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(54) **A header cover, in particular for a heat exchanger**

(57) Header cover (10), in particular for heat exchangers of automotive vehicles, comprising a vault (11) and a fluid input and/or output nozzle opening out into the header cover through a side (12) of said vault. The header cover is configured for conveying a fluid to or from a plurality of tubes (32) of circulation of a heat exchanger

core (30). The vault of the header cover is configured to open out on the heat exchanger core. The header cover comprises a plurality of deflectors (15) superimposed on one side (14) of the vault, opposite to the opening of the nozzle, in an axis defining an angle with a plane (18) defined by an opening of the vault on the heat exchanger core.

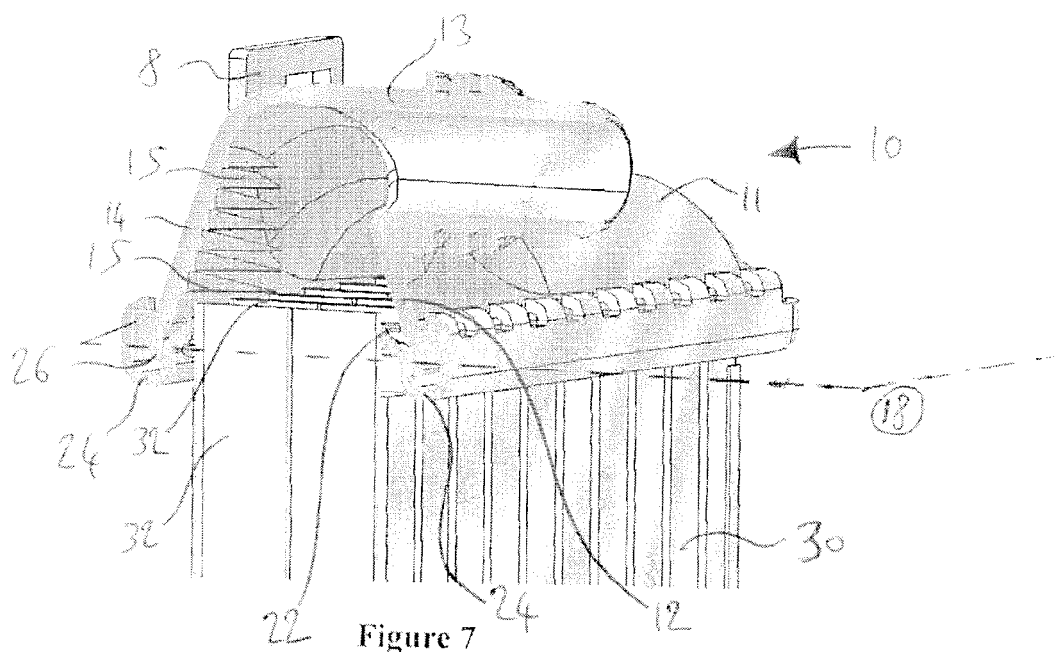


Figure 7

Description

[0001] The invention deals with heat exchangers, in particular header covers of heat exchangers.

[0002] The invention finds an advantageous application in heat exchanger systems for automotive vehicles, more particularly in cooling radiators for coolant fluid with high-speed flow, for example around 15000 l/h.

[0003] Existing heat exchangers for automotive vehicles comprise a heat exchanger core that is formed using a plurality of tubes laid out in parallel on one or several rows. These tubes allow a coolant fluid, such as e.g. water added with glycol in the case of engine cooling radiators, to flow or circulate across the heat exchanger. Coolant fluid, by cooling elements of the engine, warms up and must be cooled in its turn. It is the role of the radiator to provide this function. For this purpose, water to be cooled is put in circulation in the tubes of the radiator and cools by heat exchange with fresh air, heat exchange being realized via elements of heat transfer laid out between the tubes.

[0004] According to the technology of assembly of the heat exchanger core, one distinguishes various types of elements of heat transfer.

[0005] When the assembly is mechanical, the elements of heat transfer are parallel fins crossed, in holes performed in the fins, by the tubes of circulation of fluid. The whole is maintained altogether mechanically by means of a tool introduced inside the tubes so as to deform the walls of the tubes and to apply them to force against the holes bored in the fins.

[0006] Another technology of assembly is the brazing of the tubes and elements of heat transfer called fins placed between the tubes. In general, these fins are shaped in the form of an undulated surface, the fins being brazed on the tubes at the tops of the undulations.

[0007] The invention applies as well to heat exchanger cores with mechanical assembly as with heat exchanger cores with assembly by brazing.

[0008] The coolant is introduced into the tubes of circulation of the heat exchanger core via a distribution header placed at the entry of the beam of tubes and provided with a pipe or nozzle of arrival of the fluid. A header of the same type is installed on the outlet side of the exchanger to collect the fluid after circulation in the tubes and evacuate it through an outlet piping nozzle.

[0009] In a usual way, the header also called manifold or "radiator tank" or "water tank", consists of two parts, namely a header cover for collecting of fluid, and a collecting element called header plate. The header plate is an element in contact with the heat exchanger core. The header plate carries openings or slits intended to receive the end of the tubes emerging in the distribution header. A joint or gasket ensuring the sealing between the header and the heat exchanger core is laid out on the header plate. The ends of the tubes exceed inside the radiator tank, for example around 2 to approximately 3 mm for the heat exchanger core with mechanical assembly. It is

slightly weaker for the brazed heat exchanger core.

