Jan. 27, 1959 T. L. WOOLARD 2,870,998

HEAT EXCHANGER WALLS WITH COUPLED SINUOUS FIN ELEMENTS

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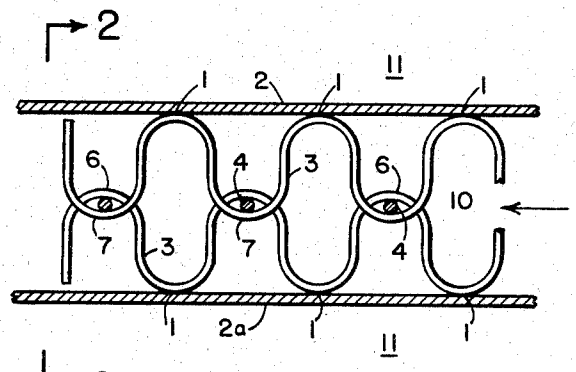


FIG. 1

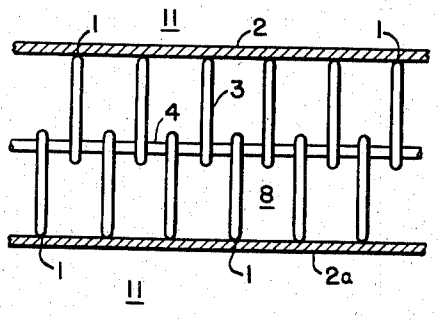


FIG. 3

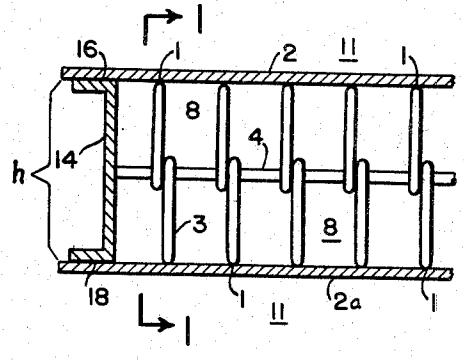


FIG. 2

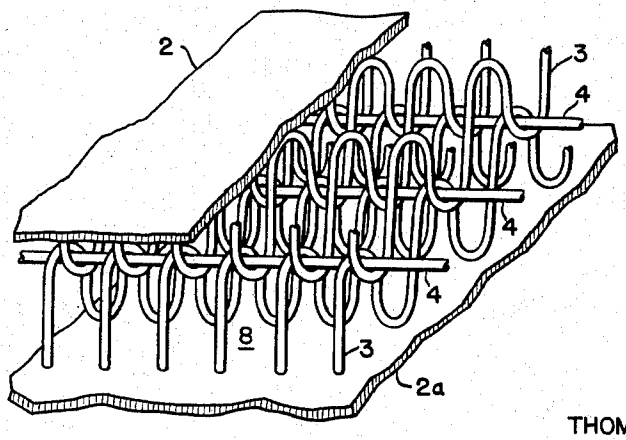


FIG. 4

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HEAT EXCHANGER WALLS WITH COUPLED SINUOUS FIN ELEMENTS

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3 Claims. (Cl. 257—245)

The present invention relates to an apparatus for the exchange of heat between two confined fluids and particularly it relates to an improved form of extended surface for application to a heat exchanger of the plate type.

A familiar type of heat exchanger for two confined fluids comprises metallic plates spaced apart to form a fluid passage through which one fluid is circulated for transferring heat through the passage wall formed by one of the metallic plates to another fluid in an adjacent passage, the passages for the heating fluid and the fluid to be heated being arranged in alternation. The spaces between the adjacent plates forming the fluid passageways are closed along one pair of opposite edges to provide an enclosed passageway having an inlet at one end and an oppositely disposed outlet.

To increase the efficiency of heat transfer between the two fluids through the passage walls the latter are frequently provided with extended surface which may be in the form of undulated wires which are joined to the opposite sides of passage walls.

Usually the plate and wire elements comprising such a plate type heat exchanger are bonded together by brazing, a process providing a reasonably strong bond entirely satisfactory for heat exchange units adapted to handle fluids at relatively low temperature and pressure. Such brazed units are not however, suitable for use at high temperature or pressure since the inherent strength of a brazed joint is not adequate for such usage.

Welded construction of a plate type heat exchanger would provide the necessary strength, however the manufacturing of such a welded unit would provided problems whose solutions would be both complicated and expensive.

It is therefore an object of this invention to provide a plate type heat exchanger which is readily adapted to fabrication by standard operations of welding.

