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(54) **A MANIFOLD FOR A HEAT EXCHANGER, IN PARTICULAR FOR AN AUTOMOTIVE RADIATOR**

(57) The subject of the invention comprises a manifold (1), in particular for use in the heat exchanger (19), such as an automotive radiator. The manifold comprises the housing (4) having defined therein at least one longitudinal channel (5) and also plurality of slots (10) on one surface thereof, which slots (10) are in fluid communication with the longitudinal channel (5). The manifold also comprises cover (2) applied on the housing (4) having plurality slots (3) at positions corresponding to the positions of the slots (10) of the housing (4) and connect-

ed to the housing (4) by a brazed connection. The cover (2) is provided with through holes (20) for detecting leakage of the cooling medium through defects of a brazed connection between said cover (2) and the housing (4), wherein said through holes (20) are formed in areas of the cover (2) between the slots (3) thereof.

The invention relates also to a heat exchanger, in particular an automotive radiator, comprising such manifold.

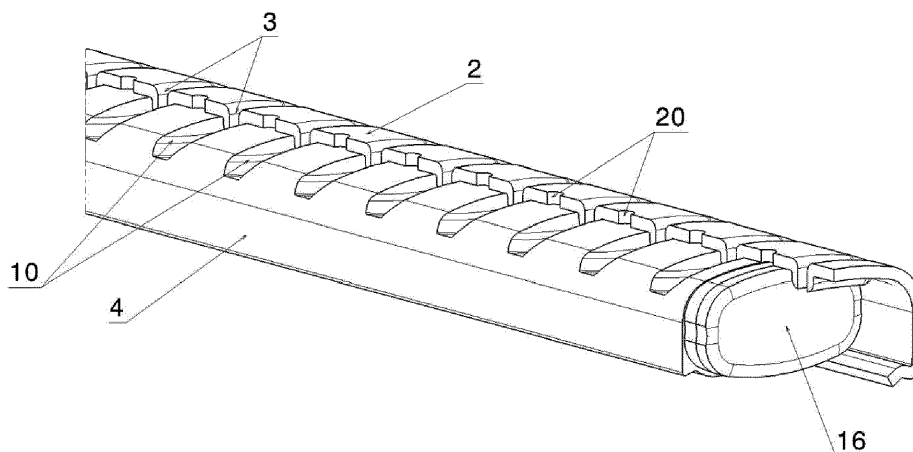


FIG. 3

Description

TECHNICAL FIELD

[0001] The present invention relates to a manifold for a heat exchanger, in particular for an automotive radiator.

BACKGROUND OF THE INVENTION

[0002] From the patent application publication EP 2960609 a manifold for a heat exchanger comprising of two parts, namely the housing and the cover applied and bent over the housing, is known. Both those elements are provided with plurality corresponding slots for receiving flat tubes of the heat exchanger. The housing is provided with channels formed therein for the flow of a cooling medium, and the tubes, which pass through the slots in the housing and the slots in the cover, are in fluid communication for the fluid to these channels for the flow of a cooling medium.

[0003] During manufacturing of the manifold the cover is connected to the housing by brazing on the interfaces of the cover and housing. Brazing of two relatively large surfaces, which are surfaces of the cover and housing, can lead to defects of brazed connections in the form of gaps, which cause the leakage of the cooling medium flowing through the manifold and prevents the operation or deteriorates stability of the heat exchanger. This is due to the fact that during operation a surface is subjected to the effects of high pressure, including pressure having pulsed character, causing fatigue cracking of the cover or, less commonly, the housing in the locations of brazing discontinuities, leading to the loss of functionality of the manifold and the entire air conditioning system. Typically, during the production of a heat exchanger, a leak test is conducted for leaks at a pressure of 1.3 x 16 MPa, giving test pressure of 20.8 MPa, in order to eliminate the defective heat exchangers before they are installed in further complex products. However, it was found such a test does not allow detecting small defects in brazed connections at an interface of large surfaces of the cover and housing of manifolds. Also, a visual overview of manifolds with such defects does not give expected results.

[0004] Satisfactory results of determining defects in brazed connections of covers and housings of manifolds could give a test carried out at pressure of 25-30 MPa, which, however, has a negative impact on the manufacturing cycle time, because such test is longer and must be carried out at increased requirements in terms of sealing and construction of the leak testing equipment.

