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(54) HEAT EXCHANGER TUBE

(57) The invention deals with a heat exchanger plate (3) for use in a heat exchanger (19) of a vehicle, the heat exchanger plate (3) is made with a continuous sheet of material (9), the heat exchanger plate (3) comprising two opposite extremities (10), at least one of the extremity (10) of said heat exchanger plate (3) defining a tank area (4) provided with at least one opening (13, 14), the heat exchanger plate (3) defining an active area (5) dedicated to heat exchange between two fluids (RF, AF), said active area (5) being located between the two opposite extremities (10) of the heat exchanger plate (3), wherein the active area (5) is made of a single layer (6) of said sheet of material (9) while the tank area (4) is made of at least two layers (7, 8) of said sheet of material (9).

For motor vehicle.

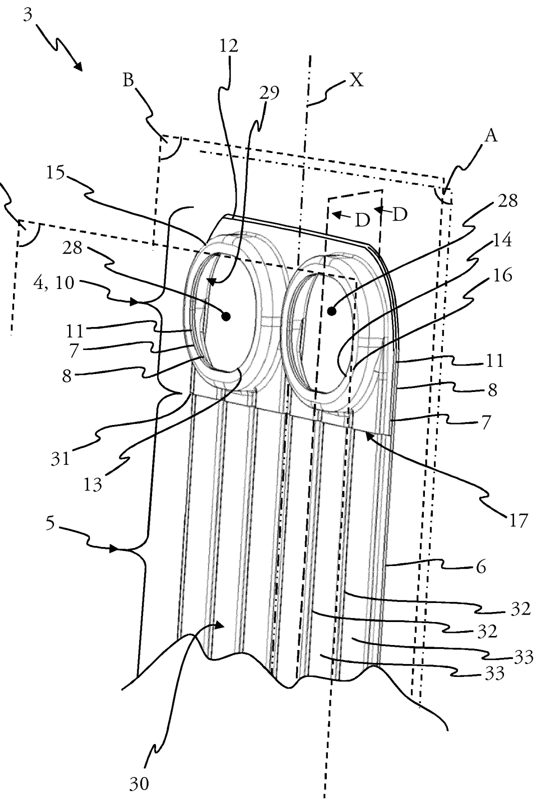

Fig. 2

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Description

[0001] The present invention relates to heat exchangers adapted to vehicle. More specifically, the present invention deal with heat exchanger tubes used for such heat exchangers and heat exchangers using such heat exchanger tubes.

[0002] Heat exchangers are commonly used to achieve a heat exchange between to fluids. Heat exchangers are in particular used to cool down an air flow, and this air flow is then transferred to a passenger compartment of the vehicle or any component of the vehicle that need to be thermally controlled. For this purpose, heat exchangers are conventionally arranged in a heating, ventilation and air-conditioning device of the vehicle.

[0003] To perform the heat exchange, two fluids circulate in the heat exchanger. In the case of aforesaid air-conditioning situation, the air flow passing through the heat exchanger is cooled while a refrigerant fluid circulating inside heat exchanger tubes part of the heat exchanger. This refrigerant fluid circulation generates heat exchange between said refrigerant fluid and the air flow.

[0004] In conventional heat exchangers, heat exchanger tubes are stacked one another with heat dissipation devices arranged in-between. Stacked heat exchanger tubes are interconnected to define together a tank able to collect one of the fluid involved in the heat exchange. Said fluid circulates inside all heat exchanger tubes thank to the tank. When both fluids circulate, one of the fluid passes between heat exchanger tubes through the dissipation devices of the heat exchanger and the other fluid passes inside heat exchanger tubes thanks to the tank. One of these fluids racks up calories of the other fluid.

[0005] The manufacturing step of conventional heat exchangers includes a pressure test in order to check the mechanical strength of heat exchanger tubes. The tank of such heat exchangers is then exposed to pressure constraints that can induces leaks due to the mechanical weakness of the tank. Furthermore, the global shape of the heat exchanger is impacted since the pressure test induce a distortion more important for the tank than for the other parts of said heat exchanger. The resulting shape of the heat exchanger causes difficulties when the heat exchanger is installed in the heating, ventilation and air-conditioning device of the vehicle.

[0006] The invention aims to provide a different heat exchanger tube in order to solve at least these problems, while providing a heat exchanger tube with a design easy to manufacture, at a lower cost and to achieve the best possible results in term of heat exchange.

[0007] For this purpose, the present invention provides a heat exchanger plate for use in a heat exchanger of a vehicle, the heat exchanger plate is made with a continuous sheet of material, the heat exchanger plate comprising two opposite extremities, at least one of the extremity of said heat exchanger plate defining a tank area provided with at least one opening, the heat exchanger plate defining an active area dedicated to heat exchange between two fluids, said active area being located between the two opposite extremities of the heat exchanger plate, wherein the active area is made of a single layer of said sheet of material while the tank area is made of at least two layers of said sheet of material. During heat exchanger plate manufacturing, a double material thickness is created by edge folded back upon itself. The tank area has this double material thickness. The active area remains with a single material thickness.

[0008] The heat exchanger plate results of a folded continuous sheet of material. The sheet of material corresponds to a single Monobloc sheet. The double material thickness is then obtained with the sheet of material itself, ant not by an additional sheet or any additional element.

