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(54) RADIATOR FOR VEHICLES

(57) It comprises a tube (5) that connects end portions of two tanks: first (3) and second (4); wherein the tube (5) is secured to a honeycomb structure (1); and wherein inlet and outlet ports of liquid fluid are strategically located in the first tank (3). The first tank (3) comprises a larger chamber (3a) and a smaller chamber (3b) that are separated by a first intermediate wall (3c). The radiator includes a first port (6) and a second port (7) that connect to the inner spaces of the larger chamber (3a) and the smaller chamber (3b) of the first tank (3).

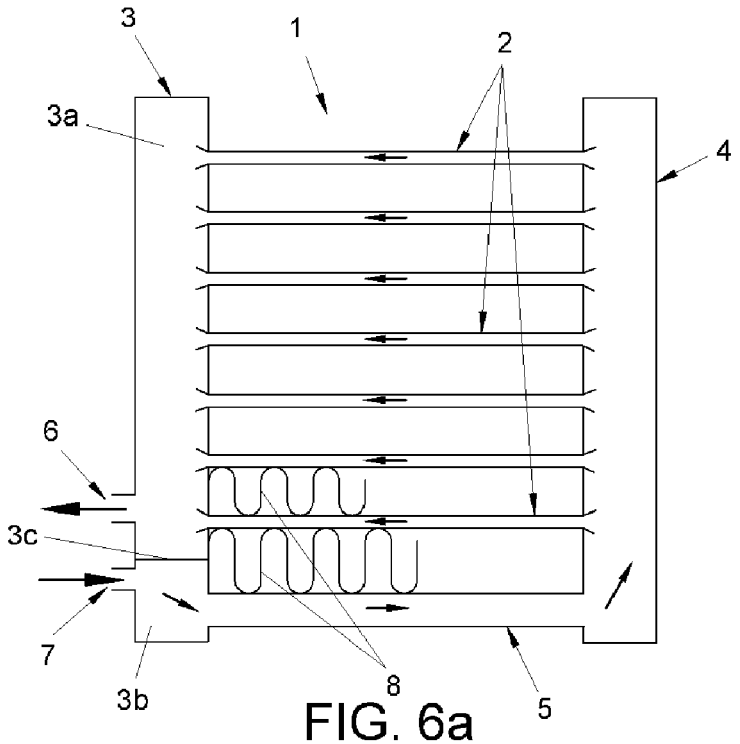

FIG. 6a

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Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a radiator for vehicles applicable to the cooling of internal combustion engines, although the radiator of the invention is also applicable to any heat exchanger that operates with water or another liquid fluid that has to be thermally conditioned. The radiator of the invention comprises improvements that provide a more mechanically resistant structure and it is also notable for having a strategic location of inlet and outlet ports of liquid fluid that flows through the inside of the radiator.

TECHNICAL PROBLEM TO BE SOLVED AND BACKGROUND OF THE INVENTION

[0002] Currently, it is common to use radiators, wherein the inlet and the outlet of the fluid are located in areas on opposite sides of the radiator, normally because the operations thereof provide it, taking into account that the fluid to be cooled crosses from side to side of the radiator by means of ducts integrated in a honeycomb of cooling fins.

[0003] This described morphology of radiators is referred to as being single pass or "I".

[0004] Moreover, on occasion the design or size of the engine of the vehicle makes it significantly difficult for the inlet and outlet of the fluid to be located in opposite areas, which sometimes forces the use of complementary connections or sleeves located on the outside of the radiator that complicate the design of the circuit because said sleeves increase the chance of leakage and also because the sleeves are susceptible to deterioration due to the heat that they receive by being close to the exhaust manifolds that reach elevated temperatures.

[0005] Radiators with the two inlet and outlets of the liquid fluid located on the same side of the radiator are also known, with the drawback that in these cases they use tubes or ducts that are added externally or in a different configuration for the fluid to flow back from one side to another and that the previously mentioned difficulties are therefore not adequately resolved.

[0006] Likewise, radiators with U-shaped circuits are known, in which the inlet and outlet ports are located in the same tank, but they have the drawback that the cooling liquid is forced to pass through half of the ducts of the honeycomb twice, such that the speed of the liquid through the ducts is duplicated, increasing the fall in pressure thereof throughout the honeycomb on the order of four on the way out and that same number on the way in to the supply tank.

[0007] The patent with publication no. WO 2016030097 relates to a collecting box for an evaporator of an air-conditioning circuit provided with tubes oriented in a main direction. The box comprises a cover and a distribution plate. It is characterized in that the cover and the distribution plate have a material thickness that is higher than, or equal to, 1 mm, and they both comprise a portion of the inlet and outlet tubes.

[0008] The patent with publication no. EP 0219419 relates to a water box and expansion chamber for a heat exchanger which is cast as a monobloc in a single piece. The water box includes two tanks, while said water box is in a generally vertical position in the heat exchanger, while the expansion chamber extends horizontally above the water box and the bank of ducts in the heat exchanger. In this patent there is a return or pass tube between the two tanks, but the cross section thereof is the same as the rest of the ducts of the honeycomb, less than 10% of the cross section of the inlet or outlet ports, and the function thereof is not that of carrying all of the cooling liquid flow from one tank to the other, but rather that of forcing a small circulation of liquid through the expansion chamber in order to favor the separation of gases existing in the cooling liquid and the containment thereof in the expansion chamber.

