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(54) A FLAT TUBE FOR A HEAT EXCHANGER

(57) A flat tube for a heat exchanger, formed by a sheet material and defined by a bottom wall 11, a top wall 12 and two side walls 13, wherein at least one of the side walls 13 comprises a first layer 13a and a second layer 13b of the sheet material, wherein the first layer 13a has an curved portion 14 forming a conduit 15 together with the second layer 13b.

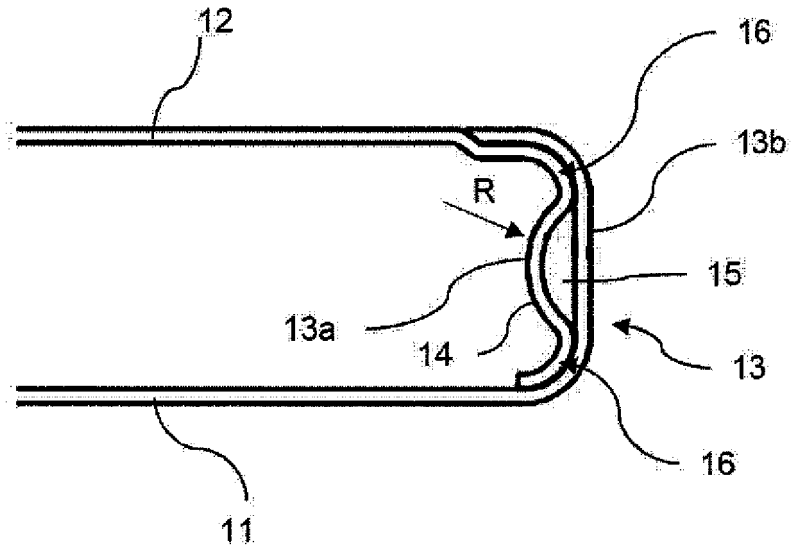

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a tube for a heat exchanger. More particularly, the present invention relates to a flat tube for a heat exchanger used in the automotive industry.

BACKGROUND OF THE INVENTION

[0002] In known heat exchangers, for example those used in the automotive industry, the heat exchange can take place between two fluids. The first fluid can be guided through a conduit formed by elements of the heat exchanger. These can be two manifolds connected fluidically by means of tubes. One of the fluids travels through these tubes between said manifolds. There can be spaces provided between the tubes, through which the second fluid can travel from one side of the tubes to the other. The tubes conduct the heat of the first fluid which is then transferred to the second fluid, or vice versa.

[0003] There are known flat tubes, which in cross-section have an elongated shape defined by two parallel walls connected at their side edges by side walls of substantially smaller height. These tubes are generally placed one above the other so that their neighboring flat, parallel walls form channels for the second fluid. The tubes can comprise inner fins, for example in form of corrugated sheets, the bent portions of which are in contact with said flat parallel walls of the flat tubes. These fins facilitate the heat exchange. The example of such tubes is described in patent applications with publication numbers EP1089047A2 or EP1906127A2.

[0004] However, for the fins commonly used in the industry, the process of successfully filling the inner channel of the flat tube is complicated. In particular, a uniform distribution of the corrugated sheet in the flat tube poses difficulties which are hard to overcome in a cost-efficient manner. This is especially the case with flat tubes in which the side walls and their corner portions between the parallel flat walls and said side walls are made of layered tube material. In other words, the material thickness of the flat tube, due to its layered structure in those areas, varies towards its inner side, thereby hindering the uniformity of the fins distribution within the tube. For example, if the tube wall thickness is greater in the corner section in which normally the last wall portion of the fin of normal height would terminate, this last wall portion is made shorter. In other cases, the fin terminates at the last bent portion. In most cases this creates a space by the side wall of the tube which is unoccupied by the fin. This space creates a so called air bypass. The bypass does not contribute to the heat exchange in a manner similar to the rest of the flat tube.

[0005] It is thus the aim of the invention to improve operation of the flat tube assembly comprising a flat tube and a fin inside said tube, and in particular to improve the heat exchange capabilities of the flat tube assembly. It is aimed to achieve this effect in a cost efficient manner which would be easy to implement.

SUMMARY OF THE INVENTION

[0006] The object of the invention is a flat tube for a heat exchanger, formed by a sheet material and defined by a bottom wall, a top wall and two side walls, wherein at least one of the side walls comprises a first layer and a second layer of the sheet material, characterized in that the first layer has an curved portion forming a conduit together with the second layer.

[0007] Preferably, the curved portion has a circular cross-sectional shape defined by radius R.

[0008] Preferably, the first layer comprises brazed portions which form a connection with the second layer at the opposing sides of the conduit.

[0009] Preferably, the tube further comprises a fin in the space defined by its walls.

[0010] Preferably, the tube has a has a height H = 7,5 mm and width W = 100 mm, and a curved portion 14 has a radius R = 2.4 mm.

BRIEF DESCRIPTION OF DRAWINGS

[0011] Examples of the invention will be apparent from and described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows the tube according to the invention.

Fig. 2 shows the tube according to the invention with a fin.

DETAILED DESCRIPTION OF EMBODIMENTS

[0012] The figures show a flat tube 10 for a heat exchanger. The heat exchanger can be a charge air cooler, water charge air cooler, condenser, radiator and the like. The flat tube 10 is formed by a sheet material and is defined by a bottom wall 11, a top wall 12 and two side walls 13. The side walls can be completely arcuate or can comprise a flat middle section. The distance between the bottom wall 11 and the top wall 12 defines the height direction H. On the other hand, the distance between the side walls 13 defines the width direction W. This width direction is to be understood to run parallel to the flat, parallel walls 11, 12, while the height direction is to be understood to run perpendicular to the flat, parallel walls 11, 12.

