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SELF-SEALING FLUID/FLUID HEAT EXCHANGER

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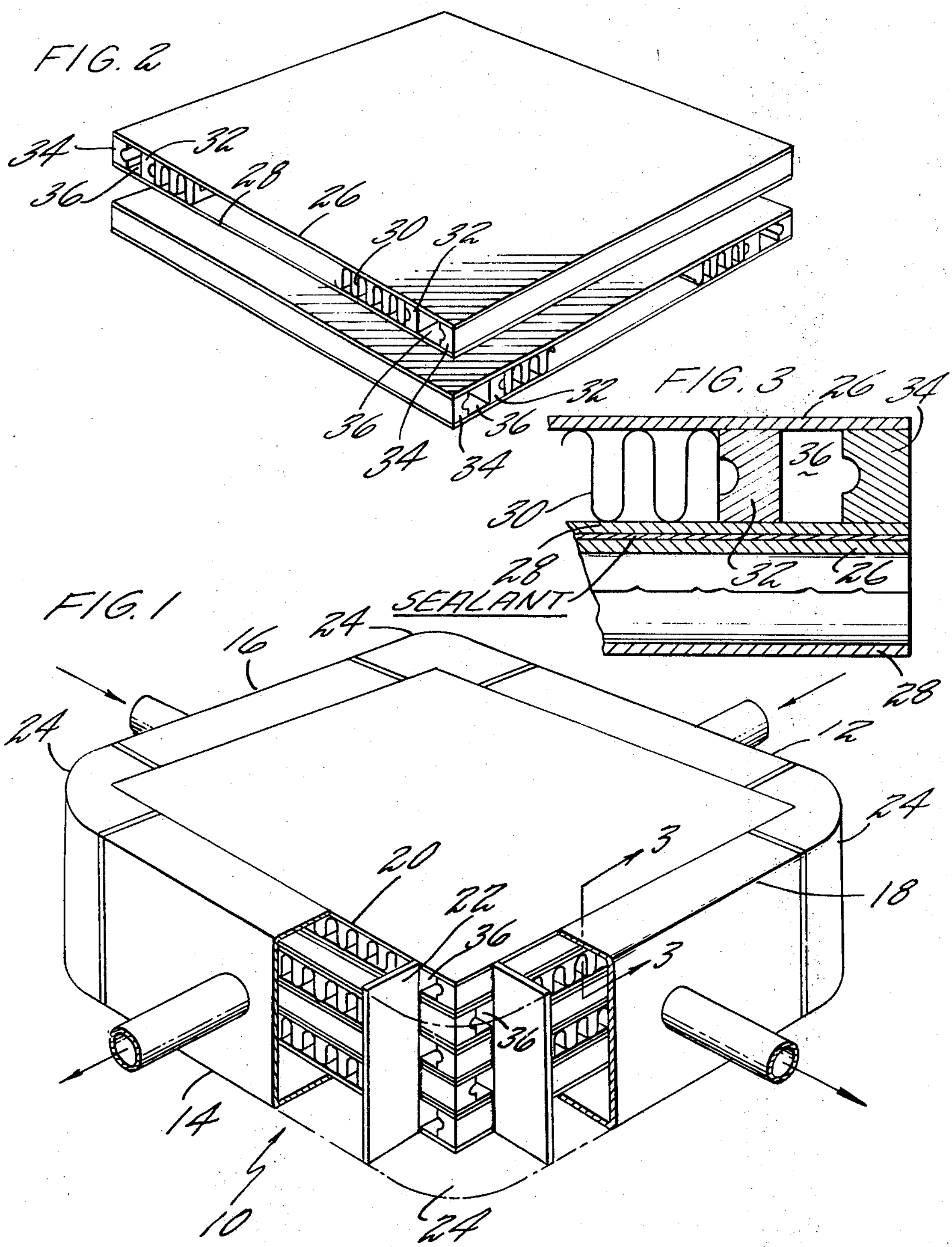

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SELF-SEALING FLUID/FLUID HEAT EXCHANGER

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ABSTRACT OF THE DISCLOSURE

The core of a plate-fin heat exchanger is made up of individual modules consisting of a pair of spaced plates sandwiching corrugated fins wherein sealant is disposed between each module so as to prevent leakage from one module to the other.

BACKGROUND OF THE INVENTION

This invention relates to plate-fin heat exchangers and particularly to means for preventing leakage occurring from one passage to the other.

For high-speed aircraft it is desirable to use the fuel as a heat sink and thus creating the need for placing the fuel in heat exchange relationship with fluid used for cooling the cabin. It is abundantly important that escapement of fuel should not contaminate the cabin air and hence, means have been devised to safeguard against this occurrence. The heretofore method of solving this problem was to dispose a dummy passage above and below the fuel carrying passage so that in the event of a leakage in the fuel pass, it would be carried over in the dummy passage. The dummy passage then, in turn, would communicate with a collecting header for sensing and/or disposing of the escaped fuel. This method obviously does not prevent leakage from occurring but rather safeguards the leakage fuel from contaminating the air by venting it away from the air-containing passage. The utilization of dummy passages in the heretofore known fuel-to-air heat exchangers not only adds size and weight to the core of the heat exchanger but also presents problems in construction particularly in view of the necessity of collecting the escaped fuel.

I have found that I can obviate these problems by manufacturing each passage into separate modules and assembling them to form the core so that each module is minutely spaced from each other. A filler of sealant is disposed in the space so as to be above and below the fuel carrying passages.

