

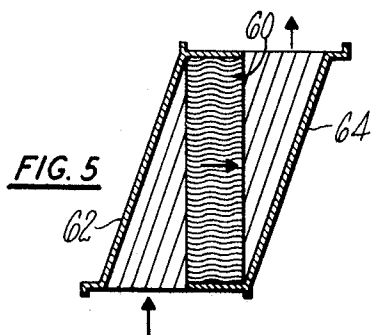
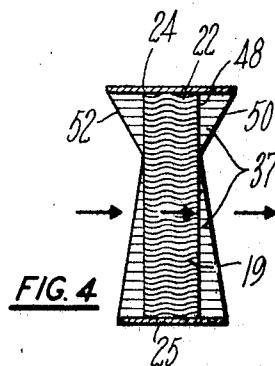
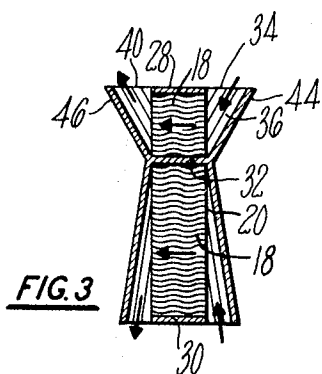
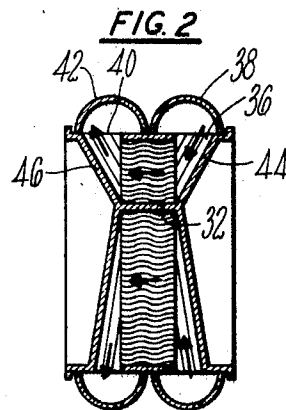
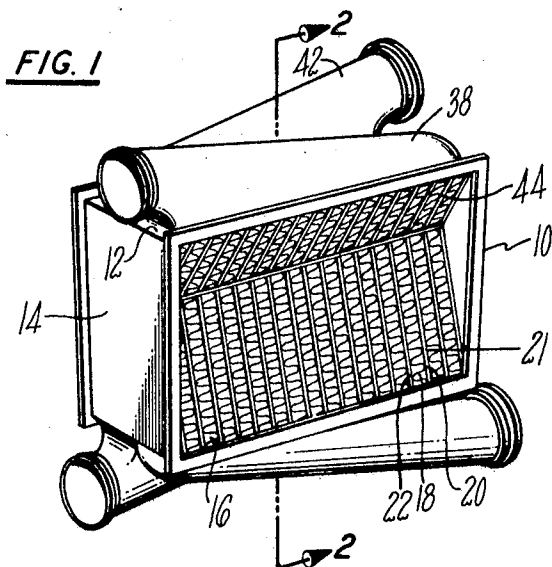
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E. A. ROTHMAN

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HEADER CONSTRUCTION FOR A PLATE-FIN HEAT EXCHANGER

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INVENTOR
EDWARD A. ROTHMAN
BY *Norman Friedland*
ATTORNEY

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HEADER CONSTRUCTION FOR A PLATE-FIN HEAT EXCHANGER

Edward A. Rothman, South Glastonbury, Conn., assignor
to United Aircraft Corporation, East Hartford, Conn.,
a corporation of Delaware

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4 Claims

ABSTRACT OF THE DISCLOSURE

The headering of a plate-fin heat exchanger is constructed to contain a series of stacked triangular-shaped plates attached to and coplanar with the parting sheets of the core and are supported by support means within the header. The triangular plates can be made integral with the normal parting plates.

BACKGROUND OF THE INVENTION

This invention relates to heat exchangers and particularly to the headering construction of a plate-fin pure counterflow heat exchanger.

As is well known in the art, plate-fin counterflow heat exchangers of the two pass type include in the thermodynamic core section means to divert the flow admitted at right angles relative to each other permitting a portion of the flow in the heat exchanger to pass in counterflow relationship. The core generally comprises parting sheets mounted in spaced stacked relationship defining alternate layers of open-ended channels where fluid in alternate layers passes parallel to, but sealed from, the fluid in the adjacent layer. Fins between the parting sheet, in the heretofore known counterflow heat exchanger, are disposed at angles to change the direction of the flow so that at least a portion of the fluid will pass in counterflow relationship which in certain heat exchangers is undesirable and results in a loss in heat transfer effectiveness when compared with the effectiveness possible with pure counterflow. Thus, a larger heat exchanger is necessary to handle the heat transfer load.