[0009] The heat exchanger plate has two opposite extremities. We consider that these extremities are located on both extreme sides of the heat exchanger plate when the largest dimension of the heat exchanger plate is considered.

[0010] The tank area is a part of a tank parts of the heat exchanger. The existence of two layers to form the tank area reinforced the structure of the tank area. Then, the tank area has better mechanical strength. Furthermore, the tank area is more resistant to corrosion.

[0011] The active area is the place dedicated to heat exchange. Both sides of the active area are each set up to be in contact with one of the two fluids. The existence of the single layer in place of the active area is suitable with a powerful heat exchange between the two fluids.

[0012] Reinforcing the mechanical resistance of the heat exchanger plate is mainly necessary on the tank area. Then, a very thin sheet of material can be used for the active area while thicken the tank area. The heat exchange plate of the invention thus keeps the mechanical strength of the tank and does not interfere with thermal propriety of the heat exchange plate. Weight of the heat exchanger can be reduced by using a thinner material sheet as usually use.

[0013] To obtain the heat exchange plate of the invention, only a folding step is added to the conventional manufacturing process. Such heat exchanger tube is then easy to manufacture.

[0014] In a specific embodiment of the present invention, the two layers of the heat exchanger plate are peripheral to the opening. The opening is surrounded by the tank area. The opening is excluded from the active area. The opening is reinforced by the two layers in its full-circumference.

[0015] In a specific embodiment of the present invention, the tank area comprises at least one collar that surround the opening. Thanks to the collar, the opening and the active area are localised in distinct plans. The active area extends throughout a general longitudinal plan of the heat exchanger plate. The opening is in a plan parallel to the general longitudinal plan. The plan of the opening is localised between the two layers of the tank area. The collar extends from the general longitudinal plan to the plan of the opening. Then, in regard to the fluid collected in the tank, the opening is in a raised plan compared to the active area, offset thanks to the collar.

[0016] In a specific embodiment of the present invention, the heat exchanger plate comprises a folding line corresponding to one of the extremities of the heat exchanger plate. During heat exchanger plate manufacturing, the edge is folded back upon itself, following the folding line. The folding is made to obtain the two layers facing each other : then the folding creates the extremity of the heat exchanger plate. In a preferred embodiment, the folding line and the edge of the sheet of material extend in parallel. Note that the folding line is not necessarily materialized previously to the sheet of material edge folding.

[0017] In a specific embodiment of the present invention, the collar is located between the folding line and an edge of said sheet of material. Then, both the opening and the related collar are in the tank area. The part of the heat exchanger plate between the folding line and the edge correspond to one of the two layers of the tank area. The other layer extends from the folding line and ends with the active area with which it is continuous.

[0018] In a specific embodiment of the present invention, one of the two layers corresponding to an external layer is located between the folding line and the edge and is outside of a tank volume defined by said collar. The collar extends from the general longitudinal plan to the plan of the opening, creating a cavity that correspond to the tank volume of the heat exchanger plate. Among the two layers, one in an internal layer and the other one an external layer. In regard to the fluid collected in the tank, the external layer located between the folding line and the edge is at the external side of the heat exchanger plate. Then, the surface of the internal side of the heat exchanger plate is smooth and the external side of the heat exchanger plate is not, due to the presence of the edge that produce a protrusion. A smooth internal side of the heat exchanger plate allows a good pairing of two heat exchanger plates associated to form a heat exchanger tube hermetically closed, except on the opening localisation.

[0019] The external side of the heat exchanger plate is set up to contact a dissipation device. The protrusion that exists thanks to the edge creates a mechanical stop for this dissipation device.

[0020] In a specific embodiment of the present invention, the two layers of the tank area are in contact with each other. "Are in contact with each other" means that the sheet of material is folded up to create either a full-contact or a partial contact of both layers, but at least there is a contact. The zone of contact is a two-layers interface. In a preferred embodiment of the invention, the two layers are in contact at the circumference of the opening. In a more preferred embodiment, the two layers are in contact at the collar localisation.

[0021] In a specific embodiment of the present invention, the layer has a thickness between 150 microns and 300 microns. This is the thickness of the active area since the active area has a single layer. Furthermore, this is the thickness of the sheet of material. This thickness is the shortest distance measured from the internal side of the heat exchanger plate to the external side of the heat exchanger plate. Such a thickness is suitable with heat exchange performances. In a particular embodiment, the thickness of the tank area is almost twice thick as the layer thickness.

[0022] In a specific embodiment of the present invention, the sheet of material is an aluminium sheet coated with a brazing film. During the brazing process, the two layers are at least joined on the localisation of the two-layers interface.

[0023] The present invention also deals with a heat exchanger tube for use in a heat exchanger of a vehicle, the heat exchanger tube comprising a pair of heat exchanger plates as previously described. To heat exchanger tubes are paired in order to form a hermetic tube, except on heat exchanger plates openings location. The internal surface of one of the heat exchanger plates face the internal surface of the other heat exchanger plate. Internal surfaces of said heat exchanger plates are partially in contact on a plates-pair interface. During the brazing process, the heat exchanger plates of a pair are at least joined on the localisation of the plates-pair interface.

[0024] The present invention also deals with a heat exchanger comprising a plurality of heat exchanger tubes as previously described, at least one dissipation device being located between two heat exchanger tubes, the dissipation device being in contact with active areas of heat exchanger plates of two heat exchanger tubes and the two heat exchanger tubes being connected to each other thanks to tank areas of heat exchanger plates of the two heat exchanger tubes.

