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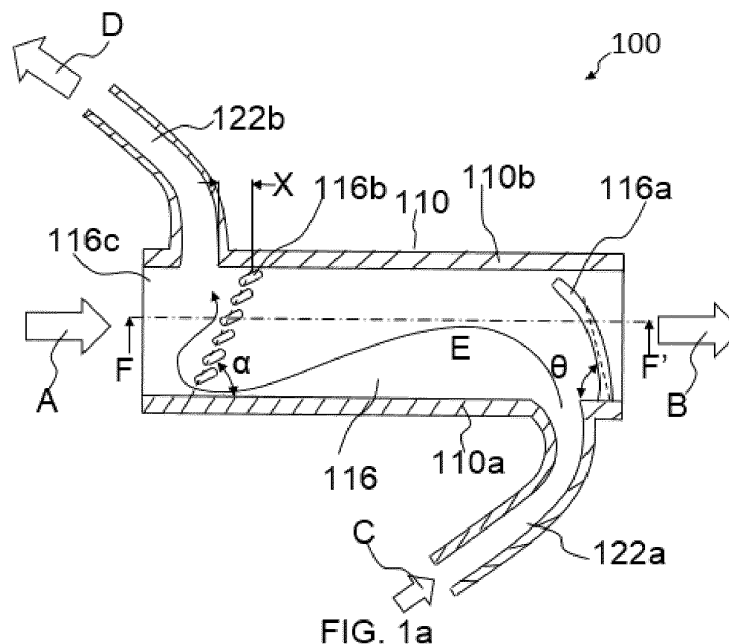
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(54) **EXHAUST GAS RE-CIRCULATION COOLER**

(57) An EGR cooler includes plates received inside a housing. The housing includes gas inlets and gas outlets, a coolant inlet and a coolant outlet. The gas inlets and the gas outlets are fluidically connected to each other by gas passages defined by the plates. The coolant inlet and the coolant outlet is for ingress of coolant inside the housing and around the gas passages and egress of the coolant from inside the housing respectively. The coolant

inlet and outlet are arranged with respect to the gas inlets outlets to define cross flow configuration between coolant flow and gas flow. At least one of the plates includes at least one first guide formed on a coolant flow side thereof and disposed near the coolant inlet and an array of second guides formed on the coolant flow side thereof and disposed near coolant outlet.



Description

[0001] The present invention relates to a heat exchanger, particularly to a thermal management system for an Exhaust Gas Re-circulation (EGR) cooler.

State of the art

[0002] An Exhaust Gas Re-circulation (EGR) cooler, hereinafter referred to as EGR cooler, receives exhaust gases from an engine and cools the exhaust gases before the exhaust gases are recirculated back to the engine's cylinder. By re-circulating the engine's exhaust gas back to the engine's cylinder, the peak in-cylinder temperatures are regulated, specifically lowered to reduce formation of NOx gases. The EGR cooler further reduces the combustion chamber temperature, thereby preventing valve clatter, detonation and further reduces NOx formation. As a result, the EGR cooler substantially reduces vehicle emissions to enable meeting stringent vehicular exhaust emission norms prevalent in most parts of the world.

[0003] Generally, in an EGR cooler, exhaust gas is received in a tank and from the tank, the exhaust gas is delivered to and passes through heat exchange tubes received inside a housing. Also, coolant is delivered inside the housing and around the heat exchange tubes by a coolant inlet pipe, with a diverging tank disposed between the coolant inlet pipe and the housing. The diverging tank is used to smooth transition of coolant flow from the coolant inlet pipe to the inside of the housing to improve coolant distribution inside the housing and around the heat exchange tubes. Uniform distribution of the coolant inside the housing and around the heat exchange tubes is necessary to achieve efficient heat exchange between the exhaust gas passing through the heat exchange tubes and the coolant flowing around the heat exchange tubes to achieve cooling of the exhaust gas and reducing the temperature of the exhaust gas. However, the need for the tank between the coolant inlet pipe and the housing increases the overall size and cost of the EGR cooler.

[0004] The coolant inlet is disposed at sidewall of the EGR cooler. The EGR cooler handles high temperature exhaust gases in the temperature range of 400 to 900 °C. Accordingly, temperatures at certain critical regions inside the EGR cooler, particularly, at a gas inlet area of the heat exchange tubes, that first comes into contact with the exhaust gas exceeds acceptable limits, sometimes reaches 850 °C and cause formation of hot spots. The hot spots at the gas inlet area cause problems such as boiling of the coolant, durability issues and excessive thermo-dynamical stresses at the gas inlet area. To avoid such problems, the coolant from the coolant inlet directed to the gas inlet area of the heat exchange tubes cools of the gas inlet area. However, coolant flow reaching the gas inlet area is required to be homogeneous, i.e. velocity of coolant reaching the gas inlet area is required to be