[0009] The patent with publication no. US 6302196 relates to a heat exchanger comprising flat tubes, each of the flat tubes having a tube partition to divide the flat tube into two parallel ducts; and a plurality of zig-zag fins, each of the zig-zag fins disposed between a pair of the flat tubes.

[0010] The patent with publication no. WO 2016/097134 A1 relates to a header for a heat exchanger, in particular an evaporator, comprising a collecting plate and a cover; said header further comprising at least one fluid inlet and/or outlet tube. The collecting plate comprises, in continuity of material, a complementary second portion of said tube.

DESCRIPTION OF THE INVENTION

[0011] With the aim of reaching the objectives and avoiding the drawbacks, the invention proposes a radiator for vehicles comprising a honeycomb structure that includes at least numerous ducts; a first tank and a second tank; wherein the numerous ducts connect the two tanks located on two opposite sides of the honeycomb structure; further including ports that make up the inlet or outlet of a liquid fluid.

[0012] The radiator of the invention further comprises a tube that connects the inner spaces of the end portions of the two tanks: first and second; wherein the tube is secured to the honeycomb structure and to the two tanks: first and second.

[0013] At least the first tank comprises a larger chamber and a smaller chamber that are separated by a first intermediate wall; wherein a first port and a second port connect to the inner spaces of the larger chamber and smaller chamber of the first tank.

[0014] In one embodiment of the invention, the tube connects on one end to the inner space of the second tank and on another end the tube connects to the inner space of the smaller chamber of the first tank; wherein

the larger chamber includes the first port that connects to the inner space of said larger chamber of the first tank; and wherein the smaller chamber includes a second port that connects to the inner space of said smaller chamber of the first tank;

[0015] The second tank is made up of a single chamber, the inner space of which is connected to the larger chamber of the first tank through the ducts; wherein the single chamber of the second tank connects to the inner space of the smaller chamber of the first tank through the tube.

[0016] In one embodiment of the invention, the honeycomb structure of the radiator is directly joined to the tube by means of a contribution of welding material included in the honeycomb structure.

[0017] In another embodiment of the invention, the radiator comprises an intermediate plate located in an intermediate space delimited between the honeycomb structure and the tube; wherein said intermediate plate in combination with the provision of welding material included in said intermediate plate, make up means of joining the honeycomb structure and tube.

[0018] The tube comprises a a cross-sectional flow areadelimited between 20% and 200% with respect to the cross-section of the inlet or outlet ports of the first tank.

[0019] Moreover, the tube comprises inside internal partitions that together with the enclosing wall of the tube itself delimit several independent conduits through which the liquid fluid flows in a compartmentalized and independent way.

[0020] In one embodiment of the invention, the tube has a square-shaped section and the independent conduits also have a square-shaped section of passage.

[0021] In a first embodiment of the invention, the first port and the second port are located in areas adjacent to the first intermediate wall that separates the larger chamber and smaller chamber of the first tank; in a second embodiment of the invention, the second port is located in an area adjacent to the first intermediate wall that separates the larger chamber and the smaller chamber of the first tank, and the first port is located in a central area of the larger chamber of the first tank; and in a third embodiment of the invention, the second port is located in an area adjacent to the first intermediate wall that separates the larger chamber and smaller chamber of the first tank; and the first port is located in an end area of the of the larger chamber removed from the first intermediate wall.

[0022] It is worth noting that the first port can be located in any area of the larger chamber of the first tank, apart from the areas described in the previous paragraph.

[0023] For the purpose of helping to make this specification more readily understandable, a set of drawings constituting an integral part of the same has been included below, wherein by way of illustration and not limitation the object of the invention has been represented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Figure 1 shows an elevation view of the radiator for vehicles, object of the invention.

Figure 2 shows a cross-sectional profile view of the radiator according to cut A-B of Figure 1.

Figure 3 shows another profile view of the radiator.

Figure 4a represents a plan view of the radiator that shows an arched configuration.

Figure 4b represents another plan view of the radiator that shows a straight configuration.

Figure 5 shows a cross-sectional view of a lower portion of the radiator, wherein a section of passage of a tube that forms part of the radiator is shown.

Figure 6a shows a schematic view of a first radiator model of the invention.

Figure 6b shows a schematic view of a second radiator model of the invention.

Figure 7a shows a schematic view of a third radiator model of the invention.

Figure 7b shows a schematic view of a fourth radiator model of the invention.

Figure 8a shows a schematic view of a fifth radiator model of the invention.

Figure 8b shows a schematic view of a sixth radiator model of the invention.

DESCRIPTION OF AN EXEMPLARY EMBODIMENT OF THE INVENTION

[0025] Considering the numbering adopted in the figures, the radiator for vehicles comprises a honeycomb structure 1 that includes numerous fins 8 in combination with numerous ducts 2 that have first ends that connect to a first tank 3, and second ends that connect to a second tank 4; wherein the two tanks: first 3 and second 4, are located on opposite sides of the radiator and wherein the two tanks: first 3 and second 4, are further connected to each other by means of ends of a tube 5, preferably manufactured with an aluminum material, without discarding other materials; wherein during the operation of the radiator a liquid fluid circulates through the ducts 2 and tube 5, passing the liquid fluid from the first tank 3 to the second tank 4, or vice versa.

[0026] The first tank 3 comprises a larger chamber 3a that has a first port 6 that connects to the inner space of said larger chamber 3a and a smaller chamber 3b that has a second port 7 that connects to the inner space of said smaller chamber 3b; wherein the larger chamber 3a and the smaller chamber 3b of the first tank 3 are separated by a first intermediate wall 3c.