[0025] The present invention also deals with a method for obtaining a heat exchanger plate as previously described, comprising a folding step defining at least the active area, the folding step being made before a plate stamping step. The folding step forms the tank area and differentiates the active area and the tank area. After the folding step, at least two layers of said sheet of material are set up in order to define the tank area.

[0026] In a specific embodiment of the present invention, the continuous sheet of material is at least folded along the folding line during the folding step to obtain a fold material, the fold material comprising at least a first area defined by the single layer and a second area defined by two layers, both first area and second area are then stamped during plate stamped step to respectively form the active area and the tank area.

[0027] The sheet of material can be introduced into the stamping tool for both folding step and plate stamping step. Edge of the sheet of material is folded along the folding line. In a specific example, both opposite edges are fold in the same time, in particular when two tanks are planned in the heat exchanger. In this situation, two second area coexist.

[0028] The double wall of material, namely the two layers, defines the future tank area corresponding to the second area of fold material. The two layers are formed before the plate stamping step. In the main time, the first area of the fold material is keeping its single material thickness. The fold material is an intermediary element between the sheet of material that is a raw material, and the heat exchanger plate that is the product used to form the heat exchanger.

[0029] The fold material, still in the stamping tool, is stamped after the folding process. The plate stamping step give to the heat exchanger plate its shape. After plate stamping step, the assembly of heat exchanger elements, and later their brazing, guarantee the existence of the tank area and the active area. After all the process, both the two layers of the tank area and the single layer of the active area remain.

[0030] Other specificities, details and characteristics of the present invention will be highlighted thanks to the following description, given for general guidance, in relation with the following figures :

- figure 1 is a general view of a heat exchanger including heat exchanger tubes according to the present invention,

- figure 2 is view of a heat exchanger plate according to the present invention,

- figure 3 to 5 are different consecutive sequences of the method for obtaining a heat exchanger plate according to the present invention,

- figure 6 is a transversal section of the heat exchanger tube according to the present invention.

[0031] Concerning dimensions, a length is a dimension measured in a direction where a considered element extends in its biggest way. A width or a height of the considered element are dimensions perpendicular to said length.

[0032] Note that features and different embodiments of the invention may be combined with one another in various combinations, as well as they are not incompatible or exclusive to one another. More particularly, it will be possible to imagine variants of the invention comprising only a selection of the features described hereinafter, without the other characteristics described, if said selection of features provides a technical advantage or if it allows to distinguish the invention over the prior art.

[0033] In particular, the embodiments described hereafter are combinable if said combination is functional from a technical point of view.

[0034] In the following figures, features common to several figures have the same reference.

[0035] Starting from figure 1, a plurality of heat exchanger tubes 1 of the invention are stacked in-between a plurality of dissipation devices 18. Both heat exchanger tubes 1 and dissipation devices 18 are oriented in parallel, according to a longitudinal plan A of one of the heat exchanger tubes 1.

[0036] Heat exchanger tubes 1 and dissipation devices 18 are integrated inside a heat exchanger 19 and alternately staked between two side mounting flanges 20, 21. These side mounting flanges 20, 21 also extend in a plan parallel to the longitudinal plan A of one of the heat exchanger tubes 1. Heat exchanger tubes 1 and dissipation devices 18 from a core 47 of the heat exchanger 19, said core 47 being the part which is crossed by an air flow AF corresponding to a first fluid and where a refrigerant fluid RF, corresponding to a second fluid, flows.

[0037] A first side mounting flange 20 is blind. A second side mounting flange 21, opposed to the first side mounting flange 20 versus the core 47, comprise two mouths 22, 23 at a same first extremity 24 of the second side mounting flange 21. One mouth is a first mouth 22 that receives an input plug 25, the other mouth is a second mouth 23 that receives an output plug 26. The input plug 25 and the output plug 26 are intended to join the heat exchanger tubes 1 to a refrigerant circuit. The refrigerant fluid RF enter the heat exchanger 19 in liquid form thanks to the input plug 25. The refrigerant fluid RF is progressively vaporized inside heat exchanger tubes 1. The refrigerant fluid RF exit the heat exchanger 19 in gaseous form thanks to the output plug 26.

[0038] In the example shows in figure 1, the heat exchanger 19 comprises two tanks 2. One tank 2 is at the first extremity 24 of the heat exchanger 19, the other tank 2 is at a second extremity 27. First extremity 24 of the heat exchanger 19 and second extremity 27 of the heat exchanger 19 are opposed each other in the longitudinal dimension of the heat exchanger 19. In a particular example, the tank 2 at the first extremity 24 is divided in two zones, a first zone connected to the first mouth 22 that receives the input plug 25, and a second zone connected to the second mouth 23 that receives the output plug 26. The refrigerant fluid RF circulates from the first zone to the other tank 2 located at a second extremity 27, and then goes to the second zone before its exits.

[0039] Each heat exchanger tube 1 has a globally flat shape. This shape optimizes the heat exchange between heat exchanger tubes 1 and dissipation devices 18. Indeed, it ensure a good contact between heat exchanger tubes 1 and dissipation devices 18, since heat exchanger tubes 1 also supports the corrugated dissipation devices 18.