The invention will be best understood upon reference to the following description of an illustrative embodiment thereof when read in conjunction with the accompanying drawing in which:

Figure 1 is a fragmentary side elevation, partially in section, of a heat exchanger envelope involving the invention of this application.

Figure 2 is an end elevation of the heat exchanger illustrated in Figure 1.

Figure 3 illustrates a modified form of the invention.

Figure 4 is a perspective view of the heat exchanger envelope illustrated in Figures 1 and 2.

In Figure 1 the numerals **2** and **2A** designate a pair of metallic plates spaced apart to form a passage **10** through which air or other fluid to be heated is circulated in heat transfer relationship with another fluid flowing past the outer surfaces of said plates in other passages at **11**. The extended surface projecting from the walls **2** and **2A** into the passage **10** comprises strips of undulated wires **3**, consecutive loops or yokes **1** of which are joined by spot welding to the inner surfaces of plates **2** or **2A**. Adjacent strips of the undulated wires are joined to the plates in parallel strips as seen in Figure 2 to

provide parallel flow lanes **8** through which the fluid may flow when the unit is completely assembled and placed in operation.

In assembling an envelope, a first plate **2A** with its parallel rows of undulated wires is placed wire side up on a relatively flat surface while a similar plate **2** having its undulated wire side down is superimposed over said first named plate and lowered until wire loops remote from the plate connected thereto lie adjacent to the inner face of the spaced plate. Retaining rods **4** having an overall length substantially equal to the length of an envelope are then inserted into the spaces formed between overlapping series of loops **6** and **7** to link the spaced plates and their undulated wires together.

The plates **2** and **2A** are then moved apart until the loops **6** and **7** tightly embrace the retaining rods **4** which have previously been inserted between loops in the manner heretofore disclosed. After the plates **2** and **2A** have been separated to the limits allowable by the interconnected loops **3**, channel members **14** of appropriate height "*h*" are inserted between the opposite side edges of a pair of plates and bonded thereto by a continuous seam weld at flanges **16** and **18**. Enclosure of opposite sides by welded channel members **14** completes the "envelope" assembly and provides it with a completely welded construction having an inherent strength at high temperatures far greater than that of a similar envelope having a standard brazed construction.

After the envelopes have been completely assembled and welded, a plurality of said units are superimposed and spaces between envelopes are enclosed on a pair of opposite sides by channels similar to channels **14** to thereby provide a passageway for a second fluid to flow in a heat exchange relationship with the fluid which flows through the passageway **10**. However, such assembly of envelope units into a composite body to provide a completed heat exchanger is of no major part of this invention and its disclosure is ancillary to the assembly of an individual envelope.

Figure 2 discloses a preferable form of the invention wherein the undulated wire strips welded to opposing faces of the spaced walls **2** and **2A** are held in a side by side contacting relationship as contrasted with the assembly of the alternative arrangement disclosed in Figure 3. In this alternative arrangement the parallel strips of undulated wires attached to one passage wall are spaced intermediate those of the opposing wall.

In use a fluid maintained at relatively high pressure is channeled through the passageway **10** inside each of the envelopes while a second fluid at a much lower pressure is passed through passageways **11** adjacent the outer envelope walls. This pressure differential between the fluids inside and outside each envelope is sufficient to force the passage walls outward bringing all of the loops **6** and **7** into abutment with the retaining rods **4** so as to provide means linking the opposing walls and their depending undulated wires into an integral envelope.

What I claim is:

1. An envelope for a plate type heat exchanger comprising a pair of metallic plates spaced apart to form opposing walls for a fluid passageway therebetween; parallel rows of undulated wires depending from each inner wall and extending toward the opposing wall thereof so the loops remote from their respective walls overlap; and metallic rods inserted through aligned spaces between overlapping loops to link the passage walls and their respective strips of undulated wires into a composite body.

2. An envelope for a plate type heat exchanger as defined in claim 1 having means closing the spaces between said plates along a pair of opposite marginal edges

to define a gas passageway having an inlet at one end and an oppositely disposed outlet.

3. A heat exchange envelope including metallic plates spaced apart to provide walls for a fluid passageway therebetween, a plurality of sinuous wires secured to each wall and adapted to extend perpendicularly between metallic plates to provide parallel rows of heat exchange elements having alternate rows secured to opposing passage walls; and linking means extending through the spaces formed between overlapping loops of oppositely extending sinuous wires to link the wires and their attached plates together into an integral body.

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