[0027] In Figures 6a, 7a and 8a, the second port 7 constitutes a liquid fluid inlet to the inside of the smaller chamber 3b of the first tank 3, while the first port 6 that connects to the inside of the larger chamber 3a constitutes the liquid fluid outlet to the outside of the radiator. In these

embodiments, the liquid fluid circulates from the smaller chamber 3b of the first tank 3 to the second tank 4 through the tube 5, and after the liquid fluid circulates from the second tank 4 to the larger chamber 3a of the first tank 3 through the ducts 2.

[0028] In Figures 6b, 7b and 8b, the first port 6 of the larger chamber 3a constitutes a liquid fluid inlet to the inside of the larger chamber 3a of the first tank 3, while the second port 7 of the smaller chamber 3b constitutes a liquid fluid outlet to the outside of the radiator. In these embodiments, the liquid fluid circulates from the larger chamber 3a of the first tank 3 to the second tank 4 through the ducts 2, and after the liquid fluid circulates from the second tank 4 to the smaller chamber 3b of the first tank 3 through the tube 5.

[0029] In Figures 1, 2, 3, 4a, 4b, 6a, 6b, the first tank 3 and the second tank 4 are situated in vertical positions; it being notable that in Figures 1 to 3, 4a and 4b, said tanks: first 3 and second 4, are situated in vertical positions with a downward convergent inclination.

[0030] In contrast, in Figures 7a, 7b, 8a and 8b, the first tank 3 and the second tank 4 can be situated in an upper portion or in a lower portion. Specifically, in Figures 7a and 7b the first tank 3 is situated in the lower portion and the second tank 4 is situated in the upper portion; while in Figures 8a and 8b the first tank 3 is situated in the upper portion and the second tank 4 is situated in the lower portion.

[0031] Nevertheless, in other complementary embodiments with respect to that shown in Figures 7a and 7b, the first tank 3 could be situated in the upper portion and the lower one in the lower portion. Following this same criteria, in other complementary embodiments with respect to what is shown in Figures 8a and 8b, the first tank 3 could be situated in the lower portion and the second tank 4 could be situated in the upper portion.

[0032] The joint between the two tanks: first 3 and second 4, by means of the tube 5 constitutes a robust tubular reinforcement that encloses the honeycomb structure 1, it being notable that in an embodiment the section of said tube 5 has a square shape as seen in Figure 5.

[0033] Considering the embodiments that are shown in all the figures, it is notable that both the first port 6 and the second port 7 are located in the same first tank 3 and it is also notable that both ports: first 6 and second 7, are close to each other and adjacent to the first intermediate wall 3c that separates the larger chamber 3a and smaller chamber 3b of said first tank 3; all of this being due to needs for space and due to the connection with the rest of the components of the cooling circuit of a vehicle engine to be cooled with the radiator of the invention.

[0034] In another embodiment of the invention, the second port (7) is located in an area adjacent to the first intermediate wall (3c) that separates the larger chamber (3a) and smaller chamber (3b) of the first tank (3), and the first port (6) is located in a central area of the larger chamber (3a) of the first tank (3) as seen for example in Figure 7a.

[0035] There is also the possibility that the second port (7) may be located in an area adjacent to the first intermediate wall (3c) that separates the larger chamber (3a) and smaller chamber (3b) of the first tank (3), and the first port (6) may be located in an end area of the larger chamber (3a) removed from the first intermediate wall (3c) as seen in Figure 8a.

[0036] Moreover, it is worth noting that the first port (6) can be located in any area of the larger chamber (3a) of the first tank (3), apart from the areas described in the three previous paragraphs.

[0037] It is notable that the two ports: first 6 and second 7, can be advantageously situated on the first tank 3 itself if the space available in the inner space wherein the radiator is installed suggests so. Thus it is notable that with the structure of the radiator of the invention, the space necessary to situate the location of ducts joining the motor and the radiator is reduced and optimized.

[0038] Considering the embodiments that are shown in all the figures, the tube 5 successfully links one of the ports: first 6 or second 7, which would have to be situated in the second tank 4, to the first tank 3; all of this as if it were a sleeve connected on one end to the second tank 4 and said sleeve would open on the opposite end thereof into the first tank 3.

[0039] The tube 5 is situated in a strategic position of the honeycomb structure 1, said tube 5 completing the function of reinforcing the honeycomb structure 1 itself and in turn it is notable that said tube 5 enhances the rigidity of the corresponding portion of the radiator of the invention.

[0040] The tube 5 comprises on the inside thereof internal partitions 10 that together with the enclosing wall of the tube 5 itself delimit several independent conduits 11 in order to canalize the liquid fluid in a compartmentalized and independent manner, while said internal partitions 10 diminish the tensions induced by the internal pressure of the liquid fluid; and said internal partitions 10 provide the radiator with an increase in mechanical resistance against deformations; mainly when the radiator has an arched configuration like the one shown in the plan view of Figure 4a. In another embodiment like the one shown in Figure 4b, the radiator has a straight configuration.

[0041] In another embodiment of the invention, the tube 5 comprises a single conduit of passage without the inclusion of the internal partitions 10.

