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(54) Process for making a heat exchanger

(57) Process for making a heat exchanger unit comprising a number of parallel tubes (4), enclosing channels for one of the heat exchanging fluidums and a heat conductive plate, the tubes being integrated in the plate (1). The process comprises the extrusion of a suitable metal, preferably aluminium, whereby the plate (1) and the tubes (4) are formed in one step. Preferably the plate (1) is extruded in a nearly circular fashion, and after extrusion, the plate (1) is reshaped into the required form.

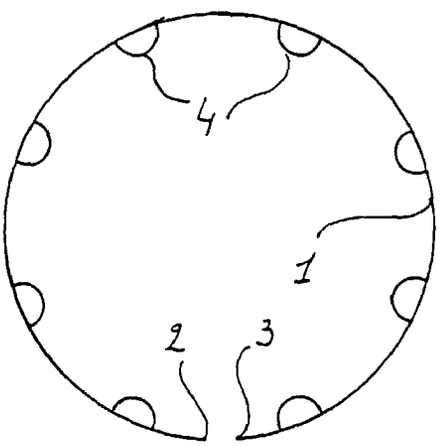

Fig. 1

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Description

[0001] The invention relates to a process for making a heat exchanger unit comprising a number of parallel tubes enclosing channels for one of the heat exchanging fluidums and a heat conductive plate, the tubes being integrated in the plate.

[0002] In the German patent application 3023256 there is disclosed a heat exchanger unit of the type having a number of parallel tubes enclosing channels for one of the heat exchanging fluidums and a heat conductive plate.

[0003] The advantages, obtained by means of such a heat exchanger unit, are well known. The use of a plate interconnecting the tubes acting as a channel for one of the heat exchanging fluidums increases the contact surface with the other heat exchanging fluidum, and thereby the heat exchange.

[0004] By the integration of the plate and the tubes a better heat transfer efficiency is obtained, as the normal problem occurring if heat has to be transferred between two solid surfaces (in this case tube and plate) has been avoided.

[0005] It is further more generally known that such a heat exchanger unit can be made by connecting a tube and plate sections together by any suitable means, such as soldening, welding, etc. . However such connecting techniques are expensive and cumbersome and do not provide satisfactory heat transfer contact areas as many defects, such as air inclusions, oxide layers and the like may occur in the contact surfaces.

[0006] According to the above mentioned German patent application 3023256 the heat exchanger unit is obtained producing a metal block, in which a number of bores are drilled. These bores or holes are filled with a weld stop means (Schweisstoppmittel). Thereupon the metal block is stretched or rolled in the longitudinal direction of the bores whereupon the collapsed or compressly bores are blown up.

[0007] In this way an improved heat transfer has been obtained between the tubes and the plate which is in fact fully integrated.

[0008] However this production method is still cumbersome as a number of successive handlings are needed in order to obtain the final product.

[0009] It is therefor an object of this invention to provide an improved method for making a heat exchange unit of the above described type.

[0010] This object has been obtained in that the unit is obtained by extruding a suitable metal whereby the plate and tubes are formed in one step.

[0011] Other characteristics and advantages will become clear from the following description, reference being made to the annexed drawings, in which:

Fig. 1 is a schematic cross-section view of a product immediately after extrusion, as obtained by means of the process according to the invention.

Fig. 2 is a schematic cross-section view of the product of Fig. 1 after flattening.

Fig. 3 A - C are schematic cross-section views corresponding to Fig. 2 of different type of products which can be obtained by means of the process according to the invention.

[0012] In Fig. 1 there is shown schematically a cross-section of an extrusion product such as it can be made according to the invention. The product consists of a plate-shaped profile 1, which is bent in a nearly complete circular shape in such a way that it presents two ends 2 and 3.

[0013] The diameter of the circular plate 1 is at most equal to the diameter of the metal billet such as an aluminium or aluminum alloy billet, used as starting material for the extrusion process. The reason therefor is that it is undesirable to use extrusion processes for products which after extrusion have a cross-section extending outside the cross-section of the billet. The reason therefor is that this leads to very extreme pressure differences over the cross-section of the extruded products and therefor to important irregularities in the product. This can also result in problems with metal flow and dimensional tolerance control.

[0014] Against the plate 1 a number of hollow D-shaped tubes 4 have been made during the extrusion process. The extrusion of tube like products is very common in the aluminium extrusion and is easily obtained by standard die-designs. Examples of such dies are described in EP-A-0 595 061. Multiple port extrusion, such as the profile according to Fig. 1 is described as well in said publication.

[0015] After extrusion the nearly circular extrusion product is rolled flat in order to obtain a product as shown in Fig. 2. In fact this product can be seen as a number of tubes 4 interconnected by means of the plate 1.

[0016] Such product may be very useful as a heat exchanger component in which the tubes 4 are used as a transport means for one of the heat exchanging fluidums the other fluidum flowing outside of said tubes 4. By the integration of the plate 1 with the tubes 4 an excellent heat exchanging contact has been obtained between the tubes 4 and the plate 4 and in this way the heat exchange surface between the external fluidum and internal fluidum has been increased.

[0017] It is possible to shape the plate 1 with its integrated tubes in other ways so as to adapt it to the different application for which it can be used.

[0018] In case of a circular extrusion shape it is possible to obtain an integrated plate with tube system having a width corresponding substantially to the circumference of the billet. In this way starting from an aluminium billet having a diameter of 25 cm a width of 75 cm can be obtained.