[0005] Another solution for the leak detection or brazing defects of covers and housings of manifolds, leading after a short operation period to leakage of the manifold, would be the use of a complicated system for detecting micro-deformations in the manifold, which would be carried out after completion of the leak test. However, this method is also complex and time-consuming.

[0006] The aim of the present invention is to provide

the manifold in which simple and efficient detection of defects of a brazed connection between the cover and the housing is possible, while it is easier and cheaper in the production.

SUMMARY OF THE INVENTION

[0007] The above object is achieved by a manifold for a heat exchanger, in particular automotive radiator, according to claim 1 and the following dependent claims.

[0008] The subject of the invention is also a heat exchanger, in particular an automotive radiator, according to claim 12, comprising such manifold.

[0009] The manifold according to the invention, in which the cover having the shaped through holes are used, allows easy and quick detection of brazing defects occurring in the brazing connection between the cover and housing of the manifold during its manufacture. The use of the cover of the manifold having holes showing a leak during a production routine test allows manifolds to be easily determined which of them are tight and which are structurally weakened by defective brazing leading to premature failure during use of the heat exchanger by end users. Thus, the use of the manifold with a cover having the through holes according to the invention facilitates elimination of defective products at the manufacturing stage of the heat exchanger due to their defects that are undetectable during routine production testing, which heat exchangers of this type are subjected to.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention is described hereinafter and illustrated in the accompanying drawings by its exemplary embodiments, wherein:

Fig. 1 is an exploded perspective view of the manifold according to the invention.

Fig. 2 is a perspective view of a fragment of the heat exchanger having the manifold of Fig. 1.

Fig. 3 is a perspective view of the manifold according to the invention, with a part of the cover cut off along the line A-A of Fig. 4, in order to show the through holes in the cover.

Fig. 4 shows a cover of the manifold viewed from the side faced to tubes.

Fig. 5 is an exploded perspective view from one side of a heat exchanger with manifolds according to the invention.

EMBODIMENTS OF THE INVENTION

[0011] As shown in Figs. 1-4 the manifold 1 according to the invention is adapted to attach the flat tubes 17 to

it for conducting the cooling medium, to form the heat exchanger 19, in particular an automotive radiator, such as shown in Fig. 5 and discussed hereinafter.

[0012] Each manifold 1 comprises a housing 4 and a cover 2, as shown in particular in Fig. 2.

[0013] The cover 2 is manufactured as one part of a metal sheet, preferably of aluminium or its alloys, having thickness 0.8 mm to 2 mm, more preferably 1 mm, by means of the stamping process in such manner that it substantially replicates an external shape of the housing 4. The cover 2 can be subjected to cladding with an alloy of lower melting point relative to the melting point of the substrate material (e.g. AlSi alloy) on one or both sides in order to facilitate brazing. The cover 2 has plurality slots 3 formed in one row and parallel to each other for receiving flat tubes 17 when the manifold 1 is used in the heat exchanger 19, said flat tubes 17 of the heat exchanger 19 are introduced, between which the ribs 18 are extended. The slots 3 are precisely matched to the dimensions of the flat tubes 17 and tightly receive the tubes 17.

[0014] The housing 4 has a closed hollow profile, it is an one-piece element manufactured using an extrusion process, it has thick and solid walls resulting in its resistance to high operational pressure and it contains at least one channel 5 in its interior at for the flow of a cooling medium. In the illustrated embodiment the housing 4 comprises two separate longitudinal channels 5a and 5b separated from each other by a reinforcing arch 7 in order to strengthen the structure of the housing 4 and the entire manifold 1. The housing 4 is also provided in its interior, i.e. on internal surfaces 6a, 6b of the channels 5a, 5b, with stopping elements 8, against which the inserted flat tubes 17 abut. The stopping elements 8 can have a form of projections extending along the channels 5a, 5b from their surfaces 6a, 6b toward a centre of the channels 5a, 5b. Furthermore, the housing 4 has plurality of slots 10 at positions corresponding to the positions of the slots 3 in the cover 2, wherein the slots 10 need not be made with such accurate dimensions as the slots 3 of the cover 2, that is, their dimensions did not have to be exactly matched to the dimensions of the flat tubes 17, but it is sufficient that the slots 10 will have a size at least the same or larger than the size of the flat tubes 17, and hence also the slots 3. This results in that the flat tubes 17 are received loosely into the slots 10 and tightly into the slots 3. Like the cover 2, the housing 4 is also preferably made of aluminium or its alloys.

