METHOD OF MAKING SHEET METAL HEAT EXCHANGERS

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This invention relates to methods of making heat exchangers and particularly to methods involving sheet metal heat exchange structure.

An object of the present invention is to provide a low-cost method of fabricating heat exchangers which is conducive to high volume production, each unit being of lightweight construction and efficient for the transfer of heat from one fluid to another.

Important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawings:

FIGURE 1 shows a plan view of a heat exchanger disclosing one embodiment of the present invention and a portion being broken away along the line 1—1 of FIGURE 2 better to illustrate the construction;

FIGURE 2 is an elevation view of the heat exchanger shown in FIGURE 1 portions being in section to aid in disclosing the passages defined and enclosed within the exchanger sheet material;

FIGURE 3 is an elevation view of a sheet of metal formed into alternating wide and narrow portions prepared for the step of folding and placing the wide portions into a stack type heat exchanger as shown in FIGURES 1 and 2;

FIGURE 4 is a cross sectional view looking in the direction of the arrows 4—4 on FIGURE 1; and

FIGURE 5 is an end view of the sheet shown in FIGURE 3 being folded to form a stack of sheet metal portions in making up the heat exchanger of FIGURES 1, 2, and 4 but with a supporting tube being omitted to avoid confusion.

In FIGURE 3 is depicted a sheet 10 of thin aluminum and in making the heat exchanger generally indicated at 12 in FIGURES 1, 2, and 4, the sheet 10 is formed into alternate wide and narrow portions A and B in being subjected to blanking and forming operations in a progressive press whereby grooves 14 on the "oil" side and large width openings 16, 18, and 20 are made in the portions A and small width openings or slots 23 and 24 are made in the portions B. In forming, the grooves 14 are indented into the sheet so that ridges 15 appear on one or a "ridged" or "air" side only of the original plane of the sheet 10. The alternate planes 21 and 22 between rows of the grooves 14 are advantageously left in the same plane as the original sheet material 10 and the peripheral margins of the latter. The slots 23 and 24 are located in the narrow portions B or the planes 21 of the sheet 10 and one set of openings 16, 18, and 20 is located in each wide portion A of the sheet. The grooves 14 are formed at a acute angle with the margins of each wide portion A and it may be seen from FIGURE 3 that each portion A is similar in construction to each other wide portion A.

In making the stack, the peripheral margin as well as the plane 22 of a wide portion A is forced into contact with the peripheral margin and plane 22 of an adjacent wide portion A so that grooves 14 on the "oil" side of the two portions A communicate and define a U-shaped passage extending from an opening 16 to an opening 20 of one portion A. The grooves around the openings 16 and 20 are such that they will register with the grooves around the openings in an adjacent wide sheet portion thereby determining a passage communicating through the consecutive wide portions A of the assembled sheet exchanger for the flow of a liquid such as oil. The openings 18 and 20 are not essential but are used in the separation of the exchanger structure disclosed in the drawings to accommodate a supporting tube 28. This tube is not intended to convey any fluid and it is arranged so as to contact, while in use, only a fluid (such as ambient air) which is admitted to the space between adjacent pairs of wide portions of the sheet material and in which the openings 15 are located. It should be noted that each plane 22 extends from around an opening 18 and terminates at a base groove 36.

It is preferable to supply the sheet material 10 in such a form that it includes a coating on both sides of some material which when subsequently heated in the stack assembly will bond or metal fuse together the peripheral margins and facing planes of the adjacent wide portions A. The openings 16 and 20 of the adjacent wide portions A are arranged in registry for communication with inlet and outlet conduits 30 and 32 for a fluid such as oil. Conveniently, commercially available aluminum brazing sheet may be used in carrying out the present invention. Such a sheet may be 1/40 inches in thickness and include a coating on one side on both sides, the coating being of brazing material such as a composition of 92½% aluminum and 7½% silicon. Other methods could be employed in permanently joining the wide portions A together and without departing from the present invention.

Substantial hinge portions of metal from the narrow portions B will exist at the ends of the slots 16 and 24 at one side of the heat exchanger and will connect the "air" sides of adjacent sheet metal portions after stacking but these hinge portions may be partly or wholly removed to permit the free flow of air through the stack. If desired, alternate sets of plane or hinge portions 21A may be made very small in width so that, upon folding of the sheet sharp folds will result at one side of the stack for forming the "oil" sections as at 50 in FIGURE 5. Wider hinge portions 21B left at the other side 42 of the stack such as shown in FIGURE 5 and spanning the heights of two abutting ridges 15 may be removed or cut away wholly or in part after the stack has been firmly joined together as a unitary structure.

Assuming that the heat exchanger is to serve as an oil cooler, the oil is admitted through the conduit 30 into the spaces such as the space 34 defined between the "oil" sides of two wide portions A of the plate 10. This oil will flow from the first space 34 into the registering openings 20 and 16 at one side of the stack and will also traverse the intersecting ridges along that side of the stack to the base groove 36 then back at the other side of the stack to the other set of registering openings 16 and 20 for discharge by way of the conduit 32. The air for cooling the oil is forced through the stack in a path extending through sides 40 and 42 (FIGURE 1) of the stack. The ridges 15 will give turbulence to the air flow. The oil will also be subjected to turbulence because of the intersecting and touching ridges of adjacent portions A contacted by the oil and an efficient heat exchange between the air and the oil is therefore possible.

1 claim:

1. A method of making a heat exchanger having opposite sides for admitting and discharging a fluid such as air, said method comprising forming alternate wide and narrow portions along a length of sheet metal, the said forming including holding peripheral margins of each said wide portions of said sheet in a given plane and simultaneously pressing the metal within the interior contour of said margins to form ridges protruding from one side of said sheet and plane, forming large
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3. A method of making a heat exchanger comprising forming alternate wide and narrow portions along a length of sheet metal, the said forming including retaining peripheral margins of each of said wide portions in a given plane and pressing the metal within the interior contour of said margins of each wide portion to form ridges extending at an acute angle with said margins protruding from one side only of said sheet and plane, forming openings of substantial width in each wide portion with each such opening surrounded by one of said ridges, forming a slot in each narrow portion, folding said sheet into a stack of said wide portions in parallel relation, forcing the adjacent facing surfaces of said wide portions together into contact, attaching the said adjacent facing surfaces of said wide portions together so that said openings determine passages for a flow of liquid such as oil through the wide portions consecutively and removing at least some of the sheet metal of said narrow portions at one side of the stack to accommodate the flow of a fluid such as air in planes parallel with said wide portions.

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