the same across all heat exchange elements for achieving effective cooling at the gas inlet region. In case of EGR cooler with parallel flow configuration, the coolant inlet and the gas inlet region are close to each other, as such the coolant flow does not get enough time to homogenize as the coolant reaches the gas inlet area and as such the coolant flow is not homogenized. Accordingly, EGR cooler with counter flow configuration is generally preferred over parallel flow configuration, wherein the coolant inlet is disposed away from the gas inlet area of the heat exchange tubes and the coolant flow gets time to homogenize before reaching the gas inlet area. However, in case the EGR cooler with counter flow configuration, the coolant entering the housing through the coolant inlet strikes inside walls of the housing, loses velocity and remains unguided and as such fails to reach the critical regions such as the gas inlet area. Generally, a baffle used for guiding and directing the coolant to the gas inlet area is an additional component and packaging thereof within limited space inside the housing is a problem. Furthermore, the conventional baffle fails to effectively regulate distribution and velocity of coolant directed to the gas inlet area. The conventional baffle is a dedicated component and as such there are product costs, inventory costs and process costs associated with configuring the baffle.

[0005] Accordingly, there is a need for an EGR cooler configured with an arrangement to effectively direct coolant to a gas inlet area of the EGR cooler, thereby preventing high temperature hot spots at the gas inlet area and accordingly addressing issues such as boiling of coolant, durability issues and excessive thermo-dynamical stresses at the gas inlet area. Still further, there is a need for an EGR cooler that ensures that coolant flow reaching the gas inlet area is homogeneous to ensure efficient cooling of the gas inlet area. Furthermore, there is a need for an EGR cooler that ensures that coolant after entering the housing is having sufficient velocity to reach the gas inlet area. Further, there is a need for an EGR cooler with an arrangement to effectively direct coolant to a gas inlet area formed by modifying an existing part of the EGR cooler, thereby eliminating the need for additional components and reducing product and process costs associated with configuring such an arrangement. Further, there is a need for an EGR cooler that exhibits extended service life, improved reliability and efficiency.

Description of the invention

[0006] An object of the present invention is to provide an EGR cooler that obviates the drawbacks associated with conventional EGR cooler that fails to effectively regulate distribution and velocity of coolant directed to a gas inlet area.

[0007] Another object of the present invention is to provide an EGR cooler configured with an arrangement to effectively direct coolant to a gas inlet area of the EGR

cooler, thereby preventing high temperature hot spots at the gas inlet area and accordingly addressing issues such as boiling of coolant, durability issues and excessive thermo-dynamical stresses at the gas inlet area.

[0008] Still another object of the present invention is to provide an EGR cooler that ensures that coolant after entering the housing is having sufficient velocity to reach the gas inlet area.

[0009] Yet another object of the present invention is to provide an EGR cooler with an arrangement to effectively direct coolant to a gas inlet area formed by modifying an existing part of the EGR cooler, thereby eliminating the need for additional components and reducing product and process costs associated with configuring such arrangement.

[0010] Another object of the present invention is to provide an EGR cooler that exhibits extended service life, improved reliability and efficiency.

[0011] 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.

[0012] A heat exchanger, particularly, a plate type Exhaust Gas Re-circulation (EGR) cooler is disclosed in accordance with an embodiment of the present invention. The plate type Exhaust Gas Re-circulation (EGR) cooler includes a housing that includes a plurality of first fluid inlets and first fluid outlets, a second fluid inlet and a second fluid outlet. The first fluid inlets and the first fluid outlets are fluidically connected to each other by first fluid passages defined by plates received in the housing. The first fluid passages near the first fluid inlets define first fluid inlet area. The second fluid inlet is for ingress of the second inside the housing and around the first fluid passages. The second fluid outlet is for egress of second from inside the housing. The second fluid inlet and the second fluid outlet are arranged with respect to the first fluid inlets and the first fluid outlets to define cross flow configuration between second fluid flow and first fluid flow. A second fluid flow side of at least one of the plates includes at least one first guide and an array of second guides. The at least one first guide is disposed near the second fluid inlet to prevent second fluid entering the housing from striking inside walls of housing. The array of second guides is disposed near second fluid outlet to direct the second fluid to the first fluid inlet area.

[0013] Generally, the at least one first guide is of either one of linear and curved profile.

[0014] Specifically, the at least one first guide is a single guide that is inclined at an angle θ with respect to a first sidewall.

[0015] Alternatively, the at least one first guide includes an array of guides arranged along a first profile that is

inclined at an angle θ with respect to the first sidewall.

[0016] Generally, the at least one first guide is formed by at least one of stamping, punching and embossing operation.

[0017] Specifically, the angle θ is in range of 90 to 0 degrees.

[0018] Generally, the array of second guides are arranged along a second profile that is diverging away from the first fluid inlets in direction of flow of second fluid towards the second fluid outlet and that terminates upstream of the second fluid outlet.

[0019] Alternatively, the second profile is parallel to the first fluid inlets.

[0020] Specifically, the array of guides are in form of dimples formed by stamping operation.

[0021] Specifically, the second profile is inclined at an angle α with respect to the first sidewall, wherein the angle α is in range of 90 to 15 degrees.

[0022] 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.