[0042] When in a manufacturing process of the radiator the assembly of said radiator is bent in order to obtain the arched structure shown in Figure 4a, the tube 5 is also bent during this manufacturing process, preventing it from unduly collapsing and becoming deformed; and it also prevents the internal section of passage of liquid fluid thereof from becoming narrower; all of this given the effects of the internal partitions 10 that said tube 5 includes.

[0043] In one embodiment of the invention, the radiator includes an intermediate aluminum plate 9 located be-

tween the honeycomb structure 1 and the tube 5; wherein said intermediate plate 9 constitutes a joining part between said elements: the honeycomb structure 1 and the tube 5.

[0044] To do so, the intermediate plate 9 includes in the outer surface thereof a provision of welding material, such that when the radiator is subjected to the welding process, said intermediate plate 9 unifies and secures the assembly of the honeycomb structure 1 and tube 5.

[0045] In another embodiment of the invention, the intermediate plate 9 is forgone; such that in this case the provision of welding material is included in the honeycomb structure 1 achieving a good joint, although the mechanical resistance would be lesser than with the inclusion of the intermediate plate 9.

[0046] Normally the tube 5 is obtained by means of a manufacturing process by extrusion, a technique that hinders the application of the provision of welding material to said tube 5.

[0047] The tube 5 comprises a section of passage delimited between 20% and 200% with respect to the section of passage of the first port 6 and second port 7 of the radiator.

Claims

1. A radiator for vehicles, comprising a honeycomb structure (1) that includes at least numerous ducts; a first tank (3) and a second tank (4); wherein the numerous ducts connect the two tanks (3, 4) located on the two opposite sides of the honeycomb structure (1); further including ports that constitute the inlet or outlet of a liquid fluid; **characterized in that**:

   - it comprises a tube (5) that connects the inner spaces of the end portions of the two tanks: first (3) and second (4);
   - the tube (5) is secured to the honeycomb structure (1) and to the two tanks: first (3) and second (4);
   - first tank (3) comprises a larger chamber (3a) and a smaller chamber (3b) that are separated by a first intermediate wall (3c); wherein a first port (6) and a second port (7) connect to the inner spaces of the larger chamber (3a) and smaller chamber (3b) of the first tank (3).

2. The radiator for vehicles according to claim 1, **characterized in that** the tube (5) connects on one end to the inner space of the second tank (4) and on another end the tube (5) connects to the inner space of the smaller chamber (3b) of the first tank (3); wherein the larger chamber (3a) includes the first port (6) that connects to the inner space of said larger chamber (3a) of the first tank (3); and where the smaller chamber (3b) includes the second port (7) that connects to the inner space of said smaller chamber (3b) of the first tank (3);

3. The radiator for vehicles according to claim 1, **characterized in that** the second tank (4) is made up of a single chamber whose inner space is connected to the larger chamber (3a) of the first tank (3) through the ducts (2); wherein the single chamber of the second tank (4) connects to the inner space of the smaller chamber (3b) of the first tank (3) through the tube (5).

4. The radiator for vehicles according to any one of the preceding claims, **characterized in that** the honeycomb structure (1) is directly joined to the tube (5) by a contribution of welding material included in said honeycomb structure (1).

5. The radiator for vehicles according to any one of preceding claims 1 to 4, **characterized in that** it comprises an intermediate plate (9) located in a space delimited between the honeycomb structure (1) and the tube (5); wherein said intermediate plate (9) in combination with a provision of welding material, included in said intermediate plate (9), constitute means of joining the honeycomb structure (1) and tube (5).

6. The radiator for vehicles according to any one of the preceding claims, **characterized in that** the tube (5) comprises a cross-sectional flow areadelimited between 20% and 200% with respect to the cross-section of the one of the ports of the first tank (3).

7. The radiator for vehicles according to any one of the preceding claims, **characterized in that** the tube (5) comprises internal partitions (10) on the inside thereof that with the enclosing wall of the tube (5) delimit several independent conduits (11) configured so that the liquid fluid can flow in a compartmentalized and independent way.

8. The radiator for vehicles according to any one of the preceding claims, **characterized in that** the tube (5) has a square-shaped section.

9. The radiator for vehicles according to claim 8, **characterized in that** independent conduits (11) have a square-shaped section of passage.

10. The radiator for vehicles according to any one of preceding claims, **characterized in that** the first port (6) and the second port (7) are located in areas adjacent to the first intermediate wall (3c) that separates the larger chamber (3a) and smaller chamber (3b) of the first tank (3).

11. The radiator for vehicles according to any one of preceding claims 1 to 10, **characterized in that** the sec-

ond port (7) is located in an area adjacent to the first intermediate wall (3c) that separates the larger chamber (3a) and smaller chamber (3b) of the first tank (3); and the first port (6) is located in a central area of the larger chamber (3a) of the first tank (3).

12. The radiator for vehicles according to any one of preceding claims 1 to 10, **characterized in that** the second port (7) is located in an area adjacent to the first intermediate wall (3c) that separates the larger chamber (3a) and smaller chamber (3b) of the first tank (3); and the first port (6) is located in an end area of the larger chamber (3a) removed from the first intermediate wall (3c).