[0040] In the heat exchanger 19, heat exchange happened between the refrigerant fluid RF and the air flow AF crossing along the dissipation devices 18. The air flow AF licks heat exchanger tubes 1 and dissipation devices 18. The corrugated shape of dissipation devices 18 optimizes the heat transfer from the air flow AF to the refrigerant fluid RF, since it increases considerably heat exchange surfaces comparing to a non-corrugated device.

[0041] Circulating through the heat exchanger tubes 1 of the heat exchanger 19 operating, for example, as an evaporator, the refrigerant fluid RF collect calories from the air flow AF, and consequently cools this air flow AF down.

[0042] The figure 2 illustrates a heat exchanger plate 3 according to the present invention. Only a part of the heat exchanger plate 3 is represented. The heat exchanger plate 3 is a monobloc structure comprising a tank area 4 and an active area 5. The active area 5 has a single layer 6. The tank area 4 has two layers 7, 8, including an external layer 7 and an internal layer 8. "monobloc" means the heat exchanger plate 3 is made with a single sheet of material 9. Any dissociation of the tank area 4 and the active area 5 leads to heat exchanger plate 3 breaking.

[0043] The heat exchanger plate 3 extends toward the longitudinal axis X localised in a general longitudinal plan B of the heat exchanger plate 3. The general longitudinal plan B and longitudinal plan A are distinct and parallel. The heat exchanger plate 3 comprises two opposite extremities 10. Only one extremity 10 is shown on the figure 2. At least one of the extremity 10 of said heat exchanger plate 3 define the tank area 4. According to figure 1, both extremities 10 of the heat exchanger plate 3 contain a distinct tank area 4. One tank area 4 is included in the tank 2 at the first extremity 24, the other tank area 4, not represented on the figure 2, is included in the tank 2 to the second extremity 27.

[0044] In tank area 4, the external layer 7 and the internal layer 8 are in contact with each other to form a two-layers interface 11. More specially, the external layer 7 and the internal layer 8 are in full-contact. In this configuration, there is no remaining space between the external layer 7 and the internal layer 8. The heat exchanger plate 3 comprises a folding line 12 corresponding to one of the extremities 10 of the heat exchanger plate 3. The folding line 12 materialize the boundary line between the external layer 7 and the internal layer 8 of the tank area 4.

[0045] The heat exchanger plate 3 comprises also the active area 5. This active area 5 is dedicated to heat exchange between the two fluids, i.e. the refrigerant fluid RF and the air flow AF. Said active area 5 is located between the two opposite extremities 10 of the heat exchanger plate 3, between the two tank areas 4. The active area 5 is made of a single layer 6 of the sheet of material 9.

[0046] The tank area 4 is provided with at least one opening 13, 14. On the example represented on figure 2, the tank area 4 has two openings 13, 14. These two openings 13, 14 are similar in shape and in size. The external layer 7 and the internal layer 8 of the heat exchanger plate 3 are peripheral to the openings 13, 14.

[0047] The tank area 4 comprises at least one collar 15, 16 that surround the opening 13, 14. For the figure 2 embodiment, both opening 13, 14 are surrounded by a dedicated collar 15, 16. The two collars 15, 16 are located between the folding line 12 and an edge 17 of said sheet of material 9. Each collar 15, 16 defines a tank volume 28, since the collar 15, 16 has its associated opening 13, 14 in a plan C different to that for the one of the active area 5 which is the general longitudinal plan B, as it is explained for figure 6. The tank volume 28 is localised on an internal side 29 of the heat exchanger plate 3. The opposite side of the heat exchanger plate 3 corresponds to an external side 30 of the heat exchanger plate 3. The heat exchanger tube 1 comprises a pair of such heat exchanger plate 3. In a heat exchanger tube 1, internal sides 29 of the heat exchanger plates 3 face each other. Furthermore, two heat exchanger tubes 1 are connected to each other thanks to the tank areas 4 of heat exchanger plates 3 of said two heat exchanger tubes 1.

[0048] The external layer 7, located between the folding line 12 and the edge 17 is outside of the tank volume 28. The folding line 12 and the edge 17 extend in parallel. The resulting internal side 29 of the heat exchanger plate 3 is smooth and the external side 30 of the heat exchanger plate 3 is not. The edge 17 of the sheet of material 9 forms a protrusion 31. This protrusion 31 can be used as a mechanical stop for the dissipation device 18 placed in contact with the active area 5. Thanks to this protrusion 31, the dissipation device 18 is in contact with only the active area 5 and does not overlap the tank area 4.

[0049] The active area 5 comprises ridges 32 limiting channels 33. The active area 5 is divided in six nearly identical straight channels 33. These channels 33 are dedicated to the refrigerant fluid RF circulation and are set up to be connected with both tanks 2 of the heat exchanger 19.

[0050] Figures 3 to 5 represent different sequences of a folding step 35 executed in the method according to the invention. The folding step 35 is followed by a plate stamping step 36 that lead to a heat exchanger plate 3 as describe in figure 6. Figures 3 to 5 are longitudinal sectional views that illustrate the folding step 35.

[0051] The figure 3 shows the continuous sheet of material 9. This sheet of material 9 is used to form a fold material 37 describe in figure 5. The heat exchanger plate 3 of figure 6 is a made with this sheet of material 9.