[0010] The header cover forms a lid for the collecting element and defines a volume of fluid in circulation at the inlet as well as at the outlet side of the heat exchanger.

[0011] In the majority of heat exchangers, header covers present a U-shaped open vault, the header plate closing the U, for instance by crimping.

[0012] The pipe called inlet nozzle (or exit) of the fluid emerges in the header cover through a wall or side of the vault.

[0013] The invention concerns a header cover of both input or output of fluid.

[0014] For strong flows of entry, the fluid, inside the header cover, generally reaches values which, at least locally, can lead to very high peaks, for example more than 8 m/s. It results that the flow in the header cover, such as it is carried out today, seriously affects the resistance of the exchanger.

[0015] More precisely, one can observe that the tubes, whose ends stick out in the distribution header, in a central zone located in the vicinity of the outlet of the nozzle, present degradations in the forms of holes appearing by erosion of the wall of the tubes approximately 10 mm beneath the header plate, which generates a risk of leakage in the heat exchanger. The formation of these holes is due to a flow peak of the fluid towards the interior of the tubes related to the reflection of the flow on the opposite wall of the vault.

[0016] Another type of degradation due to the circulation of fluid at high speeds may involve an erosion of the extremities of the tubes sticking out inside the header.

[0017] In the side zones of the heat exchanger core, the flow becomes swirling with strong speed components parallel to the axis of the vault. The degradations observed on the tubes in these zones concern especially the erosion and the deformation of the ends of the tubes, these two phenomena being likely to create an opening in the seal and thus to cause a leakage in the header.

[0018] An existing solution for these problems implies using two opposed deflectors, whose edges lay out on an axis parallel to the axis of circulation of the fluid in the heat exchanger core. A drawback of such a solution is that the size of these deflectors may create significant pressure drops when the coolant runs at high speed in the header. Another drawback is that the coolant is only split between two directions, namely left and right when hitting the deflector, which may cause an incorrect repartition of the coolant among the tubes of the heat exchanger core. Another drawback of such a solution is that it may not be suitable for deflecting fluid toward the nozzle in the outlet of the heat exchanger.

[0019] It is an object of the present apparatus to overcome disadvantages and/or make improvement over the prior art.

[0020] To that extend, the invention proposes a header cover, in particular for heat exchangers of automotive vehicles, comprising a vault and a fluid input and/or output nozzle opening out into the header cover through a

side of said vault. The header cover is configured for conveying a fluid to or from a plurality of tubes of circulation of a heat exchanger core. The vault of the header cover is configured to open out on the heat exchanger core. The header cover comprises a plurality of deflectors superimposed on one side of the vault, opposite to the opening of the nozzle, in an axis defining an angle, especially a right-angle, with a plane defined by an opening of the vault on the heat exchanger core. By defining an angle, we mean in a direction which is not parallel to the plane defined by the opening of the vault on the heat exchanger core.

[0021] This allows properly spreading and distributing the fluid among the plurality of tubes. This also helps reducing the damages made by a high speed flow of fluid entering or leaving the header cover.

[0022] According to an aspect of the invention, the plurality of deflectors comprises ribs or blades. Ribs and blades increase the spreading of the fluid among the tubes of the heat exchanger core.

[0023] According to an aspect of the invention, the deflectors of the plurality of deflectors are laid out in parallel. This makes the distribution of fluid uniform between the deflectors.

[0024] According to an aspect of the invention, the deflectors of the plurality of deflectors are bent down, relatively to the plane defined by the opening of the vault on the heat exchanger core, toward the heat exchanger core.

[0025] According to an aspect of the invention, the deflectors of the plurality of deflectors are bent up, relatively to the plane defined by the opening of the vault on the heat exchanger core, toward the nozzle.

[0026] According to an aspect of the invention, the deflectors of the plurality of deflectors are straight, in a plane parallel to the plane defined by the opening of the vault on the heat exchanger core. This allows in particular the header cover to be used both as an input and an output header cover.

[0027] According to an aspect of the invention, the vault has a half-pipe shape. Such a shape helps driving the flow of fluid through the header cover.

[0028] According to an aspect of the invention, the nozzle is located in the middle of a side of the vault along its longitudinal axis. This allows a uniform distribution of the fluid between tubes located on both sides of the nozzle. Alternatively, it can be located close to a longitudinal end of the header cover.

[0029] According to an aspect of the invention, the vault of the header cover further comprises a rounded hump, higher than the apex of the vault, said rounded hump comprising two opposite sides and defining a volume at the location of the nozzle, wherein the deflectors of the plurality of deflectors spread between said opposite sides of the rounded hump. This allows creating a space for the deflectors in the header cover further optimizing the fluid flow.

[0030] The invention also concerns a heat exchanger.

[0031] The heat exchanger comprises a header cover as described here above.

[0032] According to an aspect of the invention, the heat exchanger further comprises a header plate configured for receiving a heat exchanger core and a header cover as described here above. The header plate allows, on one side, receiving the tubes of the heat exchanger core and, on the other side, receiving the header cover.

[0033] According to an aspect of the invention, the header plate comprises slits for receiving the tubes of circulation of fluid, respectively from and to the header cover, of the heat exchanger core. The slits allow the tubes to be strongly inserted in the header plate and thereafter fixed in regard to the header cover.

[0034] According to an aspect of the invention, the header plate further comprises a groove, configured for receiving the header cover, and a gasket at the junction between the groove and the header cover for making the junction waterproof. The groove allows the header cover to be well positioned on the header plate. The gasket renders the junction between the groove of the header plate and the header cover waterproof.

