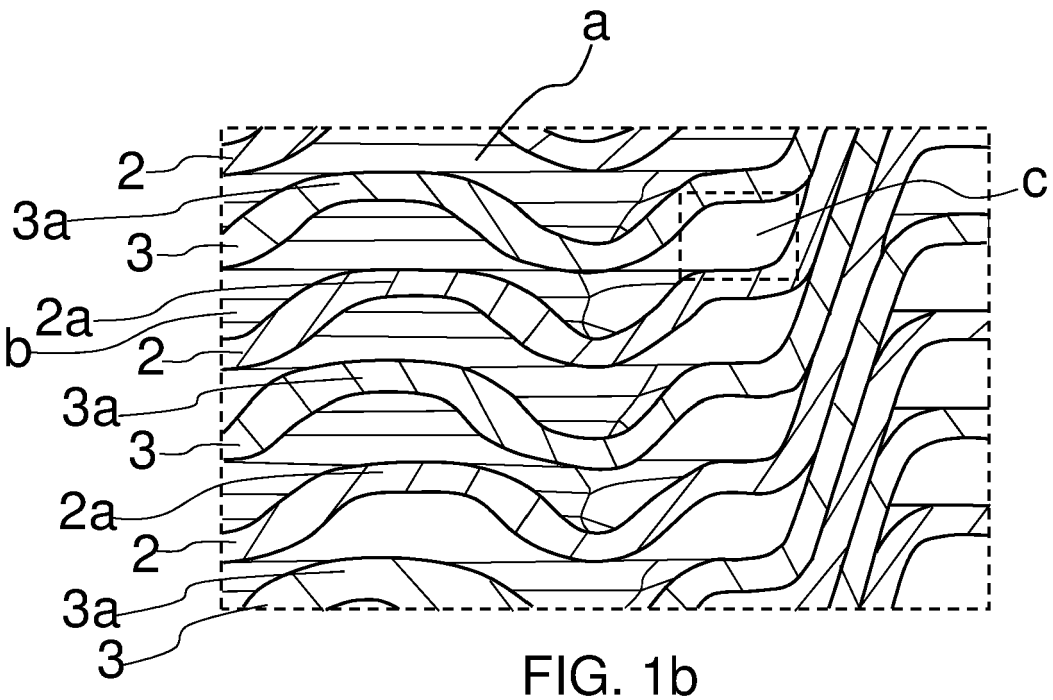

FIG. 1b
(PRIOR ART)