[0015] Referring particularly to Figs. 2, 3 and 5, it can be noted that the cover 2 is laid and bent over the housing 4, in particular over its corners 9, so that, preferably, a larger portion of one of the outer surfaces of the housing 4, opposite to the surface on which the slots 10 are made, remains an exposed surface 12. It is sufficient that the cover 2 will cover at least a surface of the housing 4, in which the slots 10 are arranged. The cover 2 can protrude longitudinally beyond the ends 14 of the housing 4, so as to form a seat 15 for a plug 16, preferably made of aluminium or its alloys, for sealing the ends of the chan-

nels 5, 5a, 5b and the entire manifold 1. In another embodiment (not shown) the plug can abut against the cover and the housing together.

[0016] As shown in Figs. 1 and 5, in use of the manifold 1 according to the invention in the heat exchanger 19, the flat tubes 17 are inserted into the slots 3, 10 of both components of the manifold 1, that is into the cover 2 and the housing 4. The tubes 17 are firstly received tightly into the slots 3 and next loosely into the slots 10 and abut against the stopping elements 8 in the housing 4 with the result that their further inward movement into the housing 4 is stopped and their position in the housing is fixed. This also results in that the outlets/inlets of the flat tubes 17 will not be blocked/closed by the surfaces 6a, 6b of the channels 5a, 5b. The flat tubes 17 are secured to and sealed against the manifold 1 by brazing between the flat tube 17 and the cover 2, i.e. around the slots 3.

[0017] The cover 2 and the housing 4 are also joined together and sealed against each other by brazing in a brazing furnace. The aim of such connection is the sealing of all contact edges between the cover 2 and the housing 4. However, the brazing of the two relatively large surfaces, such as surfaces of the cover 2 and the housing 4, can lead to brazing defects in the form of gaps, which will result in leakage of the cooling medium out the housing 2 through the areas around the tubes 17 mounted loosely in the slots 10 and through said gaps in the brazed connection.

[0018] Detection of defects of brazed connection between the cover 2 and the housing 4, leading to weakening the structure, leakages at the manufacturing stage of heat exchangers and during operation, is very important because the pressure of the cooling medium in the manifold is up 17 MPa, and even small brazing defects and small leakages cause the loss of functionality of the heat exchanger at end-users.

[0019] In order to enable easy detection such defects during the manufacture of the heat exchanger the cover 2 according to the invention is provided with a number of through holes 20 as shown in Figs. 3 and 4, for detecting the leakage of the cooling medium. The through holes 20 are formed in the areas of the cover 2 between its slots 3 for seating of the tubes 17. In particular, the through holes 20 are preferably cylindrical and are arranged along the plane of symmetry of the cover 2 as shown in Figs. 1, 3 and 4, but there are also other possible cross-sections of those through holes and their location out of the plane of symmetry of the cover 2. While in the drawings one through hole is located between each two adjacent slots 3, other arrangements of the slots are possible. If in a brazed connection of the cover 2 and the housing 4 a defect in the form of a gap, which causes the leakage of a cooling medium into the space between the cover 2 and the housing 4, occurs it is possible to easily observe and locate the presence of that cooling medium in that intermediate space from outside of the cover 2 due to the leakage of that cooling medium through the through hole 20 that is located closest to that gap.

Thanks to that it is possible quick and reliable detecting of the heat exchanger having that defective manifold, to eliminate it from further production process and application in other complex products.

[0020] The through holes 20 are formed in a known cheap and easy way through cutting them by a punching tool in a stamping process of the housing 2.

[0021] Fig. 5 shows the heat exchanger, in which manifolds 1 according to the invention are used. In the illustrated embodiment two separate manifolds 1 are arranged on the right side of the heat exchanger 19, wherein one of them is used for supplying the cooling medium into the heat exchanger, while the other is for discharging that medium. These manifolds 1 are provided with ports 13 on their exposed surfaces 12, uncovered by the cover 2, for connection to an external circuit of a cooling medium. The ports 13 are in fluid communication with the channels of the housing 4. The manifold 1 shown in Fig. 5 on the left side of the heat exchanger 19 is not provided with such ports, therefore it is only an intermediate element in the heat exchanger 19, i.e. the cooling medium enters through one of the manifolds 1 on the right side of the heat exchanger, flows through a part of the flat tubes, flows into the manifold 1 on the left side of the heat exchanger, re-enters later into the second part of the flat tubes 17 and exits through the other of the manifolds 1 on the right side of the heat exchanger 19.

