(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 521 746 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
19.04.2023 Bulletin 2023/16

(21) Application number: **18461516.9**

(22) Date of filing: **06.02.2018**

(51) International Patent Classification (IPC):
F28F 1/40 *(2006.01)* ***F28D 1/03*** *(2006.01)*
F28F 1/00 *(2006.01)* ***F28F 1/02*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F28D 1/0391; F28F 1/003; F28F 1/02; F28F 1/40;
F28F 3/025; F28F 3/06; F28F 2225/04

(54) A FLAT TUBE FOR A HEAT EXCHANGER

FLACHROHR FÜR WÄRMETAUSCHER

TUBE PLAT POUR ÉCHANGEUR DE CHALEUR

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:
07.08.2019 Bulletin 2019/32

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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] Various configuration are proposed adress this problem. For example, US2009166020A1 describes a fin with both end parts forming a second wall. Each end part of the fin formed a conduit with the corresponding wall of the tube. This solution implies forming the fin with these end parts, and thus a more complex process. JP2012229853A describes a tube which upper and lower walls form two ducts at a side wall. Such a solution solves part of the problem but requires more material, as the wall is generally thicker than the fin. Finally, US2009/014164A1 describes numerous configurations, some of which have a duct in a side wall. The fins are formed by the wall itself, which, in addition to generating process costs, involves an increase in material compared to the use of fins.

[0006] 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

[0007] 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.

[0008] Preferably, the curved portion has a circular cross-sectional shape defined by radius R.

[0009] The first layer comprises brazed portions which form a connection with the second layer at the opposing sides of the conduit.

[0010] The tube further comprises a fin in the space defined by its walls. 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 DESCRITPTION 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 a detail of 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] 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 said flat tubes further comprises a corrugated fin (16) in the space defined between its walls (11, 12, 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 a curved portion (14) forming a conduit (15) together with the second layer (13b), the curved portion (14) protruding into the inner space of the tube in the width direction and thereby preventing creation of an air bypass when the corrugated fin (16) is placed in the tube, wherein the first layer (13a) comprises brazed portions which form a connection with the second layer (13b) at the opposing sides of the conduit (15).

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 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.

Patentansprüche

1. Flachrohr für einen Wärmetauscher, das durch ein Blechmaterial gebildet ist und durch eine untere Wand (11), eine obere Wand (12) und zwei Seitenwände (13) definiert wird, wobei das Flachrohr ferner eine Wellrippe (16) in dem zwischen seinen Wänden (11, 12, 13) definierten Raum umfasst, wobei mindestens eine der Seitenwände (13) eine erste Schicht (13a) und eine zweite Schicht (13b) aus dem Blechmaterial umfasst, wobei die erste Schicht (13a) einen gekrümmten Abschnitt (14) aufweist, der zusammen mit der zweiten Schicht (13b) eine Leitung (15) bildet, wobei der gekrümmte Abschnitt (14) in Breitenrichtung in den Innenraum des Rohrs ragt und dadurch bei Platzieren der Wellrippe (16) in dem Rohr die Schaffung eines Luft-Bypasses verhindert, wobei die erste Schicht (13a) hartgelötete Abschnitte umfasst, die an den gegenüberliegenden Seiten der Leitung (15) eine Verbindung mit der zweiten Schicht (13b) bilden.

2. Flachrohr nach Anspruch 1, wobei der gekrümmte Abschnitt (14) eine durch den Radius R definierte kreisförmige Querschnittsform aufweist.

3. Flachrohr nach Anspruch 2, wobei das Rohr eine Höhe H = 7,5 mm und eine Breite W = 100 mm aufweist und ein gekrümmter Abschnitt 14 einen Radius R = 2,4 mm aufweist.

Revendications

1. Tube plat pour un échangeur de chaleur, formé par un matériau en tôle et défini par une paroi inférieure (11), une paroi supérieure (12) et deux parois latérales (13), dans lequel ledit tube plat comprend en outre une ailette ondulée (16) dans l'espace défini entre ses parois (11, 12, 13), dans lequel au moins une des parois latérales (13) comprend une premiè-

re couche (13a) et une seconde couche (13b) du matériau en tôle,
dans lequel la première couche (13a) a une partie incurvée (14) formant un conduit (15) conjointement avec la seconde couche (13b), la partie incurvée (14) faisant saillie dans l'espace intérieur du tube dans le sens de la largeur et ainsi empêchant la création d'une dérivation d'air lorsque l'ailette ondulée (16) est placée dans le tube, dans lequel la première couche (13a) comprend des parties brasées qui forment une liaison avec la seconde couche (13b) sur les côtés opposés du conduit (15).

2. Tube plat selon la revendication 1, dans lequel la partie incurvée (14) a une forme de section transversale circulaire définie par un rayon R.

3. Tube plat selon la revendication 2, dans lequel le tube a une hauteur H = 7,5 mm et une largeur W = 100 mm, et une partie incurvée (14) a un rayon R = 2,4 mm.

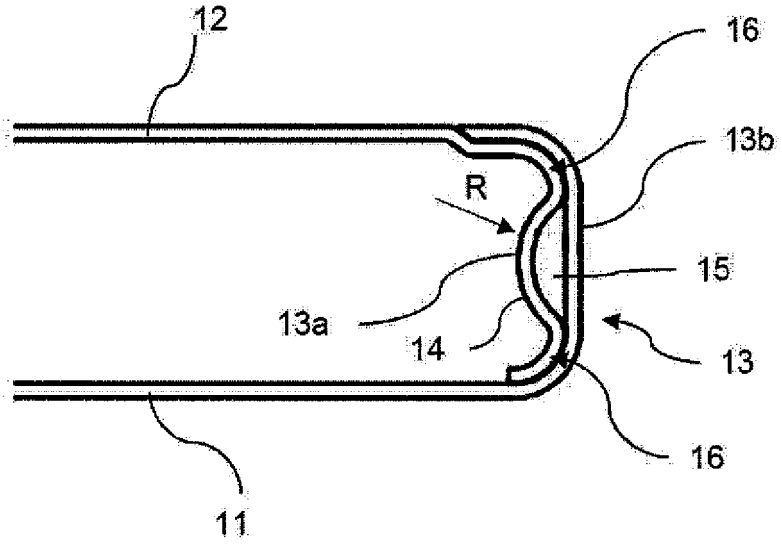

Fig. 1

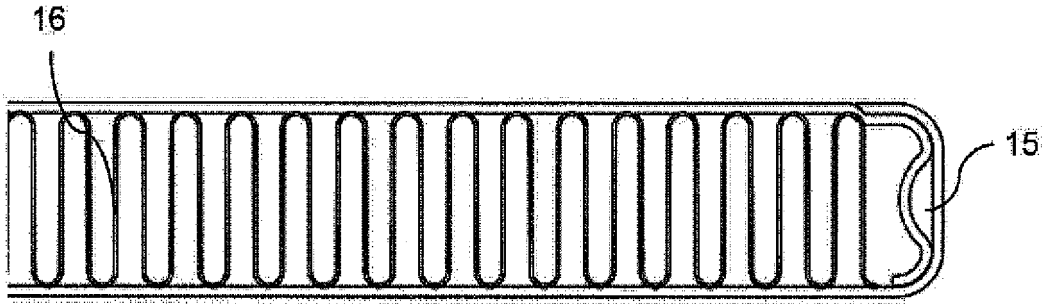

Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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