Brief description of the drawings

[0023]

FIG. 1a illustrates an EGR cooler in accordance with an embodiment of the present invention, particularly, FIG. 1a illustrates a sectional view depicting details of a plate of a plurality of plates received inside a housing of the EGR cooler;

FIG. 1b illustrates a sectional view of the EGR cooler along section plane F-F' of FIG. 1a;

FIG. 2 illustrates a sectional view depicting details of a plate of a plurality of plates received inside a housing of an EGR cooler in accordance with an embodiment of the present invention, wherein guides are formed only on one side of the plate;

FIG. 3 illustrates a sectional view depicting details of a plate of a plurality of plates received inside a housing of an EGR cooler in accordance with another embodiment of the present invention, wherein guides are formed only on both sides of the plate;

FIG. 4 illustrates a sectional view depicting details of a plate of a plurality of plates received inside a housing of an EGR cooler in accordance with yet another embodiment of the present invention;

FIG. 5 illustrates a sectional view depicting details

of a plate of a plurality of plates received inside a housing of an EGR cooler in accordance with still another embodiment of the present invention; and

FIG. 6 illustrates an isometric view of the plate received inside the housing of the EGR cooler of FIG. 1a and FIG. 1b.

[0024] 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.

Description of a preferred embodiment

[0025] The present invention relates to a thermal management system for an Exhaust Gas Re-circulation (EGR) cooler, specifically, the present invention relates to a plate type EGR cooler with counter flow configuration, wherein at least one plate of the plurality of plates received inside the housing is configured with at least one first guide and an array of second guides. The at least one first guide prevents coolant entering inside a housing from striking inside walls of the housing, thereby maintaining velocity of coolant flow sufficient enough to reach gas inlet area for cooling thereof in spite of the EGR cooler with counter flow configuration. The array of second guides directs coolant to the gas inlet area. Such configuration of at least one first guide and the array of guide addresses issues such as boiling of coolant, durability issues and excessive thermo-dynamical stresses, arising due to hot spots forming at the gas inlet area of the EGR cooler. Although, the at least one first guide and the array of guides formed on at least one plate of the plurality of plates disposed inside housing of EGR cooler of the present invention is used for directing coolant to the gas inlet area of the EGR cooler to achieve cooling of the gas inlet area. However, the at least one first guide and the array of second guides formed on at least one plate of the EGR cooler the present invention is also applicable for any other applications, where coolant or any other fluid is directed to and required to reach a particular region that is exposed to hot fluid and is required to be cooled.

[0026] FIG. 1a illustrates a plate type heat exchanger, particularly, a plate type EGR cooler 100 in accordance with an embodiment of the present invention. More Specifically, FIG. 1a illustrates a sectional view depicting details of a plate 116 of a plurality of plates 116 received inside a housing 110 of the EGR cooler 100.

[0027] The housing 110 includes a pair of opposite longitudinal walls 110a and 110b, a top wall 110c and a bottom wall 110d and a pair of opposite lateral walls. The pair of opposite lateral walls connect the pair of opposite longitudinal walls 110a and 110b and the top wall 110c to the bottom wall 110d. The housing 110 further includes a plurality of first fluid inlets, particularly, gas inlets 112a

and a plurality of first fluid outlets, particularly, gas outlets 112b formed on the opposite lateral walls. The gas inlets 112a and the gas outlets 112b are fluidically connected to each other by gas passages 114 defined by the plurality of plates 116 received in the housing 110. FIG. 1b depicts the flow of the exhaust gases through the gas passages 114. The exhaust gas to be cooled enters the gas passages 114 through the gas inlets 112a by flowing along flow direction depicted by arrow A, thereafter the exhaust gas flows through the gas passages 114 along direction depicted by arrows 114a in the process rejecting heat to the coolant flowing around the gas passages 114. The exhaust gases after rejecting heat to the coolant flowing around the gas passages 114 egresses through the gas outlets 112b by flowing along flow direction depicted by arrow B. The gas passages near to and connected to the gas inlets 112a define gas inlet area 116c. The housing 110 further includes a second fluid inlet, particularly, coolant inlet 122a and a second fluid outlet, particularly, coolant outlet 122b formed on the opposite longitudinal walls 110a and 110b. The coolant inlet 122a is in fluid communication with interior of the housing 110 for ingress of coolant inside the housing 110 and around the gas passages 114. The FIG. 1a, FIG. 2, FIG. 3, FIG. 4 and FIG. 5 depict the ingress and egress of the coolant into and out of the housing 110 respectively. More specifically, the coolant enters inside the housing 110 and around the gas passages 114 through the coolant inlet 122a by flowing along flow direction depicted by arrow C. Each of the plates 116 include a coolant flow side and a gas flow side, wherein the gas flows in the direction depicted by arrow 114a along the gas flow side of the plates 116 and the coolant flows in direction depicted by arrow 114b along the coolant flow side of the plates 116. The coolant entering inside the housing 110 flows around the gas passages 114 along the direction depicted by arrows 114b that is opposite to the direction 114a of flow of the exhaust gases, in the process the coolant extracts heat from the exhaust gases flowing through the gas passages 114. The coolant outlet 122b is for egress of coolant from inside the housing 110. More specifically, the coolant after extracting heat from the exhaust gases flowing through the gas passages 114 egresses out of the housing 110 through the coolant outlet 122b by flowing along flow direction depicted by arrow D. The gas flow through the gas passages 114 and the coolant flow around the gas passages 114 forms independent circuits, while still providing sufficient surface area of heat exchange between the coolant and the exhaust gas. The coolant inlet 122a and coolant outlet 122b are arranged with respect to the gas inlets 112a and the gas outlets 112b to define cross flow configuration between coolant flow and gas flow in the EGR cooler. More specifically, in the counter flow configuration of coolant and gas flow through the EGR cooler 100, the coolant inlet 122a is disposed near gas outlets 112b, whereas the coolant outlet 122b is disposed near the gas inlets 112a.