[0022] In another embodiment (not shown) of the heat exchanger one manifold can be used on either side of it, each of which has a port, wherein one of the tubes is an inlet tube and the other is an outlet tube.

[0023] Note that it is possible to exchange technical features between the above-described embodiments of the invention. It is possible to connect some manifolds in one longer manifold, wherein, in such a case, the manifolds without plugs are used which are firmly butt joined, and only then the ends of the extreme manifolds are closed with plugs.

Claims

1. A manifold (1) to a heat exchanger, in particular to an automotive radiator, comprising:

a housing (4) which is an one-piece element having a closed profile and having at least one longitudinal channel (5) defined therein and also plurality of slots (10) located on one of the surfaces of said housing (4), wherein said slots (10) are in fluid communication to said at least one longitudinal channel (5); and
a cover (2) laid on said housing (4) and having plurality of slots (3) at positions corresponding to the positions of said slots (10) of said housing (4) for receiving tubes (17) of the heat exchanger (19), wherein said cover (2) is connected to said housing (4) by a brazing connection;

characterized in that:

said cover (2) is provided with a number of through holes (20) for detecting leakage of the cooling medium through a brazed connection between said cover (2) and the housing (4), wherein said through holes (20) are formed in areas of the cover (2) between the slots (3).

2. The manifold (1) according to Claim 1, **characterized in that** said through holes (20) are arranged along the plane of symmetry of the cover (2).
3. The manifold (1) according to Claim 1 or 2, **characterized in that** said through holes (20) are cylindrical and have diameter in a range from 0.5 to 4mm.
4. The manifold according to any one of the preceding Claims, **characterized in that** said cover (2) and said housing (4) are made of aluminium or its alloys and are connected by means of brazing to each other.
5. The manifold according to any one of the preceding Claims, **characterized in that** said cover (2) comprises a clad layer of an alloy having a lower melting point relative to the melting point of the substrate material deposited on at least one surface thereof.
6. The manifold (1) according to any one of the preceding claims, **characterized in that** said cover (2) has thickness in a range from 0.8 to 2 mm.
7. The manifold according to any one of the preceding claims, **characterized in that** the size of said slots (3) of said cover (2) is at least equal to or greater than the size of said slots (10) of said housing (4).
8. The manifold according to any one of the preceding claims, **characterized in that** said at least one longitudinal channel (5) comprises two channels (5a, 5b) separated by a reinforcement arch (7), wherein each said channel (5a, 5b) has its own stopping element (8) on its inner surface (6a, 6b) for positioning ends of the tubes (17) in the housing (4).
9. The manifold according to any one of the preceding claims, **characterized in that** one surface (12) of said housing (4) is exposed and comprises at least one port (13), which is in fluid communication to said at least one longitudinal channel (5), for connection to an external circuit of the cooling medium circuit.
10. The manifold according to any one of the preceding claims, **characterized in that** it is closed at both of its ends by a plug (16).

11. The manifold according to Claim 8, **characterized in that** said plug (16) is made of aluminium or its alloys and is connected to said cover (2) and said housing (4) by means of brazing.

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12. A heat exchanger (19), in particular an automotive radiator, comprising the manifold (1) according to any one of Claims 1-12.