[0052] The sheet of material 9 is a plane surface with two similar edges 17 separated by a central part 38 of the sheet of material 9. The sheet of material 9 has a regular thickness throughout. Only one part of the sheet of material 9 is shown on figure 3, corresponding to one of the edges 17 and part of the central part 38.

[0053] The edge 17 is fold along the folding line 12. The folding line 12 is indicated on figure 3 but is not necessarily materialized on the sheet of material 9. The folding line 12 is materialized when the folding step 35 begin. The folding line 12 is in this example parallel to the edge 17.

[0054] The continuous sheet of material 9 folded leads to the fold material 37 as shown in figure 5. Figure 4 represents an intermediate situation 39 during the folding step 35, between the sheet of material 9 stage and the fold material 37 stage. During the intermediate situation 39, the edge 17 partially folded is not yet in contact with the central part 38 of the sheet of material 9.

[0055] After complete folding, ending the folding step 35, the fold material 37 comprises at least a first area 40 defined by the single layer 6 and a second area 41 defined by the external layer 7 and the internal layer 8. The external layer 7 and the internal layer 8 of the second area 41 are in full-contact with each other on the two-layers interface 11, from the folding line 12 to the edge 17 of the sheet of material 9, as shown in figure 5. The edge 17 create the protrusion 31 on the fold material 37. With this protrusion 31, surfaces sides 29, 30 can be distinguished: the external side 30 is the side that include the protrusion 31, an internal side 29 is the opposite side.

[0056] Both first area 40 and second area 41 are stamped during plate stamping step 36 to respectively form the active area 5 and the tank area 4 as shown in figure 6. Figure 6 correspond to a transversal view of the heat exchanger tube 1 according to a longitudinal section D-D shown in figure 2.

[0057] The active area 5 extends throughout the general longitudinal plan B. The active area 5 comprises straight channels 33 dedicated to the refrigerant fluid RF circulation. The channel 33 is included between the general longitudinal plan B and the longitudinal plan A of the heat exchanger tubes 1. A channel 33 circulation area 42 is visible on the figure 6. Ridges 32 that separate two channels 33 are localized in the longitudinal plan A. Parts of the heat exchanger plate 3 that are localized in the longitudinal plan A are intended to be in contact with the other heat exchanger plate 3 of the pair of heat exchanger plates 3 and are intended to be brazed.

[0058] The tank area 4 defines the tank volume 28 between the longitudinal plan A and the plan C of the opening 13, 14. The channel 33 circulation area 42 is connected with the tank volume 28 of the tank area 4.

[0059] The collar 15, 16 is around the opening 13, 14, extending from the general longitudinal plan B to the plan C of the opening 13, 14.

[0060] Around the folding line 12, the heat exchanger plate 3 structure is reinforced in the tank area 4 by a bending portion 43. According to the longitudinal section D-D, the bending portion 43 is between the folding line 12 and the collar 15, 16. The bending portion 43 contains a part intended to be in contact with the other heat exchanger plate 3 of the pair of heat exchanger plates 3. Said part of the bending portion 43 is also intended to be brazed.

[0061] We understand thanks to the above description, that the present invention proposes a simple design of heat exchanger plate for use in heat exchanger tube and heat exchanger used as evaporator in a motor vehicle. This one-piece heat exchanger plate is easily manufactured, at a low cost, with no additional element. Furthermore, it allows good thermal exchange performances. This design is resistant at working pressure and burst pressure, for a long term sustainability. This heat exchanger plate is dedicated to heat exchanger and can be found in a Heating, Ventilation and Air-Conditioning device of the vehicle. This kind of heat exchanger can be easily integrated into vehicle air conditioning systems thanks to the heat exchanger tubes of the invention mechanical proprieties since the global shape of the heat exchanger is guarantee.

[0062] However, the invention is not limited to resources and patterns described and illustrated here. It also includes all equivalent resources or patterns and every technical associations including such resources. More particularly, the shape of the heat exchanger plate does not affect the invention, insofar as the heat exchanger plate for use in a motor vehicle, *in fine,* has the same functionality as describes in this document.

Claims

1. Heat exchanger plate (3) for use in a heat exchanger (19) of a vehicle, the heat exchanger plate (3) is made with a continuous sheet of material (9), the heat exchanger plate (3) comprising two opposite extremities (10), at least one of the extremity (10) of said heat exchanger plate (3) defining a tank area (4) provided with at least one opening (13, 14), the heat exchanger plate (3) defining an active area (5) dedicated to heat exchange between two fluids (RF, AF), said active area (5) being located between the two opposite extremities (10) of the heat exchanger plate (3), wherein the active area (5) is made of a single layer (6) of said sheet of material (9) while the tank area (4) is made of at least two layers (7, 8) of said sheet of material (9).

2. The heat exchanger plate (3) according to claim 1, wherein the two layers (7, 8) of the heat exchanger plate (3) are peripheral to the opening (13, 14).

3. The heat exchanger plate (3) according to any of the previous claims, wherein said tank area (4) comprises at least one collar (15, 16) that surround the opening (13, 14).

4. The heat exchanger plate (3) according to any of the previous claims, wherein the heat exchanger plate (3) comprises a folding line (12) corresponding to one of the extremities (10) of the heat exchanger plate (3).

5. The heat exchanger plate (3) according to claims 3 and 4, wherein the collar (15, 16) is located between the folding line (12) and an edge (17) of said sheet of material (9).