[0035] According to an aspect of the invention, the heat exchanger comprises a first header cover as described here above and a second header cover as described here above. The first header cover is configured for acting as an input header cover for inputting a fluid into the heat exchanger. The deflectors of the plurality of deflectors of the first header cover are oriented toward the heat exchanger core. The second header cover is configured for acting as an output header cover for outputting a fluid out of the heat exchanger. The deflectors of the plurality of deflectors of the second header cover are oriented toward the heat exchanger core.

[0036] According to an aspect of the invention, the heat exchanger is a down-flow heat exchanger. The deflectors of the plurality of deflectors of the first header cover are oriented downwards toward the heat exchanger core. The deflectors of the plurality of deflectors of the second header cover are oriented upwards toward the heat exchanger core.

[0037] This allows the fluid to enter at the top of the heat exchanger, to circulate from top to bottom, using e.g. the gravity, and to leave the heat exchanger at the bottom of the heat exchanger. Such down-flow heat exchangers are commonly used in automotive vehicle.

[0038] Alternatively, the heat exchanger is a cross-flow heat exchanger.

[0039] Embodiments of the present invention will now be described solely by way of example and with reference to the accompanying drawings, where like parts are provided with corresponding reference numerals, and in which:

- figure 1 is a sectional longitudinal view schematically illustrating a header cover with horizontal bent down ribs;
- figure 2 is a sectional longitudinal view schematically

- illustrating a header cover with horizontal bent up blades;
- figure 3 is a sectional longitudinal view schematically illustrating a header cover with horizontal straight ribs;
 - figure 4 schematically illustrates a sectional view of a header cover in a vertical plane perpendicular to the longitudinal axis of the header cover ;
 - figure 5 schematically illustrates a heat exchanger from a first side of view
 - figure 6 schematically illustrates a heat exchanger from another side of view ;
 - figure 7 schematically illustrates a sectional view of a heat exchanger comprising a header cover comprising horizontal bent down blades ;
 - figure 8 schematically illustrates a sectional view of a heat exchanger comprising horizontal bent up ribs.

[0040] Figures 1 to 8 show a header cover 10, comprising a vault 11 and a fluid input and/or output nozzle 13 opening out into the header cover 10 through a side 12 of said vault 11.

[0041] The header cover 10 is configured for conveying a fluid 5 to or from a plurality of tubes 32 of circulation of a heat exchanger core 30.

[0042] The vault 11 of the header cover 10 opens out on the heat exchanger core 30. The vault 11 has a half-pipe shape. The nozzle 13 is located in the middle of a side 12 of the vault 11.

[0043] The header cover 10 comprises a plurality of deflectors 15 superimposed on one side of the vault 11, said side being opposite to the opening of the nozzle.

[0044] The vault 11 of the header cover 10 comprises a rounded hump 16, higher than the apex of the vault 11. The rounded hump 16 comprises two opposite sides 16a and 16b and defines a volume 19 at the location of the nozzle 13. The plurality of deflectors 15 spread between said opposite sides 16a, 16b of the rounded hump 16.

[0045] As represented on figures 1 to 3, the plurality of deflectors 15 are superimposed in an axis 17, which is orthogonal or substantially orthogonal to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30. In other words, the deflectors 15 are parallel or substantially parallel to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30.

[0046] Figures 1 to 3 describe three different types and orientations of deflectors 15 in regard to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30. On each of those figures, the plurality of deflectors 15 comprises ribs or blades of different sorts and orientation, relatively to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30. On each of those figures, the deflectors of the plurality of deflectors are laid out in parallel. This is in no way limiting of the scope of the present invention, as the deflectors 15 could also be V-shaped and/or inverted V-shaped, disposed in multiple configurations, e.g. mixed,

parallel or not etc...

[0047] On figure 1, the deflectors 15 of the plurality of deflectors are blades which are bent down, relatively to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30, toward the heat exchanger core 30.

[0048] On figure 2 (and also on figure 8 described here under), the deflectors 15 of the plurality of deflectors are ribs which are bent up, relatively to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30, toward the nozzle 13.

[0049] On figure 3, the deflectors 15 of the plurality of deflectors are straight, in a plane parallel to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30.

[0050] Figure 4 describes a sectional view of a header cover 10 in a vertical plane, said vertical plane comprising the longitudinal axis of the nozzle 13.

[0051] The fluid 5 enters or leaves the header cover 10 by the nozzle 13, which opens out into the header cover 10 through the side 12 of the vault 11. The rounded hump 16 defines the volume 19 inside the header cover 10 between the opening of the nozzle 13 into the header cover 10 and the opposite side 14 of the vault 11 (i.e. also of the header cover 10).

[0052] The deflectors 15 are located on the side 14 opposite to the nozzle 13. Said nozzle 13 is located at the apex of the rounded hump 16.

[0053] The thickness of the deflectors 15, at their distal edge, is somehow equal to the thickness of the header cover 10 in the location where no deflectors 15 and/or stiffening ribs or equivalent are provided. The thickness of the deflectors 15, at their proximal edge, is smaller than the thickness of the header cover 10 in the location where no deflectors 15 and/or stiffening ribs or equivalent are provided, for instance between 25% and 75% of the thickness thereof.

[0054] The deflectors 15 are made in one piece with the vault 11. They have a sectional triangular shape.

[0055] Figures 5 and 6 describe a heat exchanger 40 comprising a first header cover 10a, as described here above, and a second header cover 10b, also as described here above.

