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(71) Applicant: **Delphi Technologies, Inc.**
Troy, MI 48007 (US)

(72) Inventors:
- **Borowczyk, Pawel**
  63-400 Ostrow Wielkopolski (PL)
- **Racz, Robert**
  63-440 Raszkow (PL)

(74) Representative: **Lukaszyk, Szymon**
Kancelaria Patentowa Lukaszyk
ul. Glowackiego 8
40-062 Katowice (PL)

(54) A method of manufacturing a brazed profiled tube, in particular a header tank of a heat exchanger

(57) The invention relates to a method of manufacturing a brazed profiled tube, in particular a header tank of a heat exchanger comprising the steps of:

(i) preparing an aluminium sheet plate coated with a cladding layer, having a length corresponding to the length of a profiled tube to be formed and provided with an overlap on the first of its longitudinal edges and rectangular projections having a width corresponding substantially to the thickness of a sheet plate, on the second longitudinal edge,
(ii) forming in said overlap a number of rectangular openings corresponding to said projections, having a width greater than the thickness of the sheet plate,
(iii) folding said sheet plate so as to form a profiled tube, and inserting said projections into said openings,
(iv) closing the tubular element by bulge forming ends of said projections inside said openings; and,
(v) brazing the profiled tube.

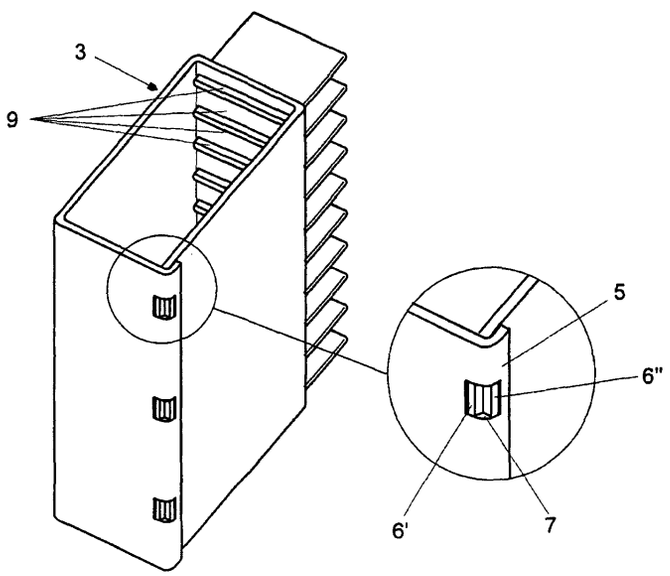

Fig 5

EP 1 515 108 A2

Description

[0001] The invention relates to a method of manufacturing a brazed profiled tube, in particular a header tank of a heat exchanger comprising a cooling core consisting of a plurality of parallel tubes and cooling fins and two radiator tanks fluidly connected with opposite ends of each tube.

[0002] During typical process of forming the header tank profile, an aluminium sheet plate covered with a cladding layer is bended and subsequently closed by direct contact of two of its edges or by an overlap. Such header tanks are disclosed for example in U.S. Pat. No. 5,867,899. Such a solution however may not ensure a durable connection for a brazing process and consequently may lead to the leakage of the profile.

[0003] It is also desired if the heat exchanger can be preliminary assembled in such a manner that, with no risk of disconnecting of its elements prior to brazing it is possible to transport the preassembled module and to braze thereof with no need of any additional elements such as brackets in a one-shot brazing operation.

[0004] A header tank enabling such an operation is presented in U.K. Pat. No. 2,371,505, where a method of making a header tank from an initially flat, elongate sheet of material is disclosed. The method comprises the steps of folding the sheet so that its longitudinal edges are in contact with one another, forming a clinched seam between the edges to make a tubular body, and closing the ends of the tubular body. This method however is relatively complicated and the clinched seam is placed on an external surface of the profile, which may increase the unused storage space during external packaging of the heat exchanger.

[0005] Therefore, the aim of the present invention is to provide a reliable and simple method of manufacturing a brazed profiled tube, in particular the header tank of the heat exchanger, which protects the elements of future brazed seam against displacement in relation to each other, thus allowing an easy preliminary preassembling.