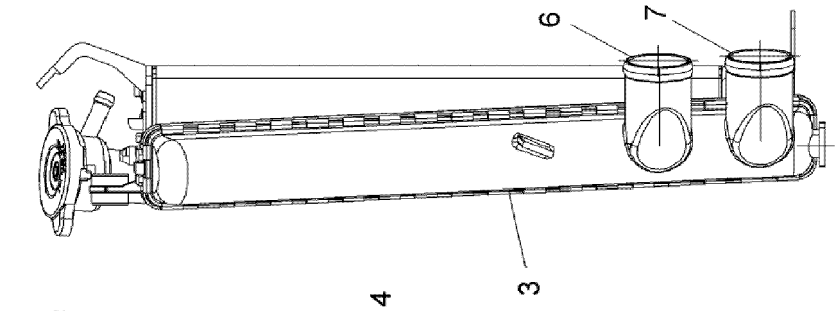

FIG. 3

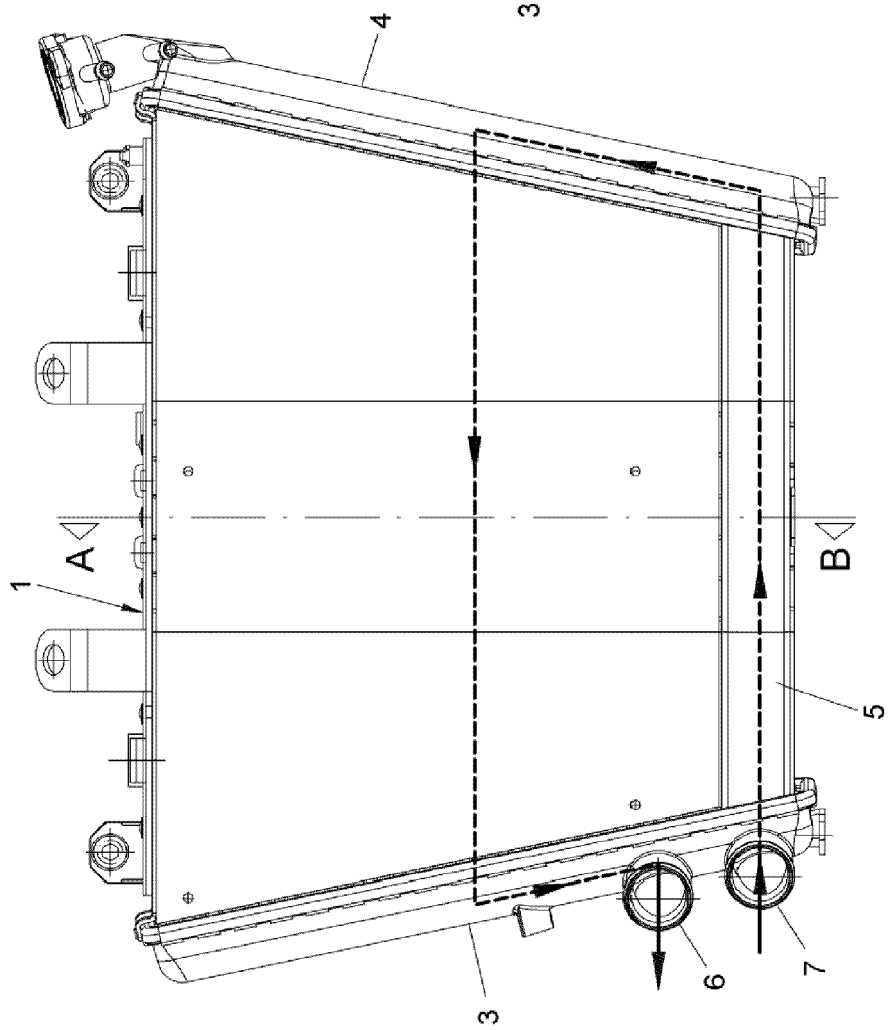

FIG. 1

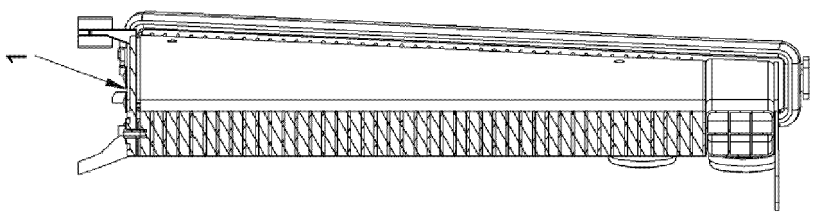

FIG. 2
CUT A - B

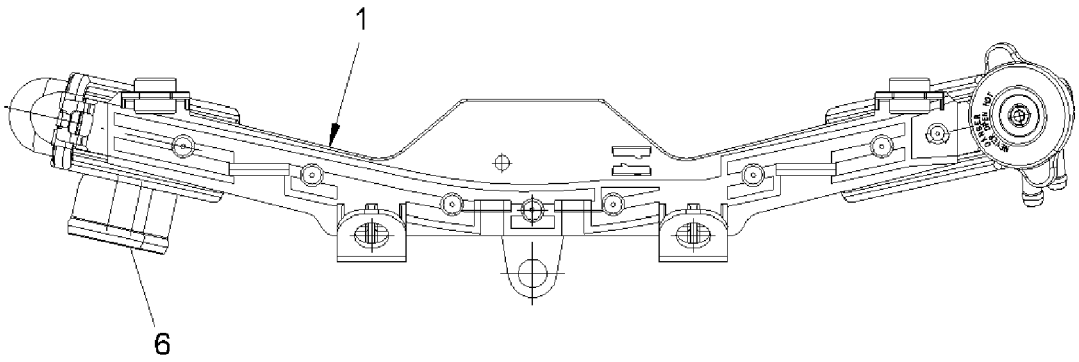

FIG. 4a

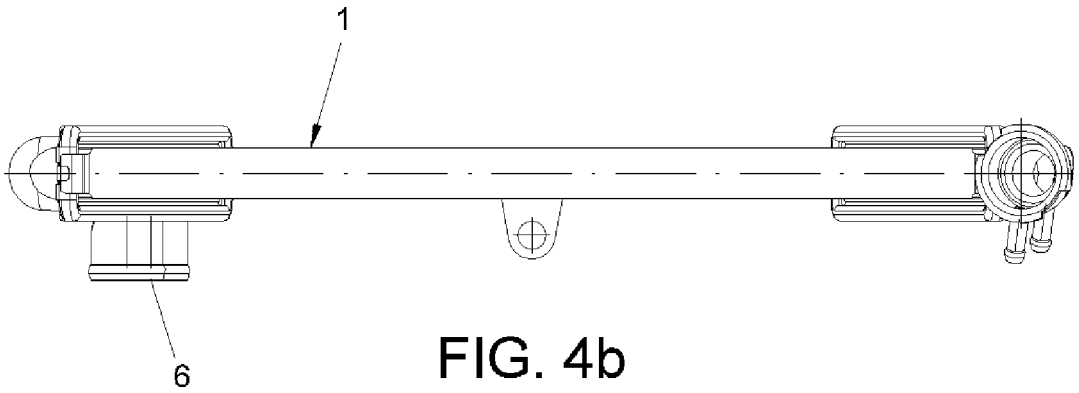

FIG. 4b

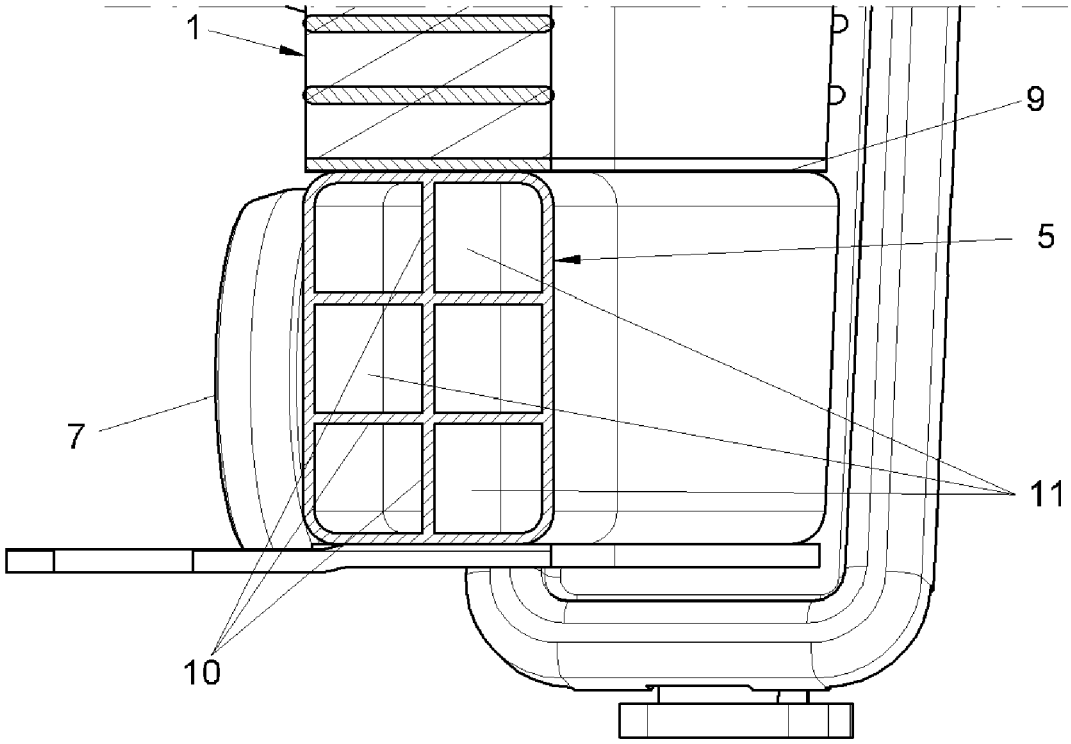

FIG. 5

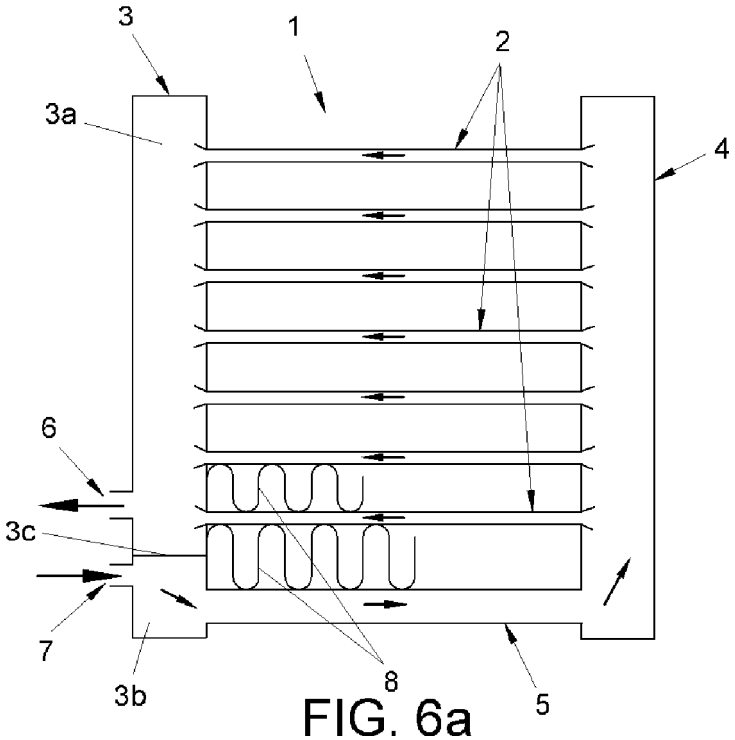

FIG. 6a

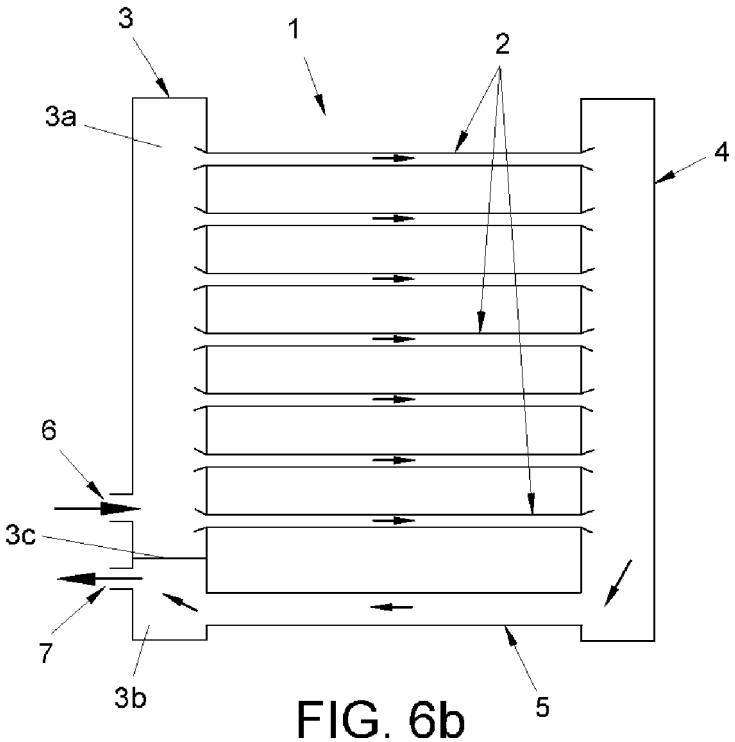