[0056] The first header cover 10a is configured for acting as an input header cover for inputting a fluid 5 into the heat exchanger 40. The deflectors of a first plurality of deflectors 15a, not shown, of the first header cover 10a, are oriented toward the heat exchanger core 30.

[0057] The second header cover 10b is configured for acting as an output header cover for outputting the fluid 5 out of the heat exchanger 40. The deflectors of a second plurality of deflectors 15b, not shown, of the second header cover 10b, are oriented toward the heat exchanger core 30.

[0058] On figures 5 and 6, the heat exchanger (40) is a down-flow heat exchanger. Such a heat exchanger is commonly used in automotive vehicles. In such a heat exchanger 40, the fluid 5 enters into the heat exchanger

in the nozzle 13 of the first header cover 10a, at the top of the heat exchanger 40 and leaves the heat exchanger by the nozzle 13 of the second header cover 10b, at the bottom of the heat exchanger 40.

[0059] The first plurality of deflectors 15a, of the first header cover 10a, are oriented downwards toward the heat exchanger core 30 so that, when the fluid 5 enters into the heat exchanger 40 by the nozzle 13 of the first header cover 10a, the fluid 5 is distributed by the first plurality of deflectors 15a among the plurality of tubes 32 of the heat exchanger core 30.

[0060] The plurality of deflectors 15b of the second header cover 10b are oriented upwards toward nozzle 13 of the second header cover 10b so that, when the fluid 5 leaves the plurality of tubes 32 of the heat exchanger core 30, the fluid 5 is deviated by the second plurality of deflectors 15b toward the nozzle 13 of the second header cover 10b.

[0061] The header cover 10 comprises fixing means 8 for attaching or fixing the header cover 10, and therefore the heat exchanger 40 to another apparatus such as for instance parts of an automotive vehicle body in white.

[0062] **Figures 7 and 8** describe a sectional view of a heat exchanger comprising a header cover as described here above.

[0063] The deflectors 15 are superimposed substantially in an axis of the tubes 32 of circulation of the heat exchanger core 30.

[0064] The heat exchanger 40 comprises a header plate 20 configured for receiving a heat exchanger core 30 and a header cover 10 as described here above.

[0065] The header plate comprises slits 22 for receiving the tubes 32 of circulation of fluid 5, respectively from and to the header cover 10, of the heat exchanger core 30. The header plate 20 further comprises a groove 24.

[0066] The groove 24 is configured for receiving the header cover 10, and a gasket 26 at the junction between the groove 24 and the header cover 10 for making the junction waterproof.

[0067] On figure 7, the deflectors 15 of the plurality of deflectors are bent down, relatively to a plane parallel to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30.

[0068] On figure 8, the deflectors 15 of the plurality of deflectors are ribs which are bent up, relatively to the plane 18 defined by the opening of the vault 11 on the heat exchanger core 30, toward the nozzle 13.

[0069] The header plate 20 is made of metal, for instance, of aluminium and/or aluminium alloys, and/or the header cover is made of plastic material. The header cover 10 is crimped on the header plate.

Claims

1. Header cover (10), in particular for heat exchangers of automotive vehicles, said header cover (10) comprising a vault (11) and a fluid input and/or output

nozzle (13) opening out into the header cover (10) through a side (12) of said vault (11), the header cover (10) being configured for conveying a fluid (5) to or from a plurality of tubes (32) of circulation of a heat exchanger core (30), the vault (11) of the header cover (10) being configured to open out on said heat exchanger core (30), the header cover (10) being **characterized in that** it comprises a plurality of deflectors (15) superimposed on one side (14) of the vault (11), opposite to the opening of the nozzle (13), in an axis (17) defining an angle with a plane (18) defined by an opening of the vault (11) on the heat exchanger core (30).

2. Header cover according to claim 1, wherein the plurality of deflectors (15) comprises ribs or blades.

3. Header cover according to any of the preceding claims, wherein the deflectors (15) of the plurality of deflectors (15) are laid out in parallel.

4. Header cover according to any of the preceding claims, wherein the deflectors (15) of the plurality of deflectors (15) are bent down, relatively to the plane (18) defined by the opening of the vault (11) on the heat exchanger core (30).

5. Header cover according to any of the preceding claims, wherein the deflectors (15) of the plurality of deflectors (15) are bent up, relatively to the plane (18) defined by the opening of the vault (11) on the heat exchanger core (30).

6. Header cover according to any of the preceding claims, wherein the deflectors (15) of the plurality of deflectors (15) are straight, in a plane parallel to the plane (18) defined by the opening of the vault (11) on the heat exchanger core (30).

7. Header cover according to any of the preceding claims, wherein the vault (11) has a half-pipe shape.

8. Header cover according to any of the preceding claims, wherein the nozzle (13) is located in the middle of a side (12) of the vault (11) along its longitudinal axis.

9. Header cover according to any of the preceding claims, wherein the vault (11) of the header cover (10) further comprises a rounded hump (16), higher than the apex of the vault (11), said rounded hump (16) comprising two opposite sides (16a, 16b) and defining a volume (19) at the location of the nozzle (13), wherein the deflectors of the plurality of deflectors (15) spread between said opposite sides (16a, 16b) of the rounded hump (16).

10. Header cover according to claim 9, wherein the noz-

zle (13) is located at the apex of the rounded hump (16).