I have found that the problem noted above can be obviated by using triangular-shaped distribution chambers in the header for distribution of the fluid through the thermodynamic core such that it passes in pure counterflow heat exchange relationship. The triangular chambers are outside of the thermodynamic core and hence, are not supported by the fins. Instead they are supported by any suitable means dictated by structure precluding the possibility of having cross-flow sections within the thermodynamic core while allowing all the heat transfer to occur in pure counterflow which is sufficiently more efficient to compensate for the triangular chambers and support structure resulting in an overall lighter weight heat exchanger manifested by the increased heat transfer effectiveness.

SUMMARY OF THE INVENTION

A primary object of this invention is to provide an improved headering for a counterflow, plate-fin heat exchanger.

In accordance with the present invention a series of stacked triangular-shaped plates mounted adjacent to and complementary with the parting sheets or formed integral therewith are disposed in the header for changing direction and distributing flow into the pure counterflow thermodynamic core section of the heat exchanger.

In accordance with the further aspect of the present invention a pair of back-to-back triangular sections of the

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headers mounted adjacent the core of the heat exchanger are arranged so as to accommodate two different fluids placed in indirect heat exchange relationship with a third fluid passing in pure counterflow heat exchange relationship.

A further object of this invention is to provide headering for a heat exchanger to assure that the fluids in indirect heat exchange relationship in the core are in pure counterflow relationship and being characterized by the fact that the overall heat exchanger is lighter in weight for the same heat transfer effectiveness that was heretofore realized.

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 DRAWINGS

FIG. 1 is a perspective view of the heat exchanger with the headering of one of the passes removed.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a detailed view in elevation showing one pass.

FIG. 4 is a view in elevation showing an adjacent pass to the pass shown in FIG. 3.

FIG. 5 is a sectional view showing another embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An understanding of this invention can best be had by referring to FIGS. 1 through 4 which show a dual heat exchanger consisting of two counterflow cores of plate and fin construction. The cores are housed in a rectangular-shaped box 10 having top and bottom walls 12 (only one wall being shown) and side walls 14 (only one wall being shown). The back and front faces carry flanges which are adapted to receiver headers for conducting the primary flow through the stacked open-ended channels 16. Each core channel comprises a fin section 18 sandwiched between parting sheets 20 and 22 and closure bars 24 and 25 attached at either end. The closure bars 24 and 25 serve to seal off the edges of the fin sections and afford structural support to the parting sheets. Typical secondary flow channels are shown in FIGS. 2 and 3, noting that they are representative of the other channels in the cores. Since all stacked channels are identical, only one will be described for the sake of simplicity.

Referring to FIG. 3 it will be noted that the core section for one of the secondary flow channels comprises a parting sheet 20 which is generally a flat sheet of metal to which is attached a plurality of parallel spaced corrugated fins 18. The spaces between the fins define open-ended channels for permitting fluid to flow through the core section. A second parting sheet 21 (see FIG. 1) similar to and coextensive with parting sheet 20 overlies the fins for defining therewith one of the layers in the core. Closure bars 28 and 30 extend the length of the core and are mounted adjacent the edge of the fins and serve to seal off the sides of the open-ended channels. It will be noted that the closure bars are the same height as the fins so as to be joined to the two adjacent parting sheets. Closure bar 32 is mounted between the fins and between closure bars 28 and 30 and attached to closure bars 46 and 44 to separate the core into two sections for accommodating different fluids.

In accordance with this invention distributing chambers are mounted adjacent to the core for passing fluid in the core in counterflow relation with the fluid in the adjacent layer. Each distributing chamber includes triangular-shaped parting sheets 34 mounted adjacent to and

extending from parting sheets 20 and 21. The structural support shown here as straight fins 36 serve to distribute fluid admitted from manifold 38 (see FIG. 2) to the core and support the structural loads on sheet 34. These sections may be integral with the parting sheets. A similar triangular-shaped parting sheet 40 similarly supported is mounted on the opposite end of the core for receiving the fluid discharging from the core and admitting it to manifold 42 for discharging the fluid out of the heat exchanger. Closure bars 44 and 46 seal off the edges of the distributing header sections. The opposite section of the core is made in a similar manner.