6. The heat exchanger plate (3) according to any of the claims 4 or 5, wherein one of the two layers (7, 8) corresponding to an external layer (7), is located between the folding line (12) and the edge (17) and is outside of a tank volume (28) defined by said collar

(15, 16).

7. A heat exchanger tube (1) for use in a heat exchanger of a vehicle, wherein the heat exchanger tube (1) comprising a pair of heat exchanger plates (3) according to at least one of the previous claims.

8. A heat exchanger comprising a plurality of heat exchanger tubes (1) of previous claim, at least one dissipation device (18) being located between two heat exchanger tubes (1), the dissipation device (18) being in contact with active areas (5) of heat exchanger plates (3) of two heat exchanger tubes (1) and the two heat exchanger tubes (1) being connected to each other thanks to tank areas (4) of heat exchanger plates (3) of the two heat exchanger tubes (1).

9. Method for obtaining a heat exchanger plate (3) according to at least one of the claims 1 to 6, comprising a folding step (35) defining at least the active area (5), the folding step (35) being made before a plate stamping step (36).

10. Method according to the previous claim, wherein the continuous sheet of material (9) is at least folded along the folding line (12) during the folding step (35) to obtain a fold material (37), the fold material (37) comprising at least a first area (40) defined by the single layer (6) and a second area (41) defined by two layers (7, 8), both first area (40) and second area (41) are then stamped during plate stamped step to respectively form the active area (5) and the tank area (4).