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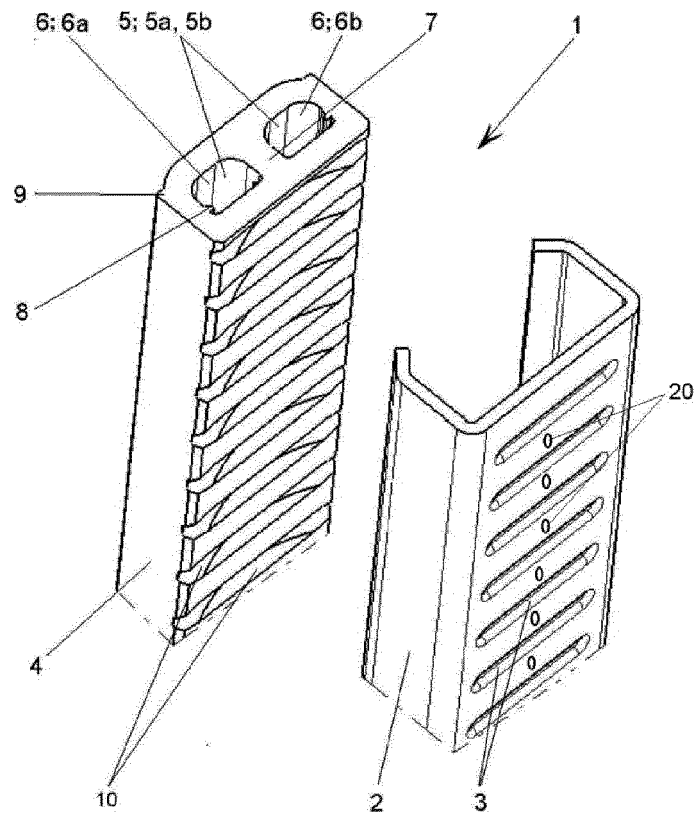


