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HEAT EXCHANGER

Filed July 10, 1958

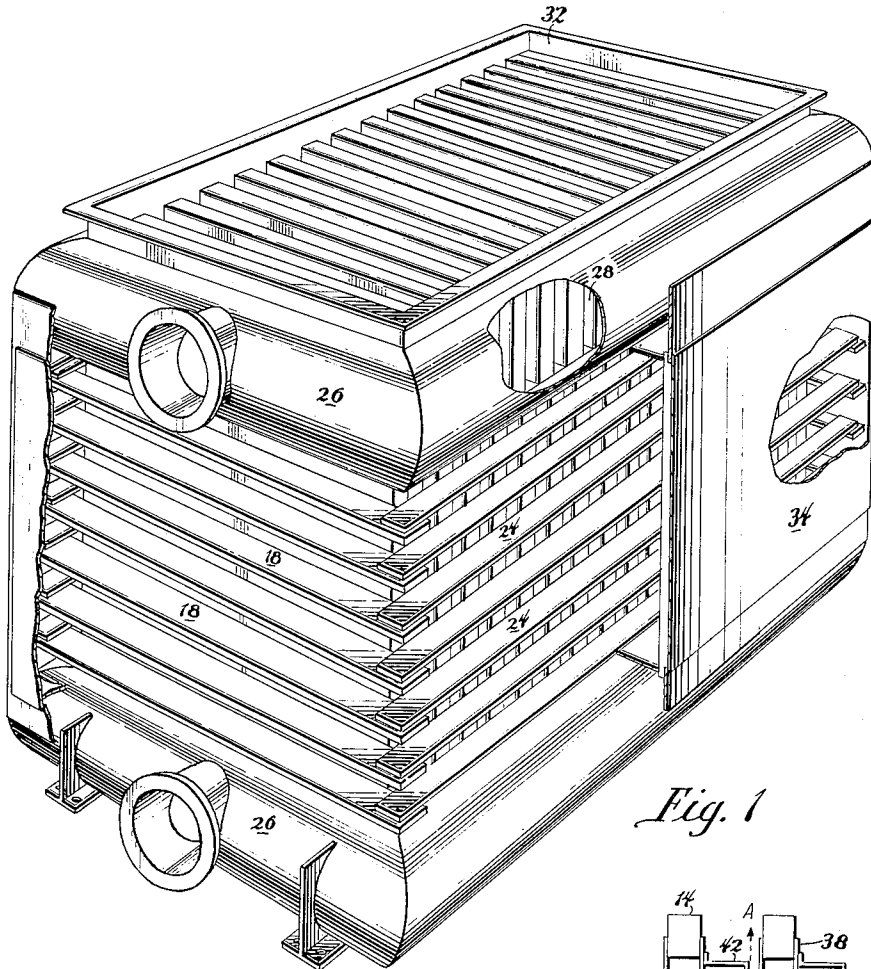


Fig. 1

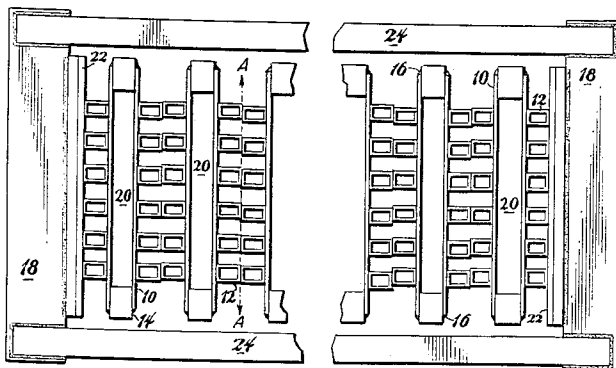


Fig. 2

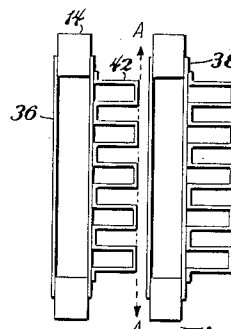


Fig. 3

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3,024,003

HEAT EXCHANGER

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2 Claims. (Cl. 257-245)

The present invention relates to improvements in plate type heat exchangers utilized for the transmission of heat between two confined fluids and particularly to an improved construction for a heat exchanger that receives substantial strength from a unique arrangement of heat exchange fins that simultaneously serve as compression members between adjacent plates thereof.