11. Header cover according to any of the preceding claims, wherein the header cover (10) has a given thickness in the location where there are no deflectors (15) and the deflectors (15) have a distal edge and a proximal edge, and wherein the thickness of the deflectors (15) at their distal edge is somehow equal to the given thickness of the header cover (10) and/or the thickness of the deflectors (15) at their proximal edge is smaller than the given thickness of the header cover (10).
12. Heat exchanger (40), said heat exchanger (40) comprising a header cover (10) according to any of the preceding claims.
13. Heat exchanger (40) according to claim 12, said heat exchanger (40) comprising a first header cover (10a) according to any of claims 1 to 9 and a second header cover (10b) according to any of claims 1 to 9, said first header cover (10a) being configured for acting as an input header cover for inputting a fluid (5) into the heat exchanger (40), the plurality of deflectors (15a) of the first header cover (10a) being oriented toward the heat exchanger core (30), the second header cover (10b) being configured for acting as an output header cover for outputting the fluid (5) out of the heat exchanger (40), the plurality of deflectors (15b) of the second header cover (10b) being oriented toward the heat exchanger core (30).
14. Heat exchanger (40) according to claim 13, said heat exchanger (40) being a down-flow heat exchanger, the plurality of deflectors (15a) of the first header cover (10a) being oriented downwards toward the heat exchanger core (30) and the plurality of deflectors (15b) of the second header cover (10b) being oriented upwards toward the heat exchanger core (30).

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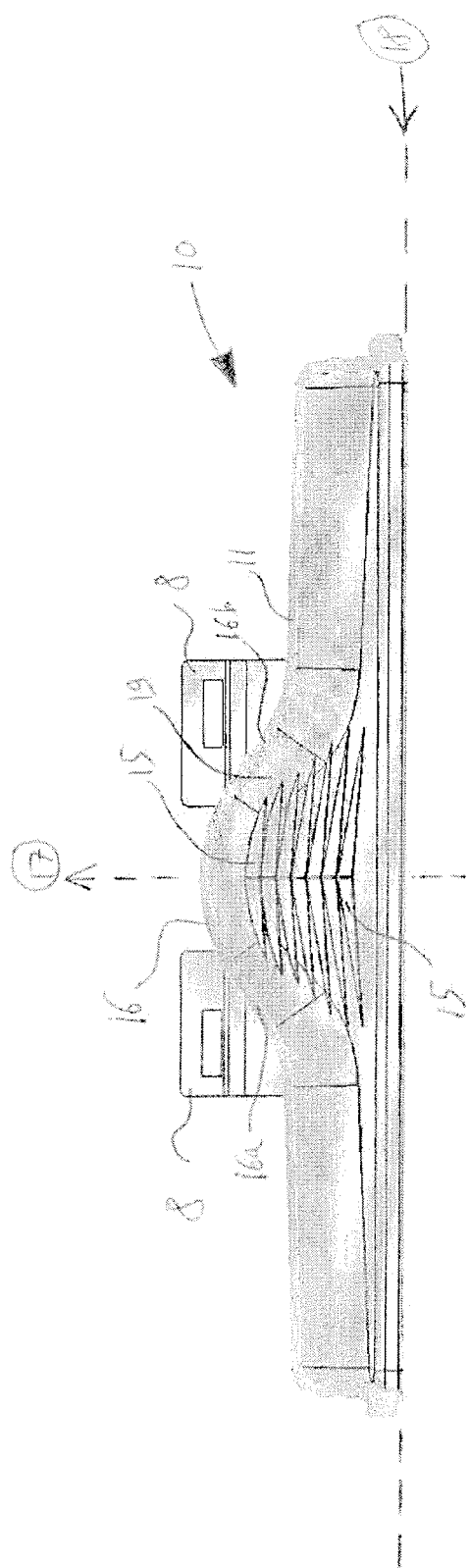