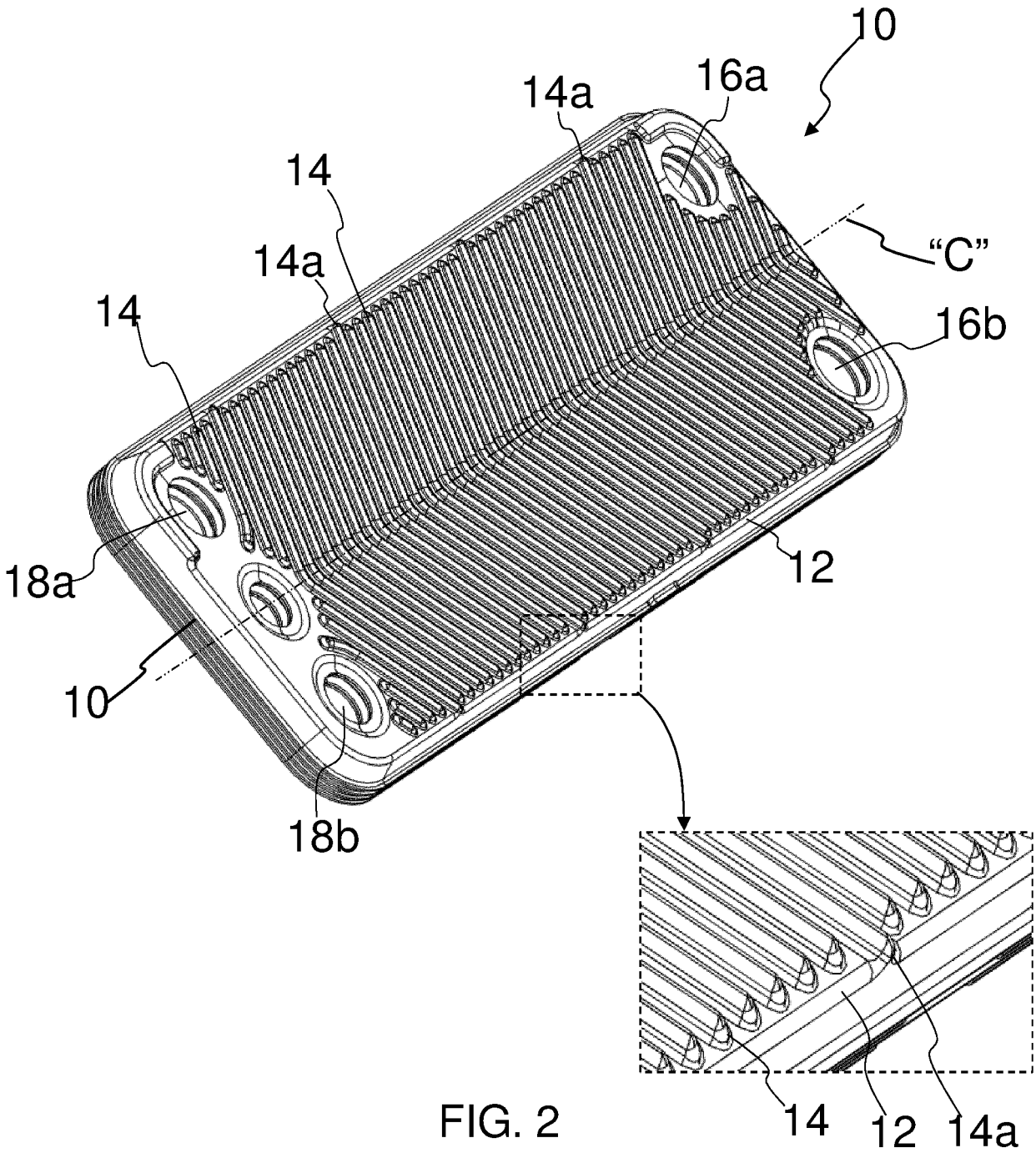

FIG. 2

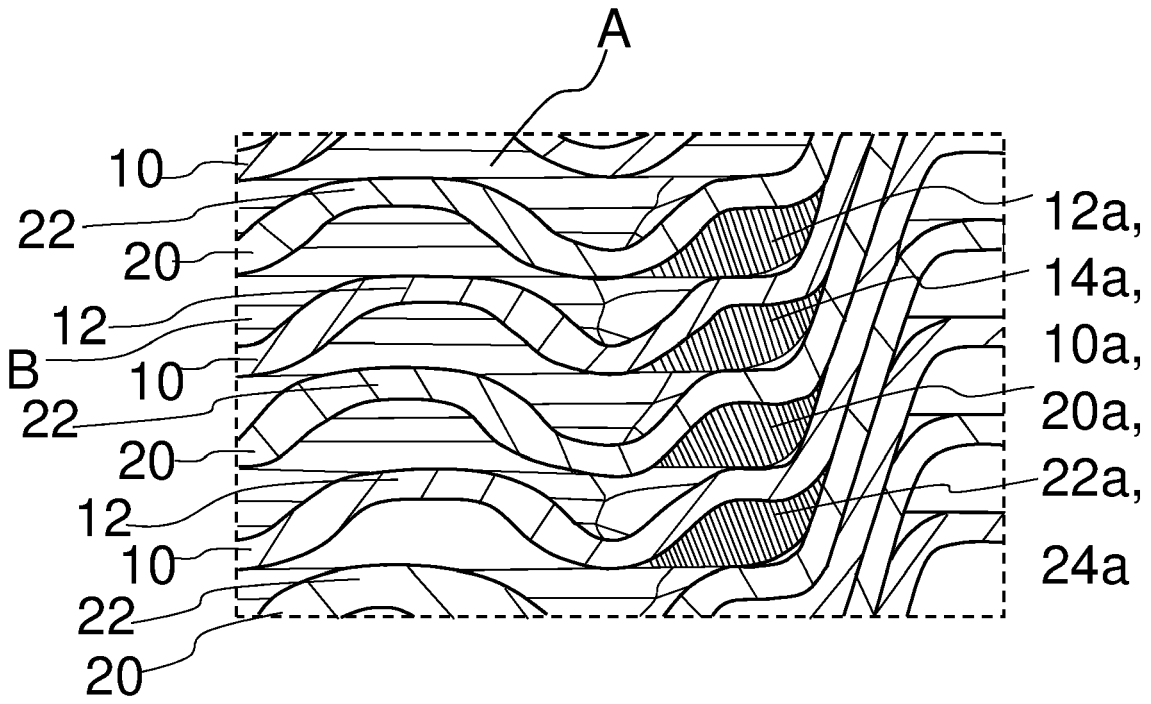

FIG. 3

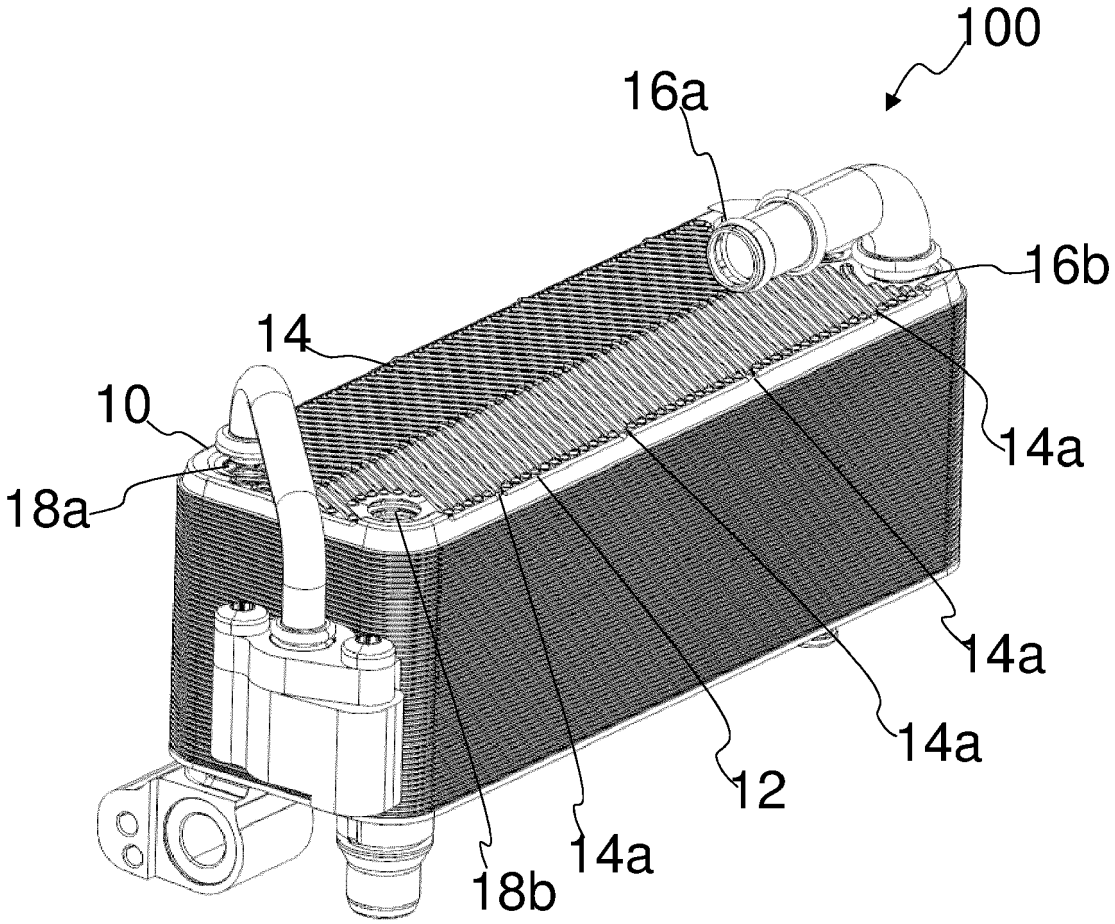

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 2173

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1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 March 2022	Vassoille, Bruno

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