[0013] At least one of the side walls 13 comprises a first layer 13a and a second layer 13b of the sheet material. This is achieved when the tube is manufactured by folding the sheet material into the shape of the flat tube, wherein two opposing ends of the sheet overlap onto each other. The tube can also be manufactured from two parts, i.e. a bottom part and a upper part, the side

walls being created when respective walls are connected in a layered manner. In either case, the layers can be connected by brazing.

[0014] According to the invention, the first layer 13a has an curved portion 14 forming a conduit 15 together with the second layer 13b. This conduit can be closed so that it can guide the fluid between the first layer 13a and the second layer 13b. The curved portion 14 protrudes into the inner space of the tube in the width direction and thereby prevents creation of the air bypass when a corrugated fin is placed in the tube. The degree of protrusion of the curved portion can be selected depending on the tube and dimensions, so that the unoccupied space between the fin 16 and side wall 13 is minimized. For example the curved portion 14 can have a circular cross-sectional shape defined by radius R. For the tube of dimensions H = 7,5 mm and W = 100 mm, the R can be 2,4 mm.

[0015] In a preferred embodiment, the first layer 13a comprises brazed portions 16 which form a connection with the second layer 13b at the opposing sides of the conduit 15, that is on the bottom and the top of the side wall 13 along the height direction. This provides improves the rigidness of the tube.

[0016] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of drawings, the disclosure, and the appended claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to the advantage.

Claims

1. A flat tube for a heat exchanger, formed by a sheet material and defined by a bottom wall 11, a top wall 12 and two side walls 13, wherein at least one of the side walls 13 comprises a first layer 13a and a second layer 13b of the sheet material, **characterized in that** the first layer 13a has an curved portion 14 forming a conduit 15 together with the second layer 13b.

2. A flat tube according to claim 1, wherein the curved portion 14 has a circular cross-sectional shape defined by radius R.

3. A flat tube according to any preceding claim, wherein the first layer 13a comprises brazed portions 16 which form a connection with the second layer 13b at the opposing sides of the conduit 15.

4. A flat tube according to any preceding claim, wherein it further comprises a fin in the space defined by its walls 11, 12, 13.

5. A flat tube according to claim 2, wherein the tube has a height H = 7,5 mm and width W = 100 mm, and a curved portion 14 has a radius R = 2.4 mm.

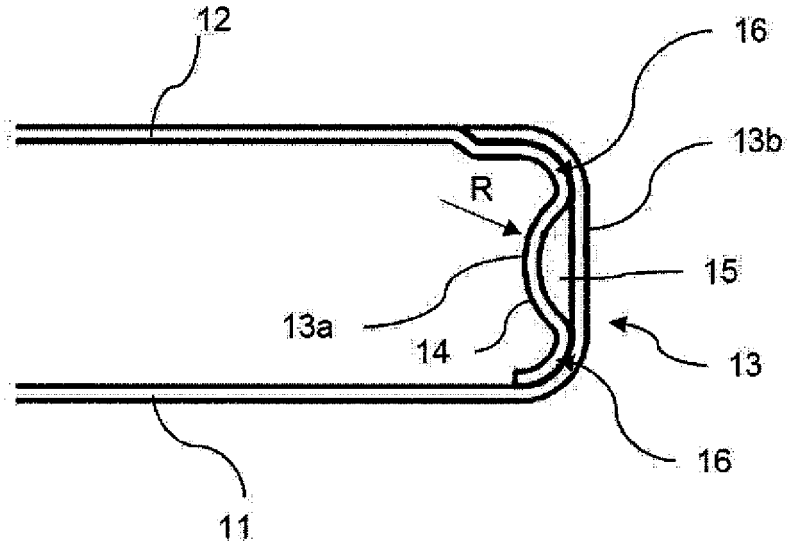

Fig. 1

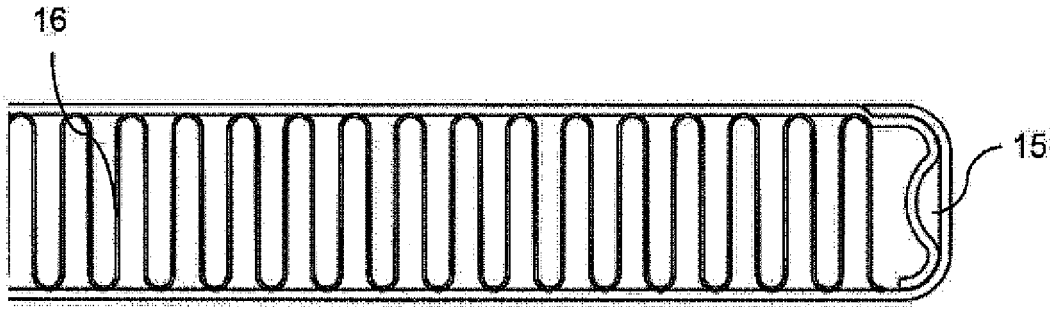

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 18 46 1516

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 2009/166020 A1 (SMITH PAUL R [US] ET AL) 2 July 2009 (2009-07-02) * abstract; figures 8B, 8D, 9B, 9c, 10A, 10C * * paragraph [0071] *	1-5	INV. F28F1/40 F28D1/03 F28F1/00 F28F1/02
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X	JP 2012 229853 A (SHOWA DENKO KK) 22 November 2012 (2012-11-22) * abstract; figures 2, 3 *	1-5	

TECHNICAL FIELDS SEARCHED (IPC)

F28F
F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 March 2018	Leclaire, Thomas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 46 1516

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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07-03-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- EP 1089047 A2 **[0003]**
- EP 1906127 A2 **[0003]**