[0006] According to the present invention, there is provided a method of manufacturing a brazed profiled tube, comprising the steps of:

(i) preparing an aluminium sheet plate coated with a cladding layer having a length corresponding to the length of the profiled tube to be formed and provided with an overlap on one of its longitudinal edges and rectangular projections on another longitudinal edge, said projections having a width corresponding substantially to the thickness of a sheet plate,
(ii) forming in said overlap a number of openings corresponding to said projections, having a width greater than the thickness of the sheet plate,
(iii) folding said sheet plate so as to form a profiled tube, and inserting said projections into said openings,
(iv) closing the tubular element by bulge forming ends of said projections inside said openings; and,
(v) brazing the profiled tube.

[0007] Preferably openings and projections are equidistantly spaced along the longitudinal axis of the profiled tube.

[0008] It is advantageous when the overlap terminates the wall parallel to the heat exchanger cooling core, which improves the outside packaging of the heat exchanger.

[0009] By closing the profile, strong adhesion of surfaces forming the junction i.e. overlap and the wall of the tube is ensured. Furthermore the profile is secured from self-opening in a furnace.

[0010] The invention is presented below in connection with the drawings on which:

Fig. 1 is an axonometric view of a heat exchanger comprising two header tanks made by the method according to the present invention;

Fig. 2 is an axonometric view of an aluminium sheet plate, the header tank will be formed from;

Fig. 3 is an axonometric view of the header tank prior to closing;

Fig. 4 is a cross-section of a fragment of the closing part; and

Fig. 5 is an enlarged axonometric view of the header tank made by the method according to the present invention;

[0011] The disclosed embodiment concerns a header tank of a vehicle heat exchanger. It is to be understood however, that other applications of the method according to the present invention, for manufacturing other tubular elements are also possible.

[0012] As shown on Fig. 1 the assembled heat exchanger 1 comprises a cooling core 2 consisting of plurality of parallel water tubes and cooling fins, and two header tanks 3, fluidly connected with reciprocal ends of each cooling core tube. After preliminary assembling, the heat exchanger 1 is placed inside the furnace where it undergoes a brazing operation.

[0013] Fig. 2 shows a fragment of the aluminium flat sheet coated with a cladding layer, from which the header tank 3 shall be formed. The sheet 4 has a width corresponding to the perimeter of the header tank 3, increased by an overlap 5 on one of its longitudinal edges. Another longitudinal edge of the sheet 4 is provided with rectangular projections 6 spaced equidistantly along its length. The width or extension of projections is the same as the thickness of the sheet plate 4. The overlap 5 is also provided with rectangular openings or windows 7

corresponding to projections 6. The width of each opening 7 is greater than the thickness of the sheet 4 and its length corresponds to the length of the projection 6. Moreover the left (on Fig. 2) longitudinal edges of openings 7 are aligned with the doted line of folding 8.

[0014] The sheet so prepared is subsequently folded along the doted lines 8 so as to finally form a rectangular header tank 3 shown on Fig. 3. During this operation the projections 6 are inserted into openings 7. Next, the header tank is closed by bulge forming ends of projections 6 inside openings 7, as shown in Fig. 4. In this embodiment, this process was carried out by using an automatic press having a number of sharp tips corresponding to projections 6 and openings 7. As a result of plastic impact and deformation of material each projection 6 is delaminated in two parts 6' and 6", which locks the position of projection 6 inside the opening 7, securing the header tank from self-opening.

[0015] Fig. 5 shows a portion of the heat exchanger with the header tank 3 made according to the method of the invention prior to brazing. The heat exchanger can be a radiator, a condenser or intercooler of a motor vehicle. As shown the plurality of cooling core tubes 9 has been already preliminary inserted into appropriate apertures formed on the wall which is opposite and perpendicular to the overlap 5.

[0016] The method according to the invention is particularly preferred for manufacturing rectangular header tanks, which are of better characteristics than the oval ones. As the appropriate pressing, folding and brazing equipment is in common use in radiator plants, the method can easily be implemented and automated.

Claims

1. A method of manufacturing a brazed profiled tube, **characterised in that** it comprises the steps of:

   (i) preparing an aluminium sheet plate coated with a cladding layer, having a length corresponding to the length of a profiled tube to be formed and provided with an overlap on the first of its longitudinal edges and rectangular projections having a width corresponding substantially to the thickness of a sheet plate, on the second longitudinal edge,
   (ii) forming in said overlap a number of rectangular openings corresponding to said projections, having a width greater than the thickness of the sheet plate,
   (iii) folding said sheet plate so as to form a profiled tube, and inserting said projections into said openings,
   (iv) closing the tubular element by bulge forming ends of said projections inside said openings; and,
   (v) brazing the profiled tube.