Figure 1

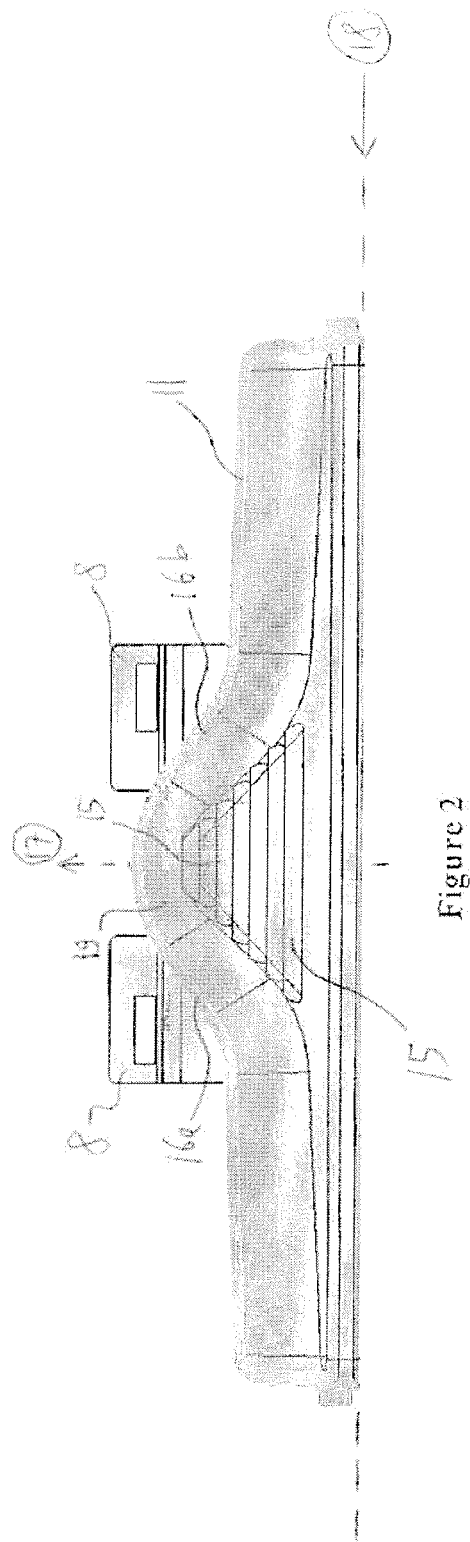
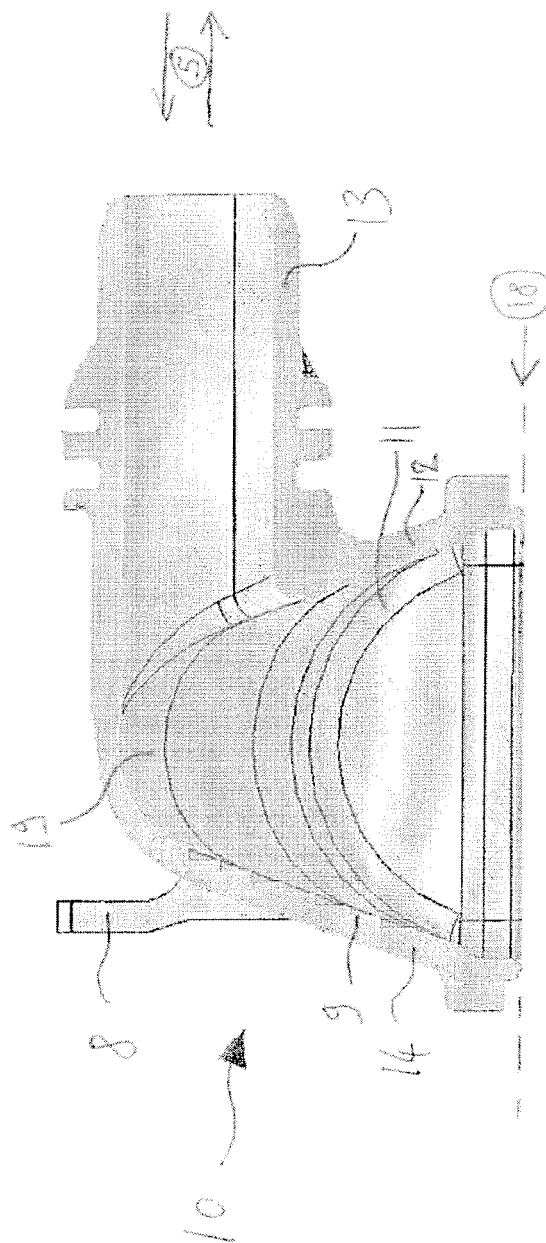
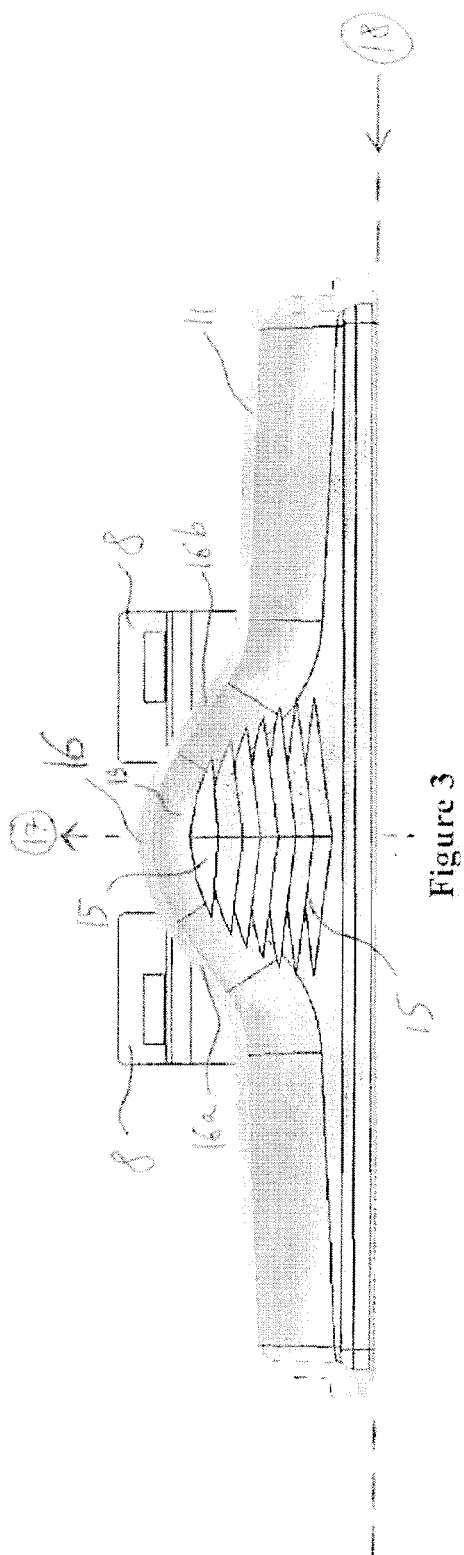