SUMMARY OF THE INVENTION

The primary object of this invention is to provide in a plate-fin heat exchanger means for sealing between passages.

A still further object of this invention is to provide a method of constructing a plate-fin type of heat exchanger core having sealant sandwiched between passages.

A still further object of this invention is to provide a heat exchanger construction such that sealant is disposed between adjacent passages in order to prevent leakage from occurring from passage to passage wherein such construction is characterized as being smaller, lighter in weight, and simpler to manufacture as compared to heretofore known heat exchanger constructions.

Other features and advantages will be apparent from the specification and claims and from the accompanying drawings which illustrate an embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view with a section broken away showing the details of the invention;

FIG. 2 is a perspective view of two modules used to make up the core of the heat exchanger; and

FIG. 3 is an enlarged view in section taken along lines 3—3 of FIG. 1.

Referring to the figures, the heat exchanger generally illustrated by numeral **10** comprises inlet header **12** and exit header **14**, inlet header **16** and exit header **18**, for receiving and discharging fluid passing in cross flow in direct heat exchange relation in the core **20**. The headers are fastened by suitable means, such as welding, to the core band **22** which is also welded to the face of core **20**. Corner headers **24** are also welded to the core band and serve to collect any escapement of fluid that might occur through or around the inner closure bar.

As noted in FIG. 2, the module consists of a pair of parting sheets **26** and **28** sandwiching the corrugated fins **30** so as to define a plurality of channels serving to distribute the fluid in a suitable heat exchange relationship with the fluid in the adjacent passage. A pair of closure bars **32** and **34** are spaced at the edge of the fins and define together with the adjoining parting sheets channel **36**. All modules are similarly made. As can be seen from FIG. 1, channels **36** communicate with headers **24**.

In manufacturing the core of the heat exchanger each module is made by brazing in any suitable manner the parting sheets to the fins and closure bars. These individual modules are then stacked such that each adjacent module is placed such that the fins are in a 90° relationship to each other. A fin spacer, say less than .005 of an inch, is placed between the modules whereupon the core bands are welded into place along the faces of the core. After welding the core into place, the spacers are then removed and the gap is then filled with a suitable substantially impervious type sealant which serves to prevent the fluid from entering between the modules and leaking to the other modules from cracks or corrosion pits that may develop in the parting sheets. Obviously, since the gap is completely filled, the sealant after solidifying is in a form of a thin sheet which is contiguous and coextensive with the adjacent parting sheets of adjacent modules. The gap is kept small for minimum size and weight, and also to minimize the insulating effect of the sealant.

The sealant is a polymer of the anerobic type that is well known in the art and has the characteristics of polymerizing or curing at room temperature when in films of approximately .005 of an inch. Additional curing can be achieved by baking at moderate temperature. A commercial example of this sealant is marketed under the trade name "Loctite," available from the Loctite Corporation, Newington, Conn. Other examples of a suitable anerobic sealant are described in Pat. Nos. 3,046,262; 3,041,322; 3,203,941 and 3,043,820. The manner of filling the gap is by immersing the edge of the core in a container which is partially filled with the liquid sealant. The level of the liquid sealant is sufficient to merely cover the edge of the core inserted in the container. By virtue of the small gap, capillary action induces the sealant to flow from the bottom to the top of the core. Due to its characteristic of curing only at thin films, it will only solidify between the gaps leaving the fin area void of sealant. The headers are then attached to the core bands to form the heat exchanger.

A suitable material for fabricating the heat exchanger may be aluminum or stainless steel.

It should be understood that the invention is not limited to the particular embodiments shown and described herein, but that various changes and modifications may be made without departing from the spirit or scope of this novel concept as defined by the following claims.

I claim:

1. Heat exchanger construction of the plate-fin type having a core comprising individual stacked modules, each module including a pair of spaced parting sheets, corrugated fins disposed in the space between said pair of parting sheets defining therewith open-ended channels, closure bars mounted adjacent opposite edges of the corrugated fins disposed in said space, and substantially impervious sealing means in contiguous and coextensive relation to the face of the parting sheets and being disposed between adjacent modules preventing the propagation of cracks in said parting sheets and leakage from occurring from said modules.

2. Heat exchanger construction as claimed in claim **1** wherein said modules are spaced approximately .005 of an inch from each adjacent module.

3. Heat exchanger construction as claimed in claim **1** wherein said sealant is an anerobic polymer.

4. Heat exchanger construction as claimed in claim **1** including additional closure bars spaced parallel to the closure bars adjacent the edge of the fins defining therewith an open-ended channel and headers mounted at the corner of said core communicating with said open-ended channel.

5. A heat exchanger having a core comprising a plurality of stacked modules, each module having a pair of spaced, parallel parting sheets defining a space therebetween, corrugated fins mounted in said space and bonded at its high and low points to the inward face of said pair of parting sheets and defining therewith a plurality of open-ended channels, closure bars at the side edges of said corrugated fins and said parting sheets and also

bonded to the inward face of said parting sheets, each of said modules being stacked so that the parting sheets of adjacent modules are in spaced parallel relation and sealing means disposed in the space between adjacent modules to prevent the propagation of cracks in said adjacent parting sheets and the escapement of fluid in the open-ended channels of one module to the open-ended channels of adjacent modules, said substantially impervious sealing means being contiguous and coextensive with the outer faces of the parting sheets defining said space between adjacent modules.

6. A heat exchanger as claimed in claim **5** wherein said sealing means is a nonmetallic sealing material.

7. A heat exchanger as claimed in claim **6** wherein said sealing material is an anerobic polymer.

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