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HEAT EXCHANGER WITH BAFFLE SECURING MEANS

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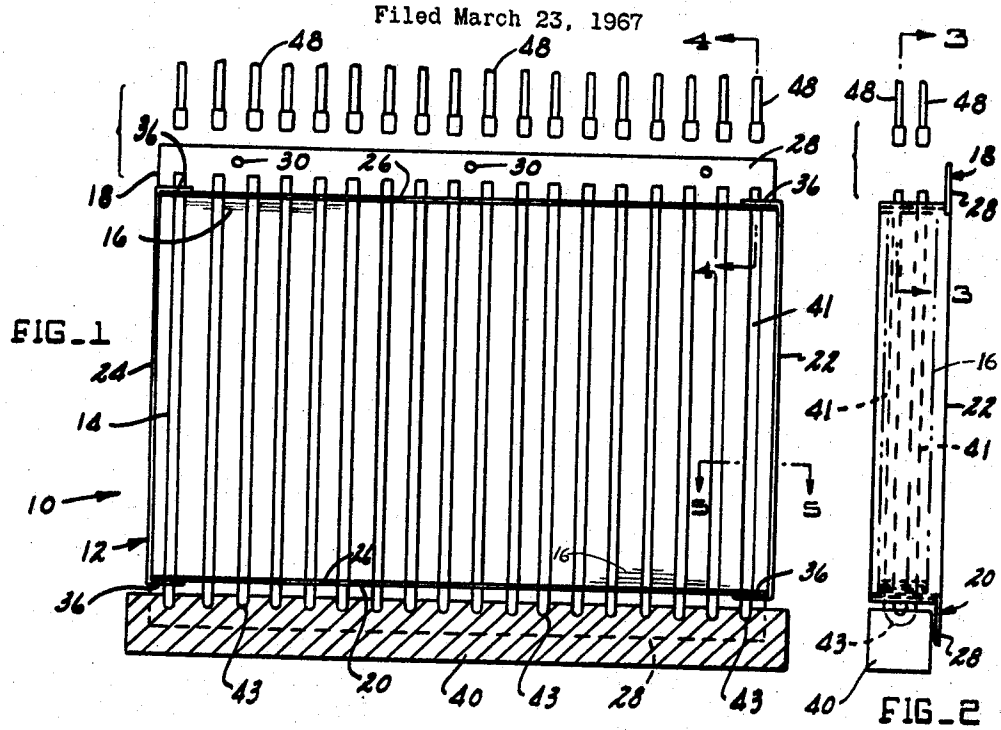


FIG_1

FIG_2

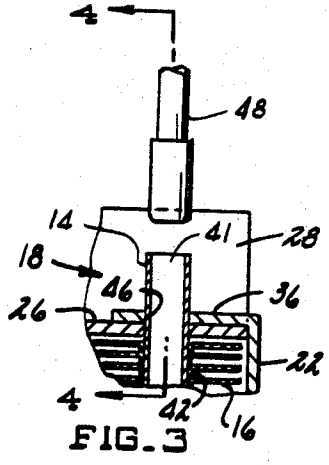


FIG_3

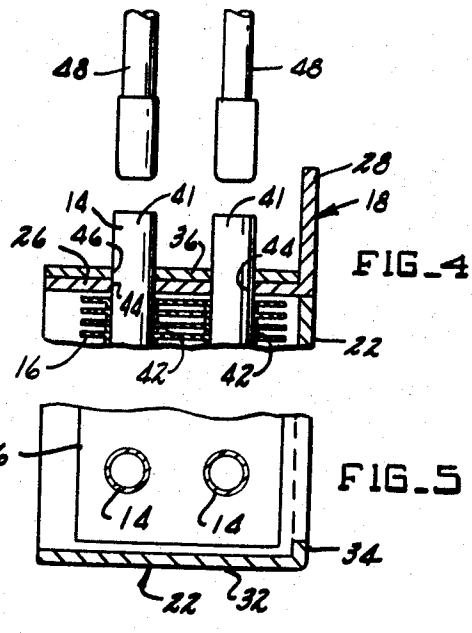


FIG_4

FIG_5

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HEAT EXCHANGER WITH BAFFLE SECURING MEANS

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ABSTRACT OF THE DISCLOSURE

A finned tube heat exchanger wherein a plurality of tubes extend through apertured tube sheets. Baffle sheets interconnect the corresponding ends of the tube sheets. Apertured flanges are provided on the baffle ends wherein one of the tubes extending through the tube sheets also passes through the apertured flanges thereby locking the baffle and tube sheets together.