Figure 2



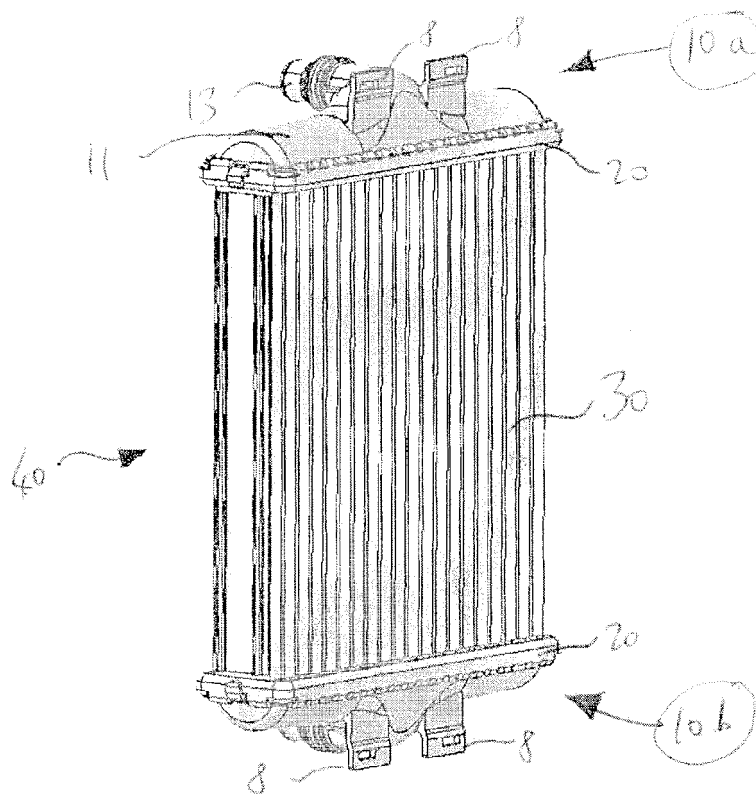


Figure 5

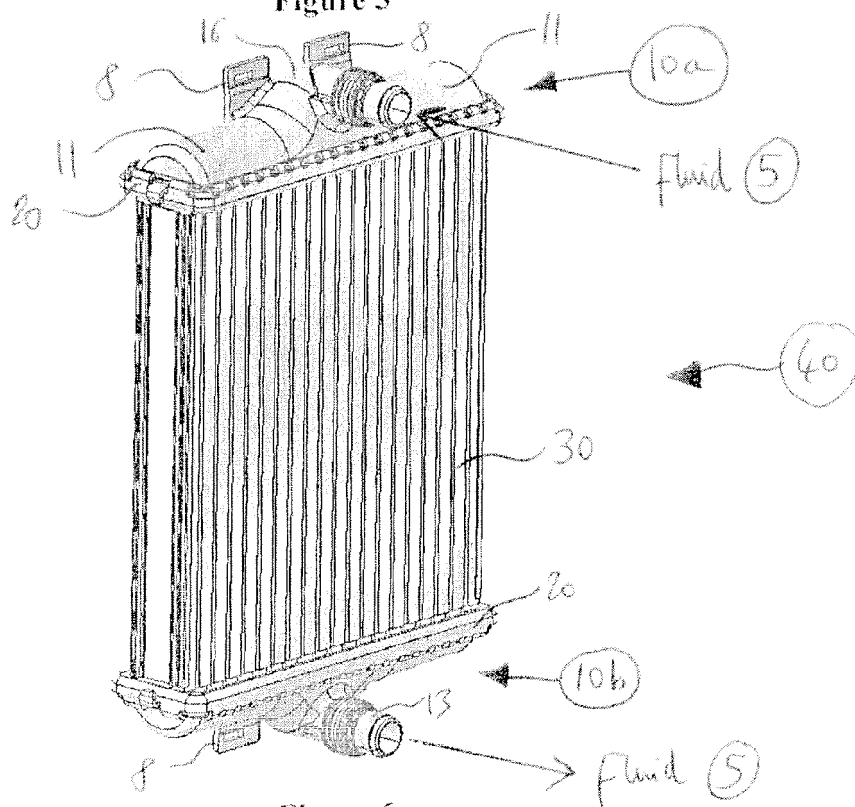
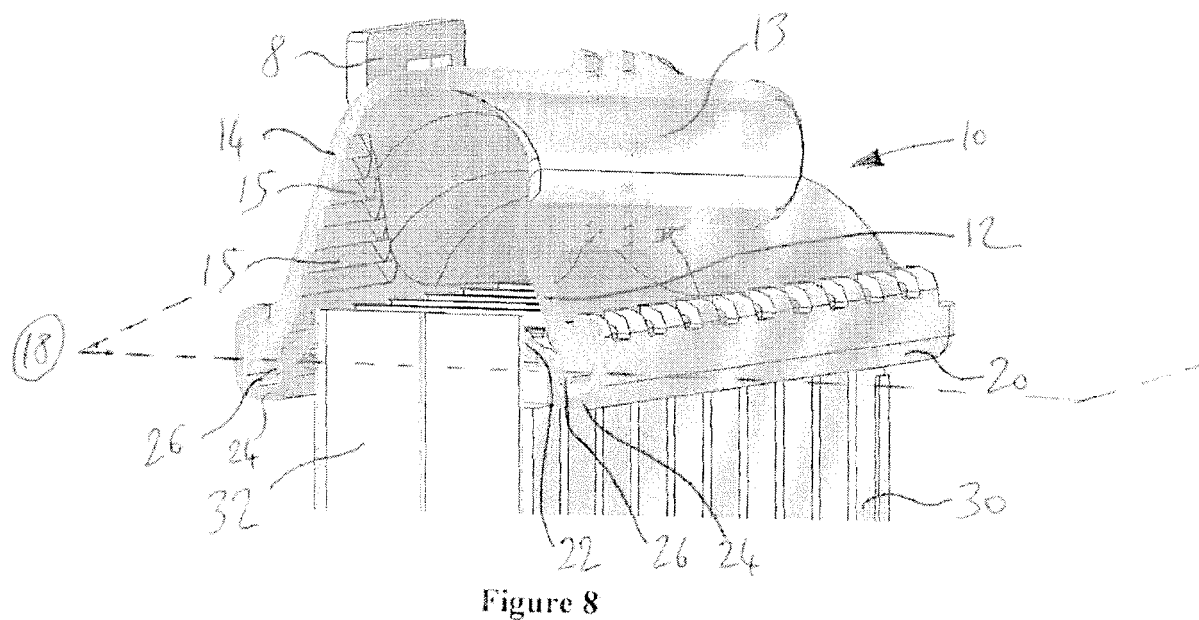
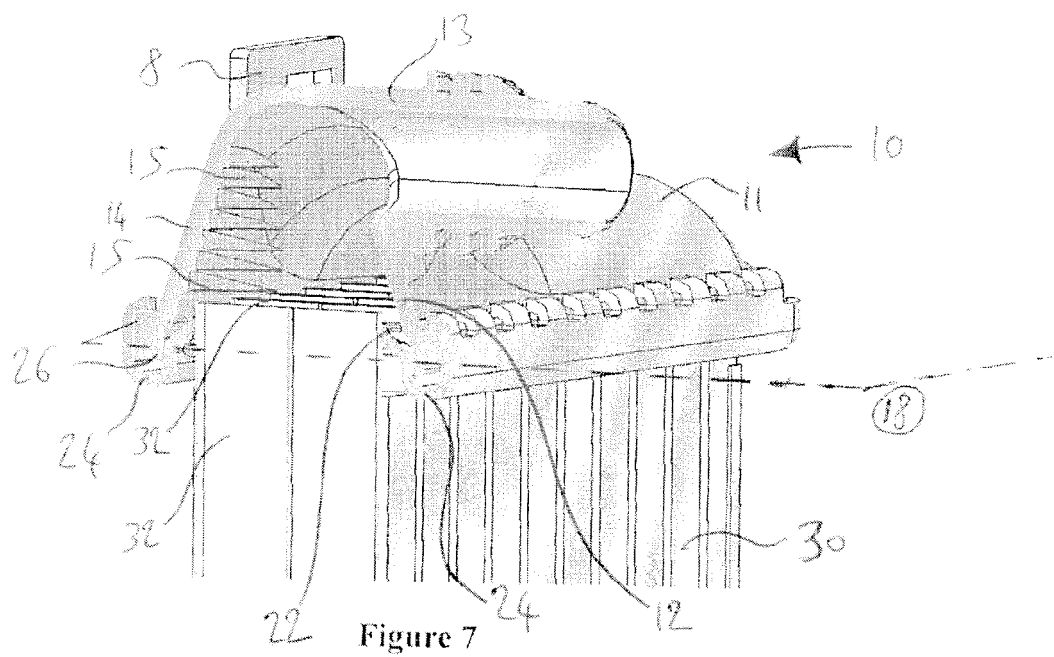