[0028] Generally, a diverging tank that is diverging

along flow direction is disposed between the coolant inlet 122a and an interior of the housing 110 to achieve smooth transition of flow from the coolant inlet 122a to the interior of the housing 110. The diverging tank ensures uniform distribution of the coolant across the length of the heat exchange plates 116 received in the housing 110 to enhance heat exchange between exhaust gas flowing through the heat exchange plates 116 and coolant flowing across the heat exchange plates 116. However, in case of the EGR cooler 100 of the present invention, the coolant inlet 122a is directly connected to and is in fluid communication with an interior of the housing 110 without any diverging tank disposed there between, accordingly, the overall size and cost of the EGR cooler 100 is reduced.

[0029] As the gas inlet area 116c is the first to come in contact with hot exhaust gases, as such the gas inlet area 116c is prone to formation of hot spots. To achieve efficient cooling of the gas inlet area 116c and to prevent formation of the hot spots, the coolant is directed to the gas inlet area 116c. However, for efficient cooling at the gas inlet area 116c, the coolant flow reaching the gas inlet area 116c is required to be homogeneous, i.e. velocity of coolant reaching the gas inlet area 116c is required to be same across all heat exchange plates. Accordingly, the EGR cooler with counter flow configuration is preferred over parallel flow configuration. In case of counter flow configuration, the coolant inlet 122a being farther away from the gas inlet area 116c, the coolant gets sufficient time to homogenize before reaching the gas inlet area 116c. However, the counter flow configuration has drawbacks associated therewith, particularly, in case of counter flow configuration, the coolant inlet 122a is far away from the gas inlet area 116c and the velocity of the coolant depletes due to coolant striking with inside walls of the housing 110. Accordingly, coolant fails to reach the gas inlet area 116c and fails to provide cooling of the gas inlet area 116c.

[0030] In order to overcome the problem of inefficient cooling of the gas inlet area 116c, an arrangement of guides is configured on the plates of the plate type EGR cooler 100 to enable the coolant to reach the gas inlet area 116c for efficient cooling thereof. Particularly, the at least one plate 116 of the plurality of plates include at least one first guide 116a disposed near the coolant inlet 122a and an array of second guides 116b disposed near the coolant outlet 122b.

[0031] The at least one first guide 116a prevents coolant entering the housing 110 of the EGR cooler 100 from striking the inside walls of the housing 110, thereby ensuring that the velocity of the coolant entering inside the housing 110 is sufficient to reach the gas inlet area 116c to cause efficient cooling thereof. Specifically, the at least one first guide 116a is disposed along the coolant flow side of the at least one plate of the plurality of plates 116 and effectively regulates distribution and velocity of coolant directed to the gas inlet area 116c. Generally, the at least one first guide 116a is of either one of linear and

curved profile. Specifically, the at least one first guide 116a is a single guide as illustrated in FIG. 1a. As illustrated in FIG. 1a, the single guide is having a curved profile that is inclined at an angle θ with respect to a first longitudinal wall 110a of the pair of opposite longitudinal walls 110a and 110b. Alternatively, the at least one first guide 116a includes an array of guides arranged along a first profile that is inclined at an angle θ with respect to the first longitudinal wall 110a, wherein the angle θ is in range of 90 to 0 degrees. FIG. 3, FIG. 4 and FIG. 5 illustrate different configurations of the first profile along which the array of guides of the at least one guide 116a are arranged. The first profile can have different angle of inclination, for example, in one embodiment depicted in FIG. 5, the first profile is has a comparatively greater angle of inclination as compared to the first profile in accordance with another embodiment depicted in FIG. 4. Generally, the at least one first guide 116a is integrally formed on the plate 116 by at least one of stamping, punching and embossing operation. Accordingly, such configuration eliminates need for additional component such as baffles that are conventionally used for directing the coolant flow, thereby reducing product and process costs associated with configuring such conventional arrangement. However, the present invention is not limited to any particular configuration and placement of the at least one first guide 116a as far as the at least one first guide 116a prevents coolant entering the housing 110 from striking inside walls of the housing 110 to ensure that the velocity of the coolant entering inside the housing 110 is sufficient to reach the gas inlet area 116c to cause efficient cooling thereof. In accordance with another embodiment as illustrated in FIG. 2, at least one plate 116 of the plurality of plates received inside the housing 110 is configured with array of second guides 116b only but is without first guide or array of first guides of the at least one first guide 116a.