[0019] In case a larger width is required it is possible to use another shape for the extrusion product, e.g. a helical fashion in stead of the circular fashion. Otherwise it is still possible to have two juxtapositioned plates joined by traditional techniques such as welding, brazing or soldering. This can be easily and reliably done starting from the flat shape shown in Fig. 2, as this means the assembling of two flat products. If needed the edges of the extruded product may have interlock details built in during extrusion to further assist assembly and construction of the ultimate heat exchanger.

[0020] In fig. 3 there are shown several products which can be obtained by means of the process according to the invention. In Fig. 2 there is shown a product comprising a flat plate with D-shaped tubes extending on one side from the plate. As shown in Fig. 3 A it is possible to have round tubes extending both sides of the plate 1.

[0021] In fig. 3B there is shown a plate 1 having trapezium-shaped tubes extending on one side of the plate and in fig. 3C there is shown a plate 1 having hexagonal tubes extending both sides of the plate.

[0022] From the above it will be clear that modifications are possible within the basic idea of the invention as represented by the following claims.

Claims

1. Process for making a heat exchanger unit comprising a number of parallel tubes enclosing channels for one of the heat exchanging fluidums and a heat conductive plate, the tubes being integrated in the plate, characterised is that the unit is obtained by extruding a suitable metal whereby the plate and tubes are formed in one step.

2. Process according to claim 1, characterised is that the metal is aluminium.

3. Process according to any of the claims 1 or 2, characterised is that the plate is extruded in a nearly circular fashion.

4. Process according to claim 3, characterised is that after extrusion, the plate is reshaped into the required form.

5. Process according to claim 4, characterised is that the plate is made flat.

6. Process according to any of the claims 1-5, characterised is that the tubes are all positioned at one side of the plate surface.

7. Process according to claim 6, characterised is that the tubes are all positioned at one side of the plate surface.

8. Process according to any other claims 1-5, characterised in that the tubes protude on both sides of the plate surface.

9. Process according to any of the proceeding claims, characterised in that the plate between two adjacent tube has been louvered.

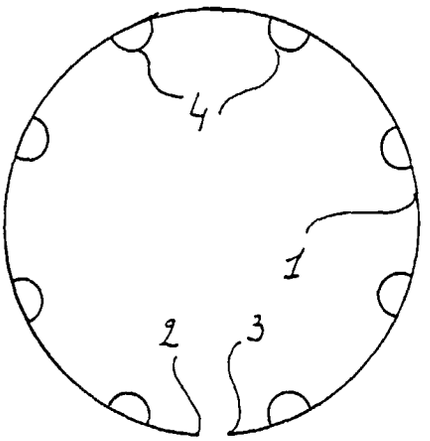

Fig. 1

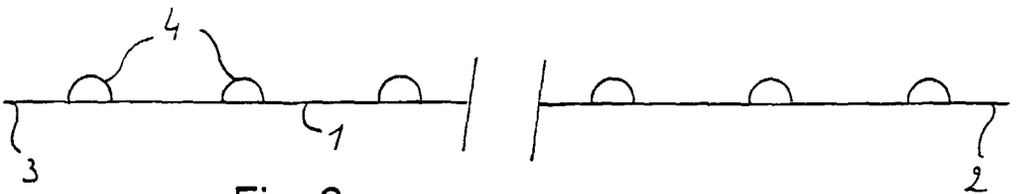

Fig. 2

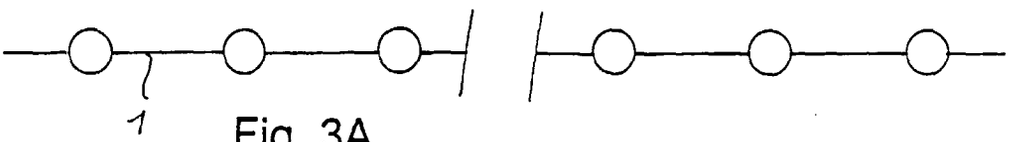

Fig. 3A

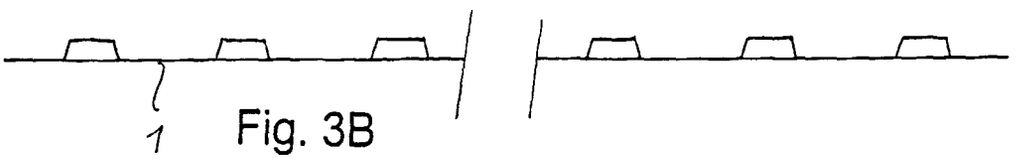

Fig. 3B

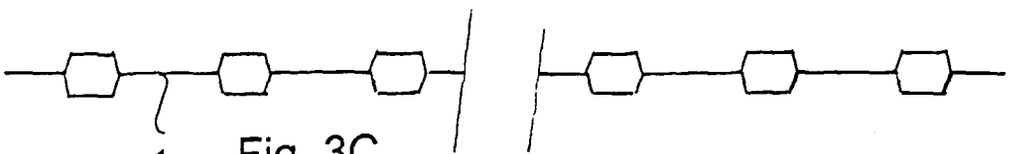

Fig. 3C

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EUROPEAN SEARCH REPORT

Application Number
EP 97 20 3020

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US 4 071 934 A (ZOLMAN JUNIOR O ET AL) * column 3, line 21 - line 35; figures 7-9 * ---	1,2,8,9 3-5	B21C23/10
X	US 3 333 317 A (SHOCKLEY) * column 2, line 46 - line 60; figures * ---	1,2	
Y	US 2 716 805 A (MACDONALD) * column 3, line 65 - column 4, line 6; figures * ---	3-5	
A	DE 43 40 506 A (WILLY SCHULER GMBH & CO KG MET) * figure 12 * ---	6,7	
A	US 3 164 898 A (KOTRBATY) * figures * -----	3-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B21C
F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 March 1998	Barrow, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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