FIG. 6b

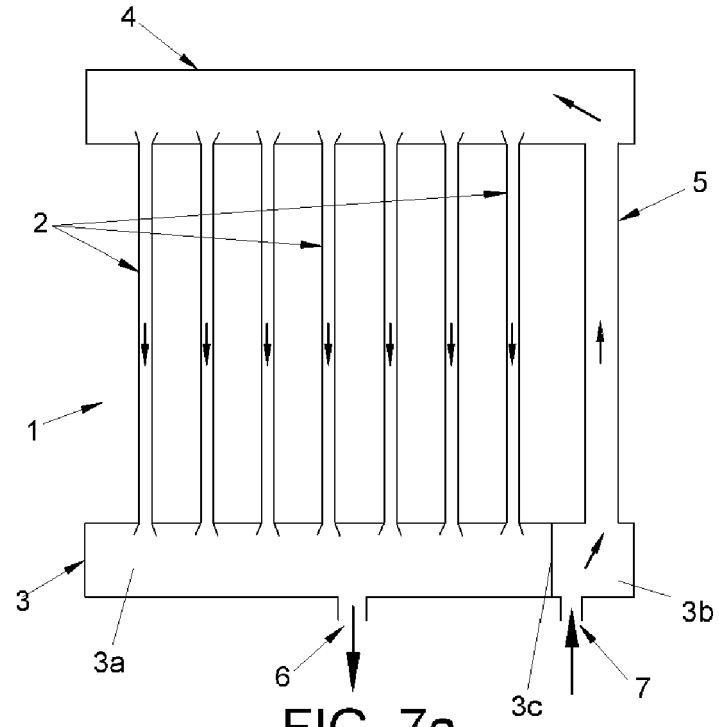

FIG. 7a

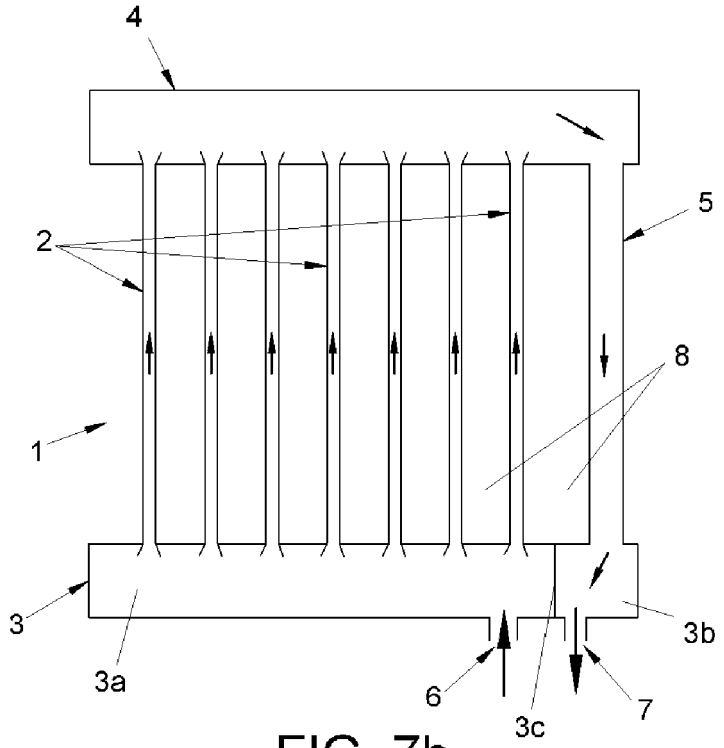

FIG. 7b

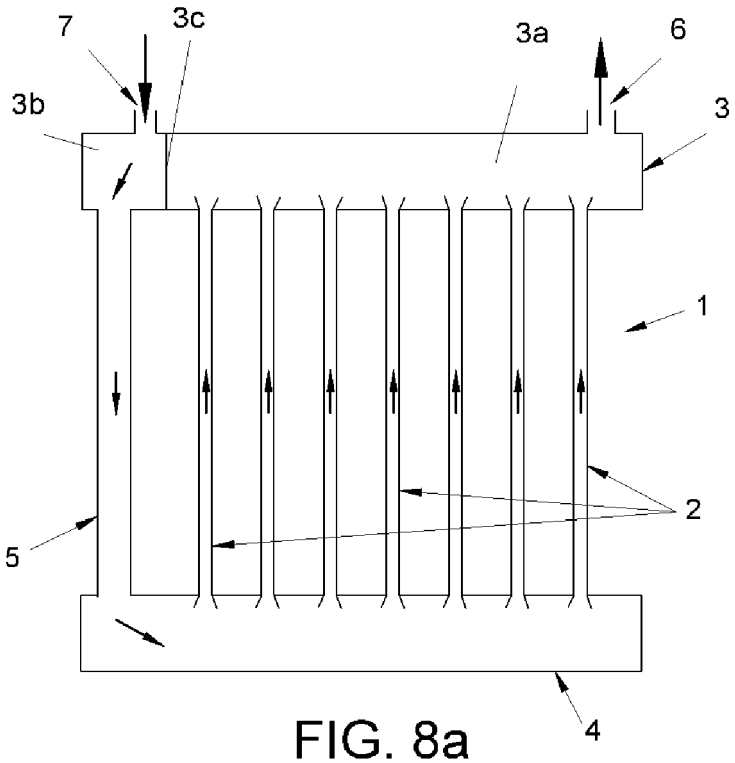

FIG. 8a

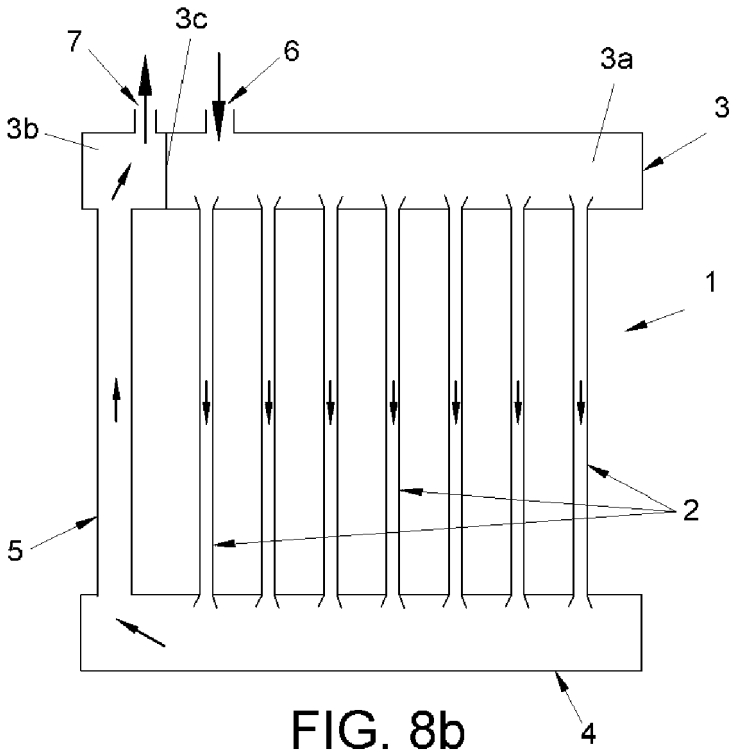

FIG. 8b

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 3398

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2001/004935 A1 (SANADA RYOUICHI [JP] ET AL) 28 June 2001 (2001-06-28) * paragraphs [0026] - [0030]; figures 1, 2 * -----	1-12	INV. F28F9/02 F01P3/18 F28D1/053
X	CN 106 240 081 A (KEIHIN THERMAL TECHNOLOGY CORP) 21 December 2016 (2016-12-21) * figure 3 * -----	1-12	ADD. F28D21/00 F28D1/02
X	US 2010/252242 A1 (XIANGXUN LU [CN] ET AL) 7 October 2010 (2010-10-07) * paragraphs [0030] - [0032], [0043] - [0045]; figure 3 * -----	1-12	
X	WO 2012/148223 A2 (LG ELECTRONICS INC [KR]; PARK TAEGYUN [KR]; PARK NAEHYUN [KR]) 1 November 2012 (2012-11-01) * figure 4 * -----	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

F28F
F01P
F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 June 2018	Louchet, Nicolas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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20-06-2018

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