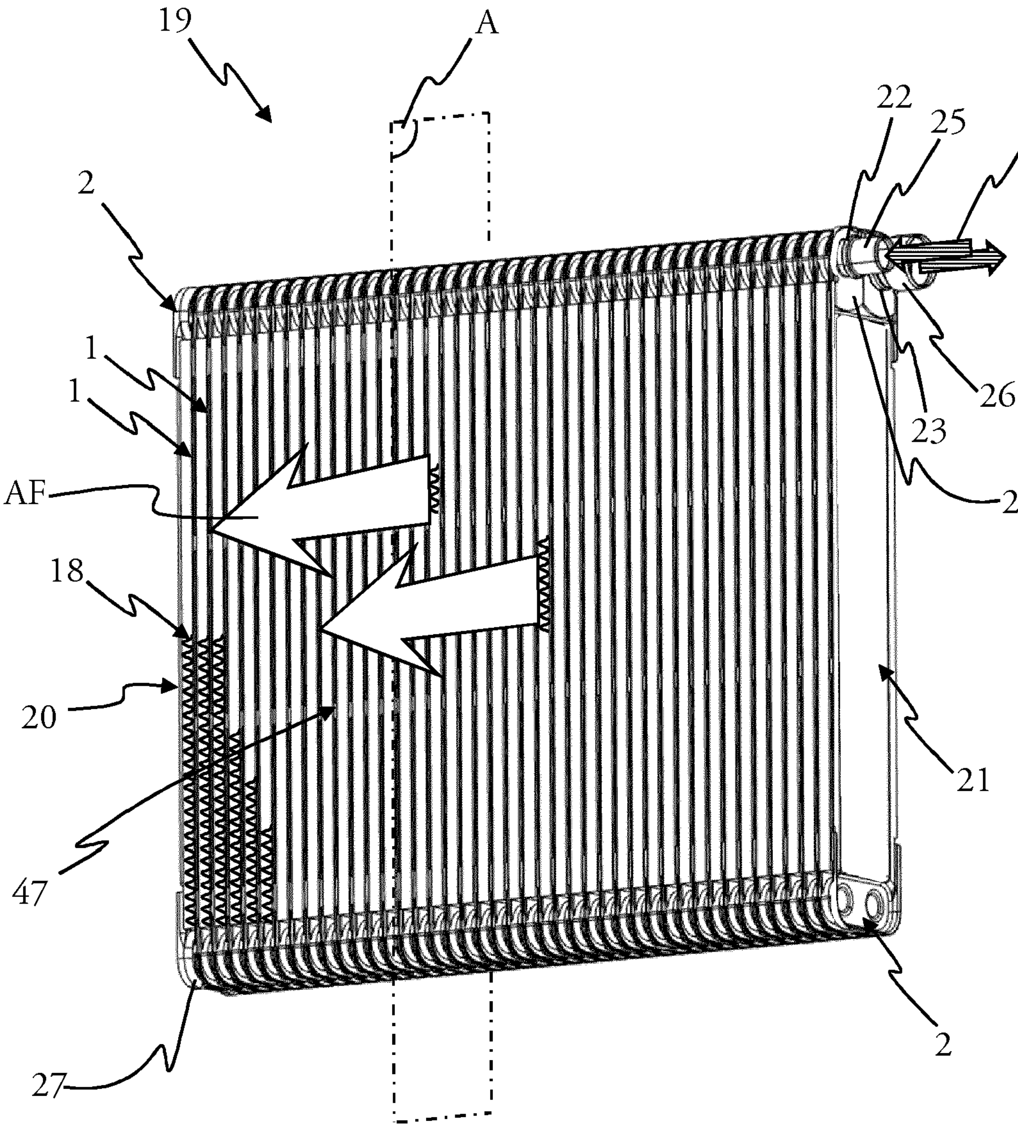

Fig. 1

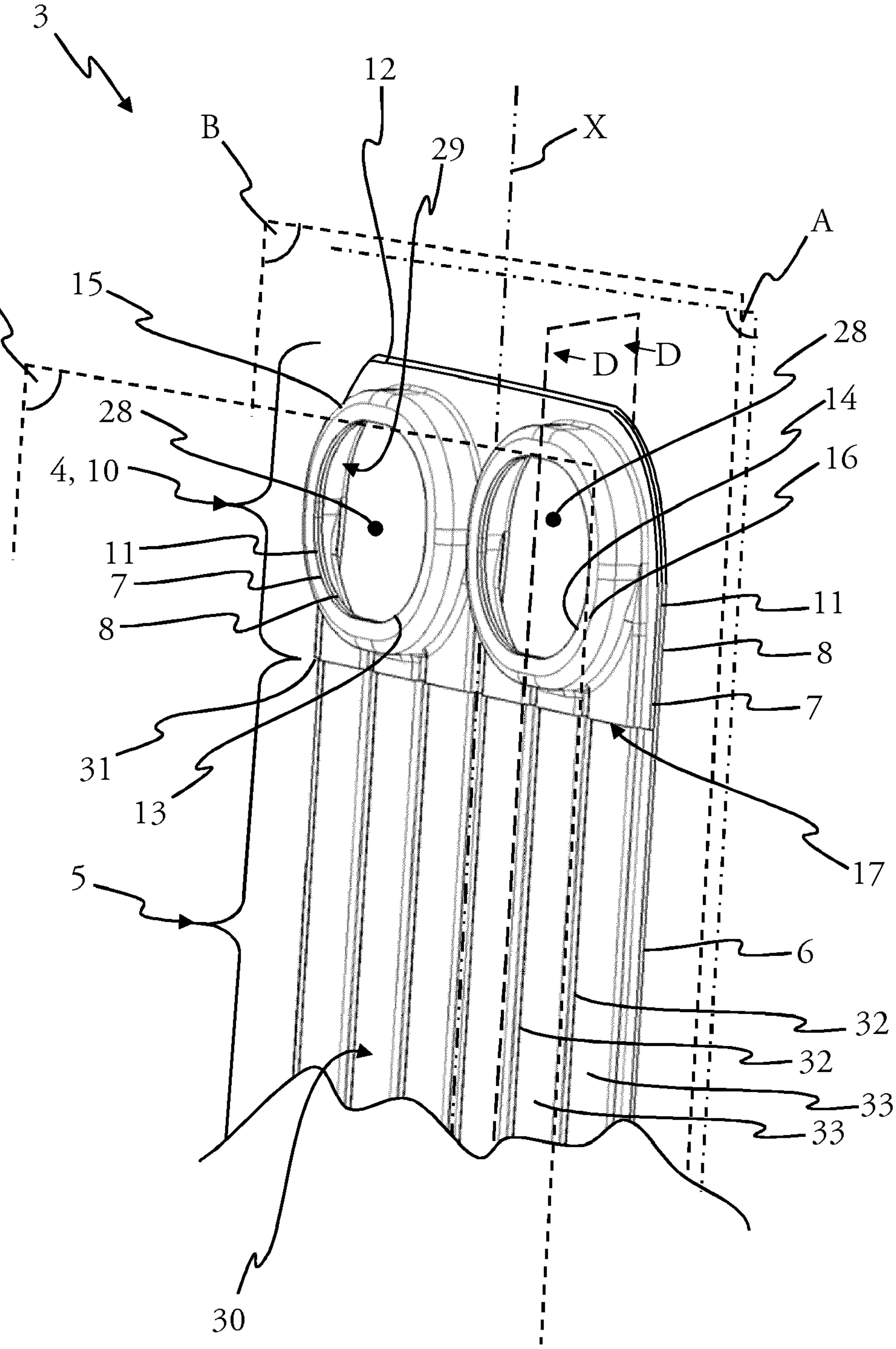
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Fig. 2