2. A method as claimed in claim 1, **characterised in that** the profiled tube has a rectangular cross-section.

3. A method as claimed in claim 1 or 2, **characterised in that** openings and projections are equidistantly spaced along the longitudinal axis of the profiled tube.

4. A method as claimed in claim 1 or 2 or 3, **characterised in that** the profiled tube is a header tank of a heat exchanger.

5. A method as claimed in claim 4, **characterised in that** prior to brazing it comprises an additional step of forming a plurality of apertures for cooling core tubes.

6. A method as claimed in claim 4, **characterised in that** the overlap terminates the wall parallel to the heat exchanger cooling core.

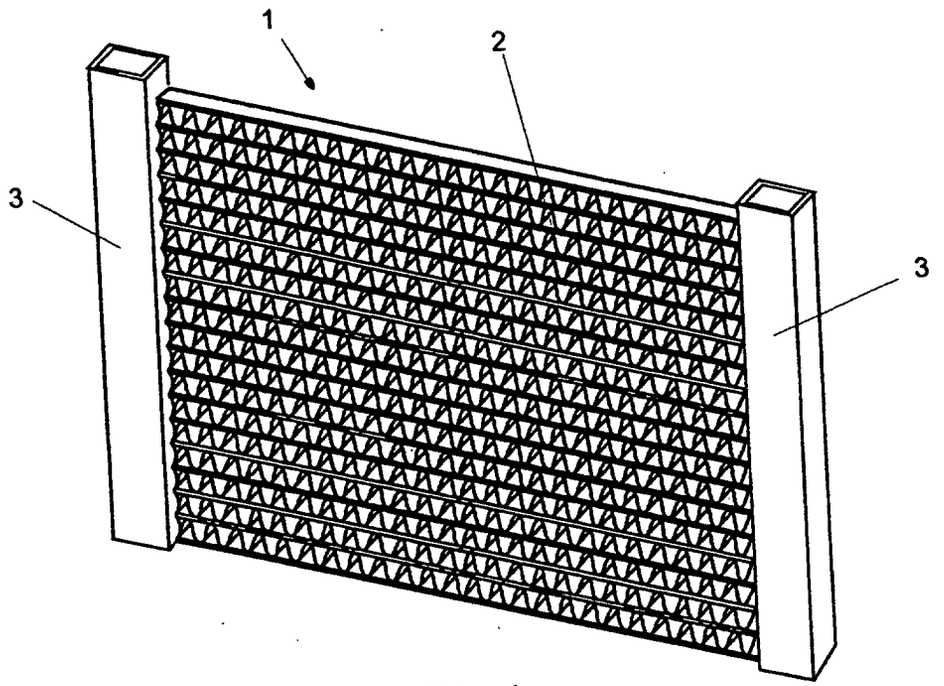

Fig 1

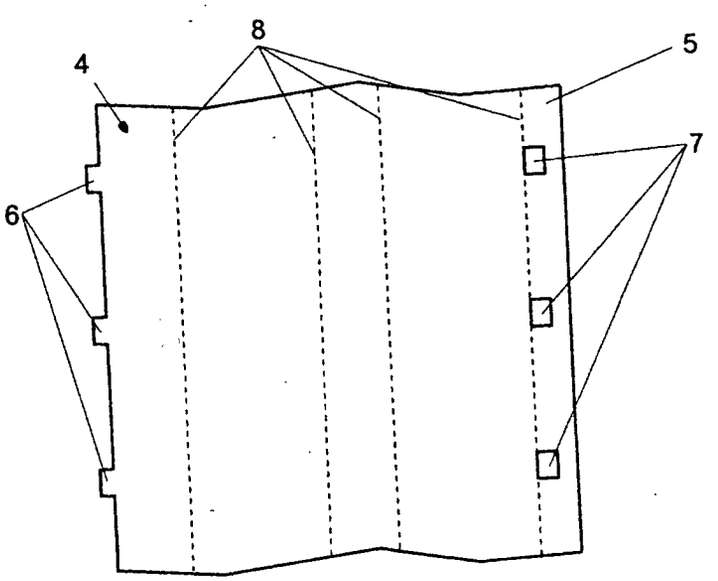

Fig 2

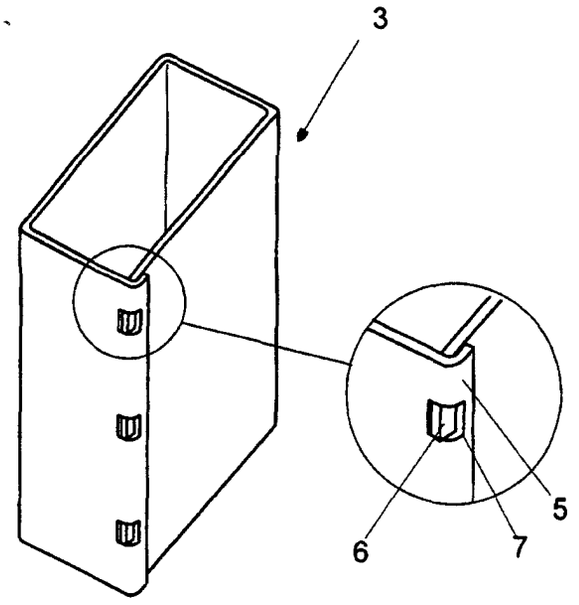

Fig 3

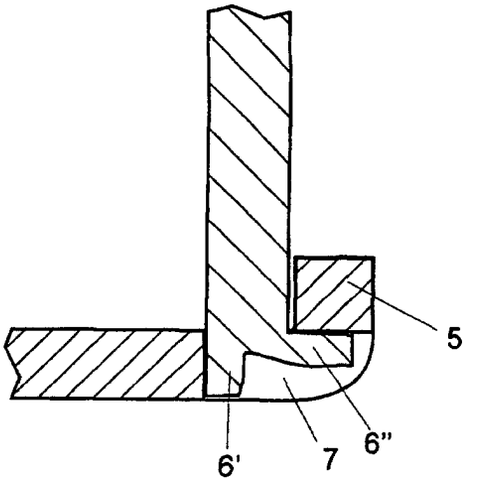

Fig 4

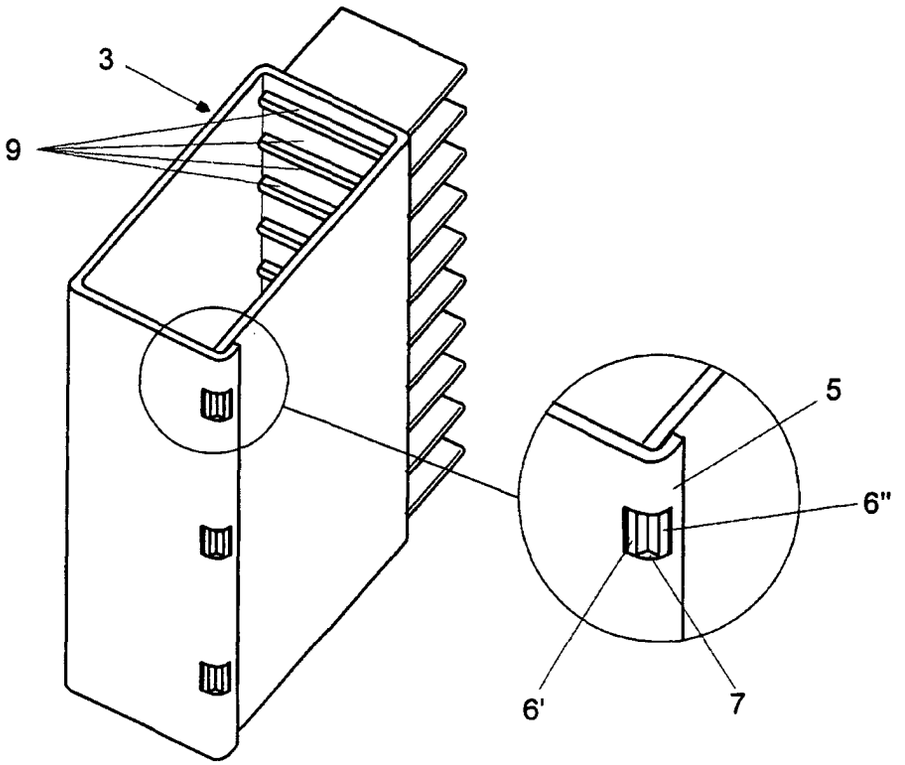

Fig 5