A typical plate type heat exchange apparatus for the transfer of heat between two confined fluids comprises a plurality of spaced metallic plates forming passages through alternate ones of which a relatively hot gas flows in heat exchange relationship with air or other fluid to be heated that in turn traverses the intermediate passages. In many such heat exchangers a series of envelopes are provided each comprising a pair of parallel plates with the space therebetween closed along one pair of opposite edges to bound the sides of a passage for one of the fluids. The envelopes are mounted in spaced parallel relation to form therebetween a passage for a second fluid, the inter-envelope spaces also being closed along one pair of opposite side edges to direct the flow of fluid therethrough.

A series of such spaced envelopes form a heat exchanger core that is then enclosed in a housing having inlet and outlet manifolds leading to and away from the gas and air passages through the heat exchanger.

Heat exchangers of this general type are usually provided with extended surface in the form of fins extending into the path of the fluids flowing therethrough so as to increase the transfer of heat to and through the passage walls. These fins are formed variously but are usually assembled in a direction generally parallel to the flow of fluid to provide a minimum of resistance thereto while serving heat to transmit heat to and from the passage walls. The component parts of such a heat exchanger are generally brazed together into envelope type units that then become the basis for further assembly into a heat exchange core of predetermined capacity.

Since brazed assemblies are generally inferior to welded assemblies from a standpoint of strength and resistance to corrosion and erosion, it becomes an important object of this invention to provide a welded envelope assembly that may readily be combined in multiples into a heat exchanger core.

It is also an important object of this invention to provide an envelope assembly that permits visual observation of all bonded joints prior to final assembly.

It is another object of this invention to provide an envelope assembly of metallic plates spaced apart by fin elements that are adapted to permit relative movement between adjacent plates to accommodate differences in expansion and contraction thereof.

It is a further object of this invention to provide a plate type heat exchanger assembly wherein all joints maintained under tension are readily accessible for welding procedures.

It is a still further object of this invention to provide a plate type heat exchanger for high pressure fluids that does not require the usual type pressure vessel around the entire heat exchanger.

These and other objects of our invention will become more readily apparent when read in conjunction with the drawing in which:

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FIGURE 1 represents a perspective view of a plate type heat exchanger involving our invention.

FIGURE 2 is a cross sectional view of a heat exchanger as seen in FIGURE 1.

FIGURE 3 is a partial sectional view of basic envelope components for a heat exchanger involving a modified form of the invention.

In our invention a pair of plates 10 having extended surface means on at least one side are bonded to opposite sides of a frame of metallic bars 14 to provide an envelope with extended surface means on each outer wall thereof. Openings 28 in opposite ends of a pair of bars 14 permit the flow of fluid to and through the space 20 within the envelope. The plates 10 are preferably welded to the closure bars 14 along plate edges 16 to provide a composite body wherein the welds have substantially the same strength as the parent material that comprises plates 10 or closure bars 14. The extended surface means disclosed in FIGURE 2 comprises a series of parallel tube-like members or their equivalent having a rectangular cross-section that collectively provides a broken planar surface A—A parallel to the plate 10. The surface A—A of one series of tubes is adapted to abut a similar surface depending from an adjacent sheet 10 and in order that tubes so abutting will not "nest" under any circumstances, the lateral spacing between tubes is always somewhat less than their own width.

The extended surface members 12 may be bulk brazed or otherwise bonded to their respective plates 10 since such members are adapted to be placed in compression by the same unbalance of fluid pressures within the apparatus that places the welds along plate edges 16 in a state of tension.