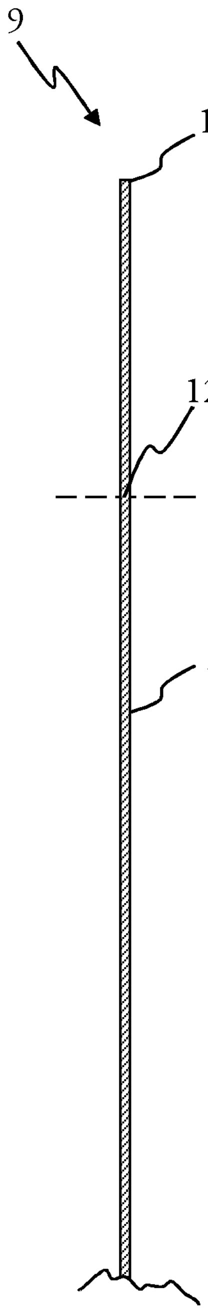

Fig. 3

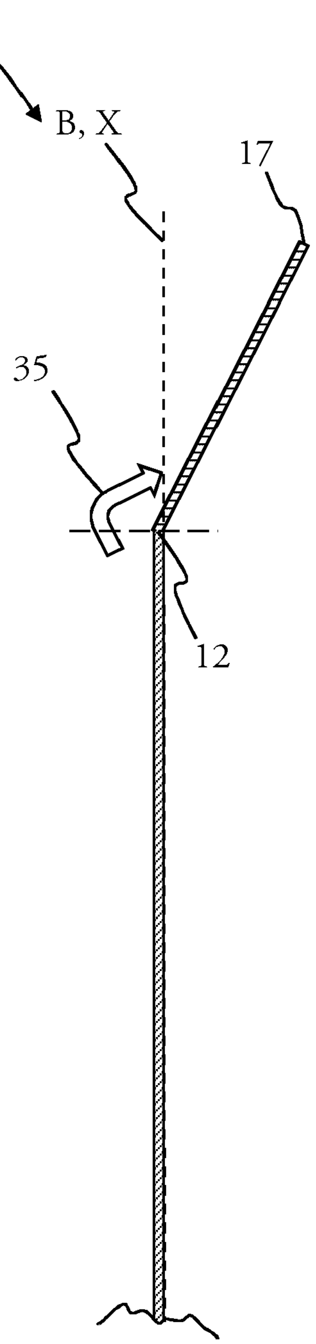

Fig. 4

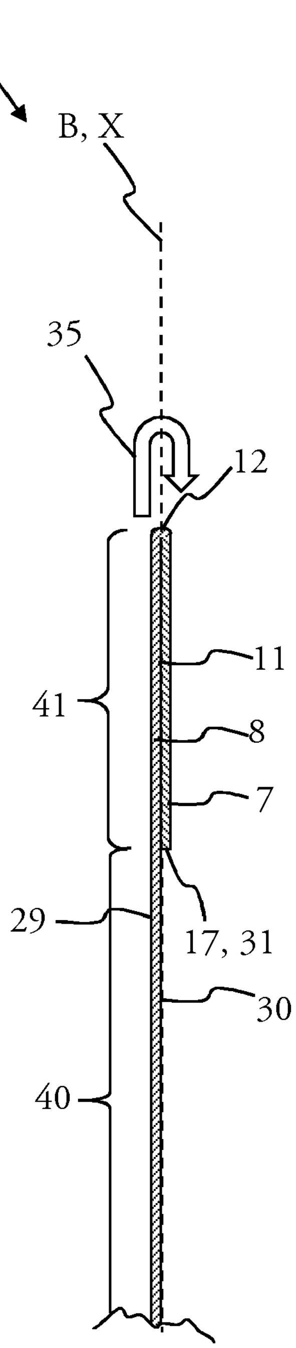

Fig. 5

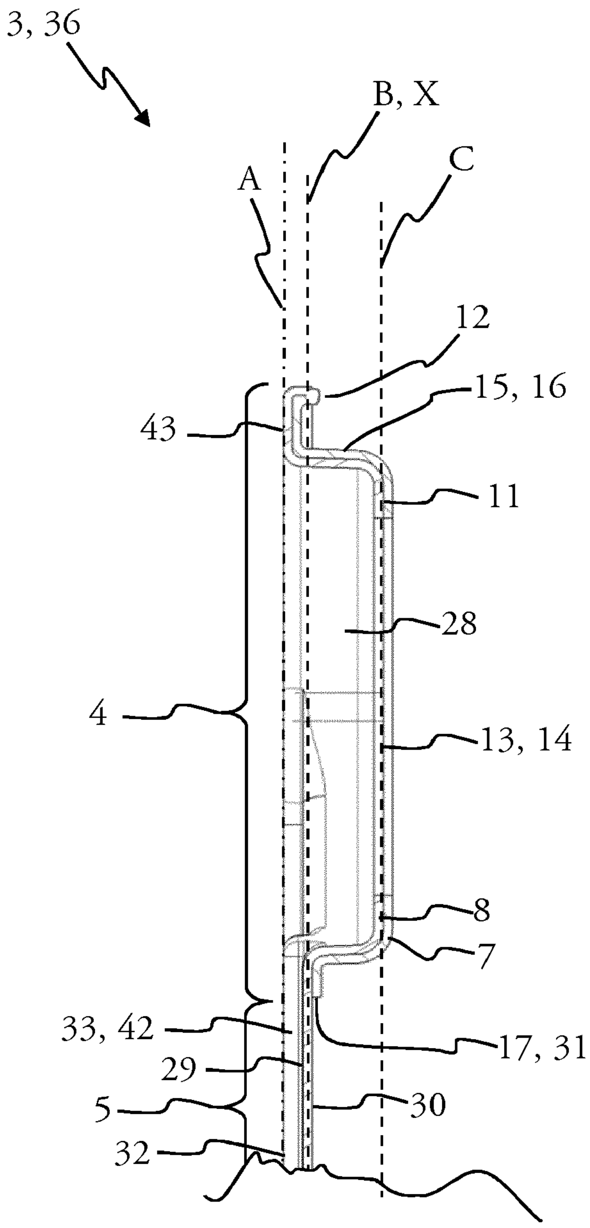

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 9913

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP H09 113171 A (SHOWA ALUMINUM CORP) 2 May 1997 (1997-05-02) * figures 1-9 *	1-10	INV. F28D1/03 B21D53/04 F28D21/00
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X	US 2014/151006 A1 (MOREAU SYLVAIN [FR] ET AL) 5 June 2014 (2014-06-05) * abstract; figures 1-4 *	1	
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Place of search	Date of completion of the search	Examiner
Munich	4 December 2018	Bloch, Gregor

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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 17 9913

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