Figure 6





EUROPEAN SEARCH REPORT

Application Number
EP 11 46 1504

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	JP 2006 118425 A (USUI KOKUSAI SANGYO KK) 11 May 2006 (2006-05-11) * figures 1-4 *	1,2,4-6, 11-14	INV. F28F9/02
X	EP 2 256 450 A2 (BEHR GMBH & CO KG [DE]) 1 December 2010 (2010-12-01) * figure 7 *	1-6,11, 12	
X	FR 2 910 120 A1 (VALEO SYSTEMES THERMIQUES [FR]) 20 June 2008 (2008-06-20) * figure 4 *	1,2,4-8, 10,12	
Y		8-10,13, 14	
X	DE 10 2008 006474 A1 (MODINE MFG CO [US]) 30 July 2009 (2009-07-30) * figures 1,2 *	1,2,7,8, 12	
X	DE 197 19 250 A1 (VALEO KLIMATECH GMBH & CO KG [DE]) 12 November 1998 (1998-11-12) * figure 7 *	1-6,12	
X	US 4 693 084 A (AHRENS WILLIAM K [US]) 15 September 1987 (1987-09-15) * figures 1,2 *	1,2,8,12	TECHNICAL FIELDS SEARCHED (IPC)
Y	EP 0 864 839 A2 (BEHR GMBH & CO [DE]) 16 September 1998 (1998-09-16) * figure 3 *	8-10,13, 14	F28F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 June 2011	Examiner Vassoille, Bruno
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EPO FORM 1503 03/82 (P04C01)

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

EP 11 46 1504

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-06-2011

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 2006118425	A	11-05-2006	NONE	
EP 2256450	A2	01-12-2010	DE 102009022986 A1 US 2010300647 A1	02-12-2010 02-12-2010
FR 2910120	A1	20-06-2008	NONE	
DE 102008006474	A1	30-07-2009	NONE	
DE 19719250	A1	12-11-1998	NONE	
US 4693084	A	15-09-1987	NONE	
EP 0864839	A2	16-09-1998	JP 3996258 B2 JP 10292996 A	24-10-2007 04-11-1998