[0032] The array of second guides 116b direct the coolant entering in the housing 110 to the gas inlet area 116c to cause efficient cooling of the gas inlet area 116c. Specifically, the array of guides 116b are disposed along the coolant flow side of the at least one plate of the plurality of plates 116 and effectively regulate distribution and velocity of coolant directed to the gas inlet area 116c. Also, such configuration of the array of second guides 116b creates a barrier between the coolant entering from the coolant inlet 122a and the coolant outlet 122b, to prevent from directly escaping out of the housing 110 through the coolant outlet 122b without extracting heat from the exhaust gases flowing through the gas passages 114. Generally, the array of second guides 116b are arranged along a second profile that is diverging away from the gas inlets 112a in direction of flow of coolant towards the coolant outlet 122b. Alternatively, the second profile is parallel to the gas inlets 112a. In accordance with an embodiment of the present invention, the second profile is inclined at an angle α with respect to the first longitudinal wall 110a, wherein the angle α is in range of 90 to

15 degrees. In accordance with an embodiment of the present invention as illustrated in FIG. 2 and FIG. 3, the second profile terminates near the coolant outlet 122b. In accordance with another embodiment of the present invention as illustrated in FIG. 1, FIG. 4 and FIG. 5, the second profile terminates at a distance X from the coolant outlet 122b and preferably upstream thereof in the coolant flow direction. The inclination of the second profile and the distance from the coolant outlet 122b at which the second profile terminates can be selected based on cooling required to be achieved at the gas inlet area 116c by directing the coolant to the gas inlet area 116c. The array of guides 116b are in form of dimples formed by at least one of stamping, punching and embossing operation. Accordingly, such configuration eliminates need for additional component such as baffles that are conventionally used for directing the coolant towards the gas inlet area 116c, thereby reducing product and process costs associated with configuring such arrangement. However, the present invention is not limited to any particular configuration and placement of the array of second guides 116b as far as the array of second guides 116b are capable of directing coolant entering the housing 110 to the gas inlet area 116c to cause efficient cooling of the gas inlet area 116c. FIG. 6 illustrates an isometric view of the plate 116 received inside the housing 110 of the EGR cooler 100 configured with at least one first guide 116a and the array of second guides 116b in accordance with an embodiment of the present invention. However, the number of the at least one first guide 116a and the array of second guides 116b and placement thereof on the plate can vary.

[0033] With such configuration of the plate 116 with the at least one first guide 116a and the array of second guides 116b configured thereon, effective cooling of the gas inlet area 116c is achieved and the percentage volume of the coolant reaching temperature above boiling point thereof is reduced. Further, such configuration of the EGR cooler 100 improves coolant flow and coolant distribution to the gas inlet area 116c and reduces the chances of coolant boiling and thermal shock impact.

[0034] Several modifications and improvement might be applied by the person skilled in the art to a plate type EGR cooler 100 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 plate type EGR cooler 100 includes plates received inside a housing. The housing includes gas inlets and gas outlets and a coolant inlet and a coolant outlet. The gas inlets and the gas outlets are fluidically connected to each other by gas passages defined by the plates. The coolant inlet and the coolant outlet is for ingress of coolant inside the housing and around the gas passages and egress of the coolant from inside the housing respectively. The coolant inlet and outlet are arranged with respect to the gas inlets outlets to define cross flow configuration between coolant flow and gas flow. At least one of the plates includes at least one first guide formed on a coolant flow

side thereof and disposed near the coolant inlet to prevent coolant entering the housing from striking inside walls of housing and an array of second guides formed on the coolant flow side thereof and disposed near coolant outlet to direct the coolant to the gas inlet area.

[0035] 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 type heat exchanger (100) comprising:

- a plurality of plates (116);
- a housing (110) comprising:

- a plurality of first fluid inlets (112a) and first fluid outlets (112b) fluidically connected to each other by first fluid passages (114) defined by the plates (116) received in the housing (110), the first fluid passages (114) near the first fluid inlets (112a) define first fluid inlet area (116c);

- a second fluid inlet (122a) for ingress of second coolant inside the housing (110) and around the first fluid passages (114) and a second fluid outlet (122b) for egress of the second fluid from inside the housing (110), the second fluid inlet (122a) and the second fluid outlet (122b) are arranged with respect to the first fluid inlets (112a) and the first fluid outlets (112b) to define cross flow configuration between the second fluid flow and the first fluid flow;

characterized in that a second fluid flow side of at least one of the plates (116) comprising:

- at least one first guide (116a) formed thereon and disposed near the second fluid inlet (122a) adapted to prevent second fluid entering the housing (110) from striking inside walls of the housing (110); and
- an array of second guides (116b) formed thereon and disposed near the second outlet (122b), the array of second guides (116b) adapted to direct the second fluid to the first fluid inlet area (116c).

2. The plate type heat exchanger (100) according to claim 1, wherein the at least one first guide (116a) is arranged along a first profile, which is of either one of linear and curved profile.

3. The plate type heat exchanger (100) according to

any of the preceding claims, wherein the at least one first guide (116a) is a single guide that is inclined at an angle θ with respect to a first longitudinal wall (110a).