A series of envelopes including extended surface means 12 on the outer walls that collectively provide a plane surface A—A are placed in juxtaposition to provide a heat exchanger core of predetermined capacity. Inlet and outlet headers 26 at opposite ends of the assembled core are adapted to admit air or other high pressure fluid to and exhaust it from the passageways 20 within the assembled envelopes, the high pressure fluid having access to the interior of the envelopes through ports 28 in closure bars 14 while a low pressure fluid has access to the inter-envelope spaces through ducts 32 at opposite ends of the assembled core.

Inasmuch as low pressure fluid is directed through the inter-envelope spaces a light weight housing 34 surrounding the core is sufficient to restrain the fluid therein while the high pressure fluid is being directed through the passageways 20 within the envelopes. When high pressure fluid is directed through the passageways within the envelopes each envelope wall tends to be forced outward by the unbalance of fluid pressure until the extended surface means 12 on the outer surface of adjacent envelopes tightly abut and are subjected to substantial compressive force. Thus, the walls of adjacent envelopes within the core provide mutual support one for another while the passage walls of the envelopes at remote ends of the core are supported and restrained by a strongback arrangement that surrounds the core assembly.

The strongback arrangement comprises a series of flat bars 18 placed on edge normal to plate 22 at each end of the core assembly, the plate 22 serving as a backing plate to distribute the force of the high pressure fluid in passageways 20 over the largest possible area. Each pair of bars 18 laterally aligned at opposite ends of the core assembly is maintained in position by a pair of tie bars 24 connected to opposite ends thereof. Since the tie bars 24 are adapted to be placed in tension by the force of the high pressure fluid in end passageways 20, the physical relationship of such members and those of bars 18 may

be readily varied to meet the requirements of the conditions involved.

FIGURE 3 is exemplary of a modified form of the invention wherein each envelope assembly is provided with one wall 36 that comprises a plane metallic sheet and a wall 38 that includes a corrugated extended surface member with a plane outer surface A—A bonded to the outer surface thereof. The walls 36 and 38 are spaced apart by conventional closure bars 14. Tubular members, channel members, undulated sheets or other equivalent forms of extended surface may be readily substituted for the corrugated member 42, it being only necessary that such extended surface offer a plane outer surface A—A for contact with the plane surface provided by wall 36 of an adjacent envelope.

When assembled as disclosed, each individual envelope maintains its structural independence and is free to shift laterally along plane A—A or become otherwise distorted without adversely affecting the envelopes adjacent thereto. Inasmuch as the spacing between members 12 is less than the width of such members, nesting of abutting envelopes is effectively precluded.

While this invention has been described with reference to the embodiments illustrated in the drawing it is evident that numerous changes may be made without departing from the spirit of the invention, and it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What we claim is:

1. A plate type heat exchanger having a series of spaced metallic plates that define walls for a plurality of fluid passageways therebetween; closure bars between end edges of adjacent pairs of spaced plates adapted to enclose the space therebetween and provide a series of envelopes having passageways therethrough for a high pres-

sure fluid and inter-envelope spaces for a low pressure fluid; extended surface means bridging the inter-envelope spaces comprising a series of laterally spaced protrusions on each envelope wall having plane outer surfaces that combine to form a broken plane surface parallel to the envelope walls, said protrusions having a width greater than their lateral spacing and a length substantially that of the envelope walls; openings in said closure bars at opposite ends of the heat exchanger; inlet and outlet headers encircling the heat exchanger at its opposite ends arranged to interconnect aligned openings and direct high pressure fluid to and from the fluid passageways within the envelopes; and a series of parallel bars encircling said heat exchanger assembly between the inlet and outlet headers serving to restrain the fluid pressure acting against the outer walls of the end envelopes.

2. A plate type heat exchanger as defined in claim 1 wherein the parallel bars encircling said heat exchanger about the outer walls of the end envelopes and are spaced from the closure bars at the sides of said envelopes to permit limited lateral misalignment of said envelopes.

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