Fig. 1

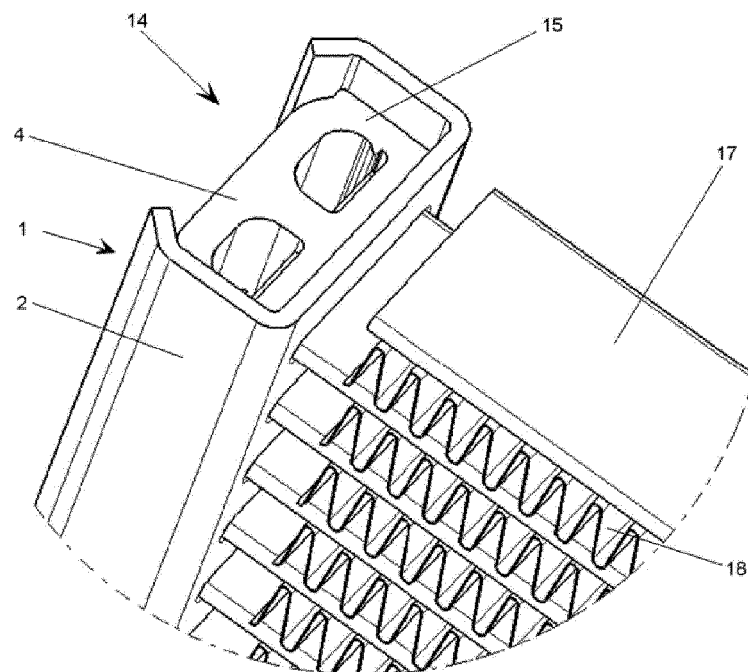


Fig. 2

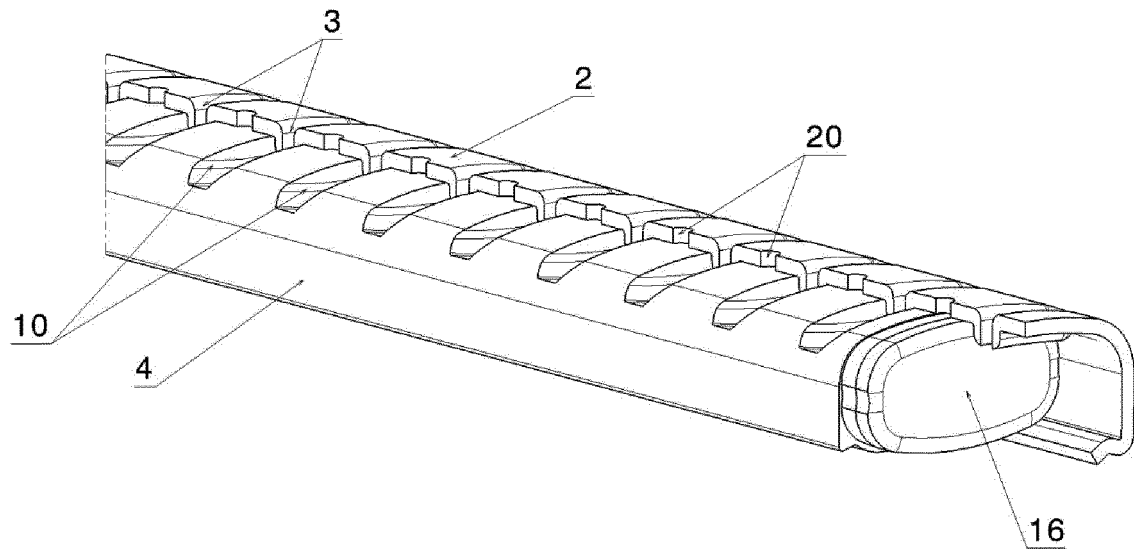


FIG. 3

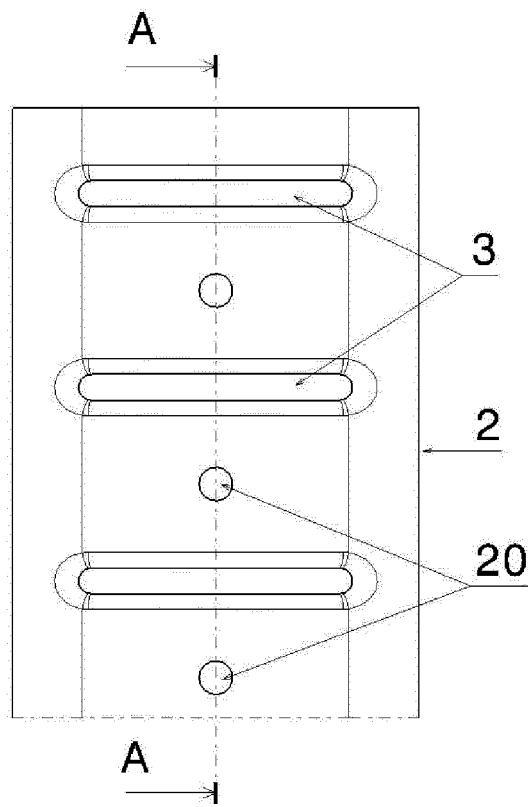


FIG. 4

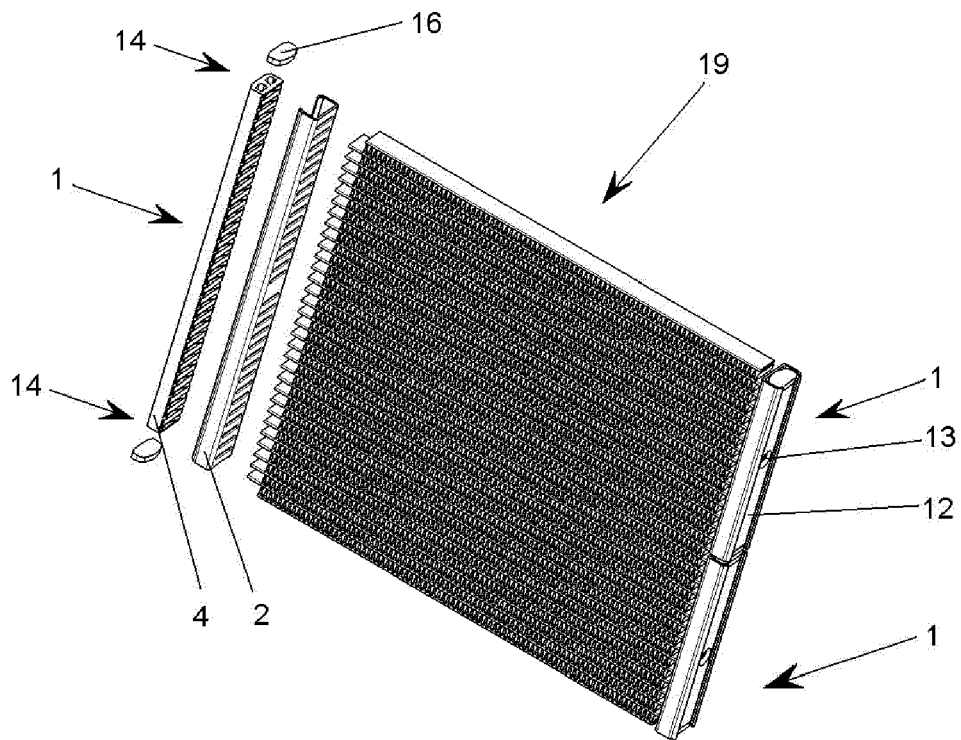


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 16 17 0581

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 October 2016	Examiner Bain, David
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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