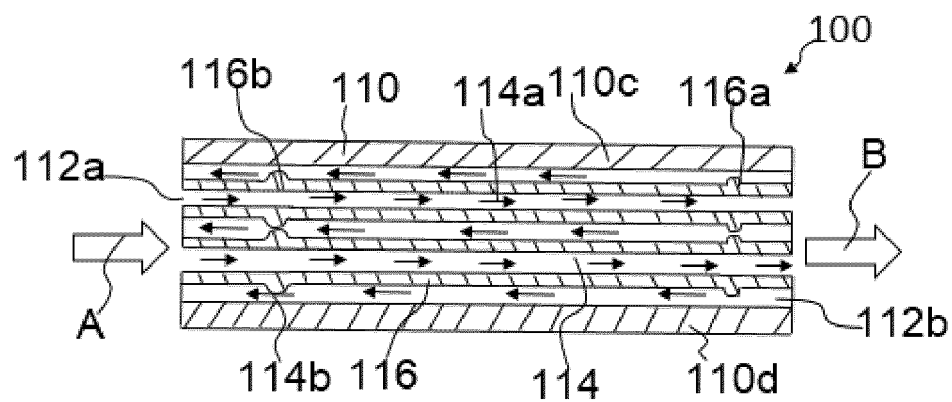
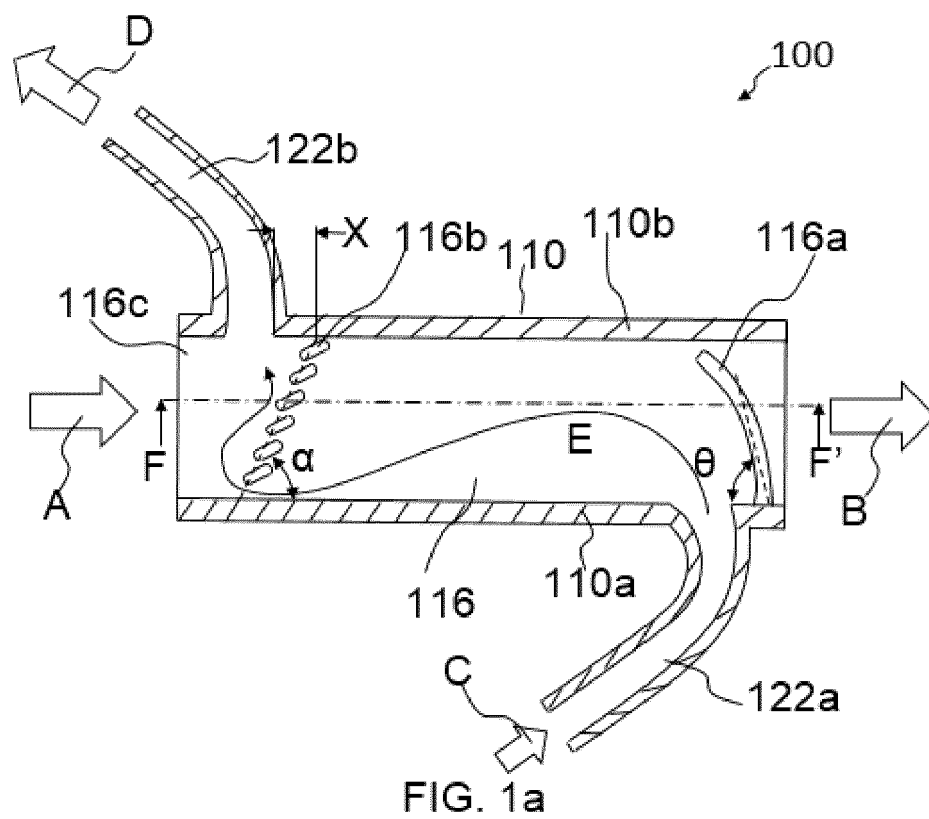
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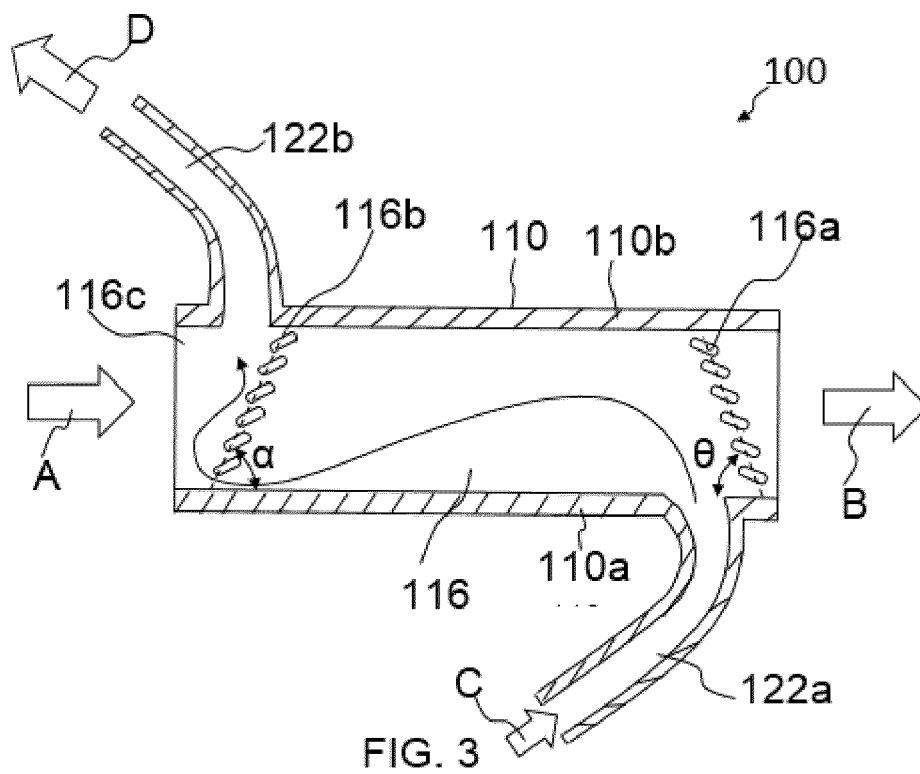
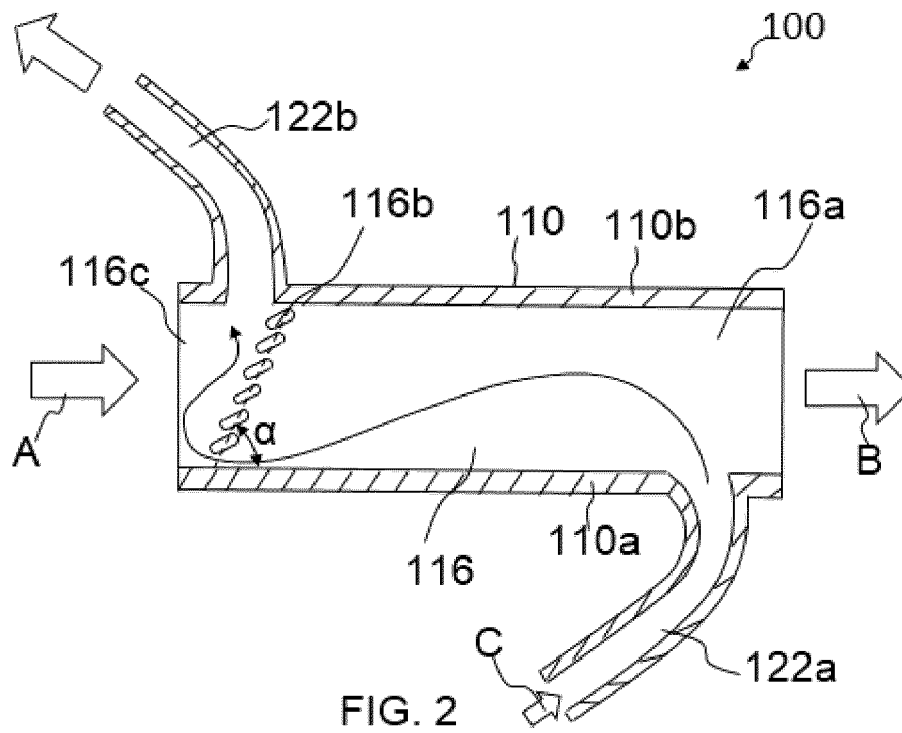
4. The plate type heat exchanger (100) according to claim 2, wherein the at least one first guide (116a) comprises an array of guides arranged along the first profile, which is inclined at an angle θ with respect to the first longitudinal wall (110a). 10
5. The plate type heat exchanger (100) according to any one of the preceding claims, wherein the at least one first guide (116a) is formed by at least one of stamping, punching and embossing operation. 15
6. The plate type heat exchanger (100) according to any of claims from 3 to 5, wherein the angle θ is in range of 90 to 0 degrees. 20
7. The plate type heat exchanger (100) according to any of the preceding claims, wherein the array of second guides (116b) is arranged along a second profile that is diverging away from the first fluid inlets (112a) in direction of flow of second fluid towards the second fluid outlet (122b) and terminates upstream of the second fluid outlet (122b). 25
8. The plate type heat exchanger (100) according to claim 7, wherein the second profile is parallel to the first fluid inlets (112a). 30
9. The plate type heat exchanger (100) according to any of the preceding claims, wherein the array of second guides (116b) is in form of dimples formed by stamping operation. 35
10. The plate type heat exchanger (100) according to any of claims from 7 to 9, wherein the second profile is inclined at an angle α with respect to the first longitudinal wall (110a), wherein the angle α is in range of 90 to 15 degrees. 40