FIG. 4 shows the next adjacent pass (primary flow) comprising the core section 48 formed in the same manner as the core section of the secondary fluid. This section carries triangular-shaped parting sheets or plates 50 and 52 extending from and mounted adjacent to the parting sheet 22 of the core section. The structural support shown here as straight fin 36 are arranged parallel to the flow path in the thermodynamic fin 18. Closure bars 24 and 25 mounted on the top and bottom edges serve to seal the fluid. It being noted that this channel of the core is coextensive with the next adjacent channel as shown in FIG. 1.

FIG. 5 shows another embodiment of this invention wherein the secondary pass is constructed as a single section to accommodate one fluid rather than two as shown in FIGS. 1 through 4. The core section 60 is constructed identical to the core section described above. The triangular-shaped distributing sections 62 and 64 are substantially the same as described above but one is reversed so as to pass the flow into and out of the heat exchanger in "Z" route fashion.

It will be noted that each closure bar in the embodiments shown in FIGS. 1 through 4 and for FIG. 5 may be constructed such that the portion sealing off the edge of the core and the portion sealing off the edge of the distributing section are made from one piece. Also the parting sheets of the core and distributing section may be integral.

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. Header construction for a plate fin heat exchanger in combination with a counterflow core section, said core section including a series of stacked coplanar plates, fins coextensively sandwiched in between said plates defining counterflow passes, the fins in adjacent passes being oriented in the same direction, said header comprising a triangular shaped header chamber formed from a series of stacked triangularly shaped flat plates, closure bars mounted alternately on the end of and between two adjacent flat plates and extending from the apex to the base of said triangle, support members mounted between said flat plates, and said triangular shaped header chambers being in register with said fins to distribute heat exchanger fluid to alternate passes.

2. A heat exchanger having plate and fin core section, first means for directing flow through alternate layers of said plate and fin section, second means for conducting flow through intervening layers of said plate and fin core section so as to direct the flow in adjacent layers in counterflow relation, said second means comprising stacked parallelly spaced triangularly shaped plate members having one side mounted adjacent the core, closure bars mounted between said triangularly shaped plate members extending at one end from the apex to the base thereof for defining a passage therewith for conducting flow to said core section.

3. A heat exchanger comprising a core section having parallelly stacked rectangularly shaped parting sheets forming layers of passages, fins sandwiched between said parting sheets defining a plurality of open ended channels, disposed in counterflow relation, closure bars mounted between said parting sheets adjacent the opposite sides of said fins, first pair of headers mounted on opposite faces of said core adapter to conduct fluid through alternate layers of said open ended channels, header means on another side of said core and having complementary layers of parallelly stacked triangularly shaped flat plates mounted adjacent said parting sheets, closure bars mounted on the outer side of alternate layers between said triangularly shaped flat plates blocking off the flow from said first pair of headers and defining a distributing chamber for conducting fluid through intervening layers of said core.

4. A heat exchanger having plate and fin core section, means for directing flow through alternate layers of said plate and fin core section, means including a distributing chamber for leading flow to intervening layers of said plate and fin core section so as to direct the flow in adjacent layers in counterflow relation, said distributing chamber comprising a first series of stacked parallelly spaced triangularly shaped plate members having one side mounted adjacent the core section, closure bars mounted between said triangularly shaped plate members extending at one end from the apex to the base thereof for defining a passage for conducting flow to said core section, said apex being located at one end of said core section, and a receiving chamber having a second series of stacked parallelly spaced triangular shaped plate members having one side mounted adjacent the opposite side of said core section, closure bars mounted between said triangularly shaped plate members extending at one end from the apex to the base thereof for defining a passage therewith for receiving flow discharging from said core section.

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ROBERT A. O'LEARY, Primary Examiner

T. W. STREULE, Assistant Examiner