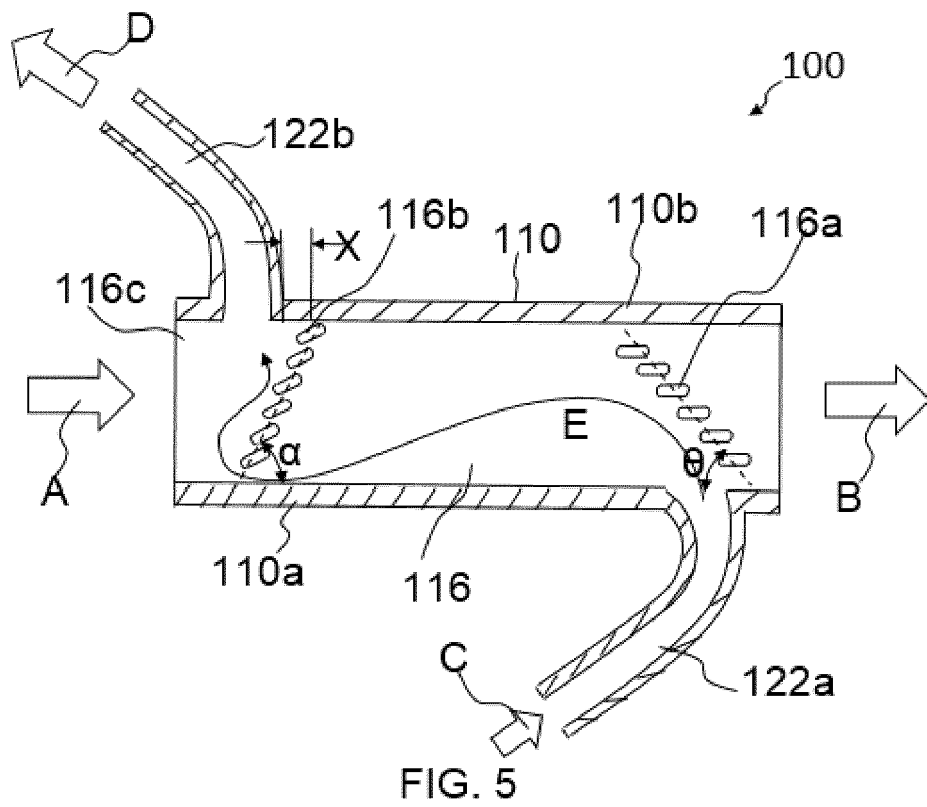
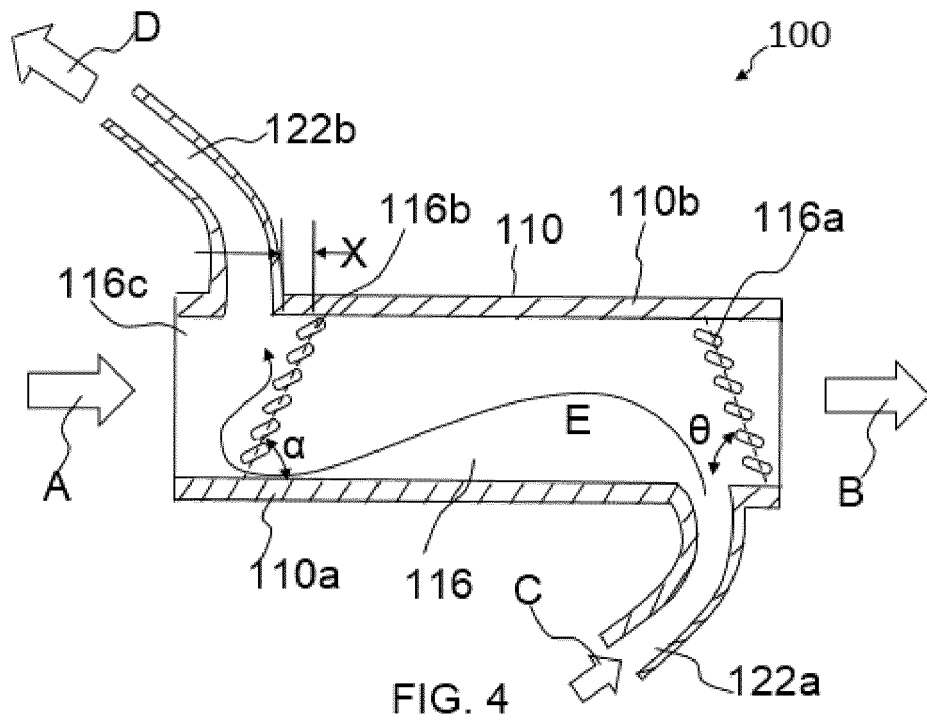
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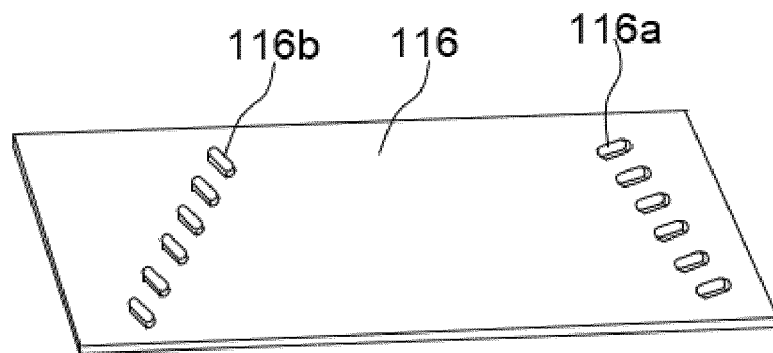


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 19 38 3212

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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)
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			F28F F28D F02M
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 May 2020	Examiner Martínez Rico, Celia
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