Summary

Under the invention a rectangular framework is formed by a pair of longitudinal tube sheets and interconnecting perpendicular baffle sheets. The baffle sheets are provided with flanges which are turned onto the outside faces of the tube sheets so that suitable openings in said flanges fit over selected ones of the tube sheet fluid tube openings. Final assembly may be performed in a one-step process which involves running a tube-expander mandrel through each fluid tube. Mechanical expansion of the tubes automatically locks the baffle sheet flanges to the selected tubes, thus eliminating the need for screws, rivets, or other separate fastener devices. Improvement resides in lower assembly cost, higher strength connections, and greater rigidity of the framework.

The drawings

FIG. 1 is a front elevational view of a heat exchanger and forming apparatus embodying the present invention.

FIG. 2 is a right end elevational view of the FIG. 1 structure.

FIG. 3 is an enlarged sectional view taken on line 3—3 in FIG. 2.

FIG. 4 is a sectional view taken on line 4—4 in FIGS. 1 and 3.

FIG. 5 is an enlarged sectional view taken on line 5—5 in FIG. 1.

The drawings in greater detail

FIG. 1 shows a partially formed heat exchanger **10** comprising a rigid framework **12**, fluid tubes **14**, and heat exchange fins **16**. Framework **12** is made up of two tube sheets **18** and **20**, each of right angle cross section, and two connecting baffle sheets **22** and **24**, also of right angle cross section. Each tube sheet **18** or **20** includes an apertured leg **26** for receiving the ends of tubes **14** and a second leg **28** provided with suitable openings **30** for mounting the heat exchanger in place on a suitable duct or unit structure (not shown). Each baffle sheet **22** or **24** includes a main leg portion **32** and a rigidifying leg **34** (see FIG. 5). The opposite end of each baffle sheet are turned inwardly to provide flanges or tabs **36**. As shown best in FIG. 1, the two baffle sheets are arranged so that flanges **36** thereof overlap wall portions **26** of the tube sheets **18** and **20**.

In the illustrated heat exchanger the tubes **14** are formed as U-tubes comprised of straight portions **41** and return bend portions **43**. This provides two rows of tubes having connected lower ends and open upper ends, said upper ends being subsequently connectable to suitable headers, return bends, distributors or other fluid line connectors (not shown) to provide a complete heat exchanger.

Fluid tubes **14** extend through apertures **44** in the tube sheets; additionally the two endmost fluid tubes extend through openings **46** in flange portions **38** of the baffle sheets. By this arrangement the tubes serve as mechanical connections between the tube sheets and baffle sheets.

In assembling the heat exchanger components together the tubes are preferably positioned with their end portions **43** abutting against a stationary contoured support or nest **40**, as shown in FIG. 2. The plate type fins **16** are stacked within the defined framework **12** with their collars **42** loosely encircling the tubes. Thereafter tube-expander mandrels **48** are moved downwardly into the non-supported or free ends of the tubes by a mechanical press or other power device, not shown. Preferably the mandrels are operated together as a bank.

As each mandrel begins to move through the tube it initially forces the tube wall to move outwardly against the surfaces of tube sheet apertures **44**, thus locking the tubes to the tube sheet **18**. Additionally, the four endmost tubes are caused to be locked against the surfaces of baffle flange openings **46**. The tubes are thus locked to the tube sheet **18** and baffle sheets **22** and **24** as a rigid construction; this is accomplished without extraneous bolts, rivets, adhesives or the like.

Movement of the mandrels through the tubes expands the tubes against the fin collars **42**, thus locking the fins onto the tubes (for improved heat transfer). The final portion of the mandrel stroke locks the respective tubes to tube sheet **20** and the adjacent baffle flanges **36**. Preferably the expansion operation is a single stroke process. It is believed that hydraulic expansion can be used in lieu of mechanical expansion.

During the tube expansion process the outward radial movement of the tube wall draws the tube materially axially. As a result, the tube tends to elongate slightly, about 2% in a typical situation. Because of this elongation factor it is desirable during the expansion process to avoid any restrainment on the baffle sheets or fins. The baffle sheets and fins should be in a free-floating condition without applied stress, as from fixed guide or support structures.

FIG. 4 illustrates an arrangement in which the baffle sheet flanges **36** lie against the outer faces of the tube sheets. It is possible of course to size the parts so that the baffle sheet flanges lie against the inner faces of the tube sheets. The tubes used in the FIG. 1 arrangement are U-shaped, but it is of course possible to use straight open-ended tubes if desired.

Differentiation over prior art practice

It is old to form heat exchangers to include rectangular framework structures, and to connect the fluid tubes thereto by running expander tools through the tube interiors. What is new is my use of baffle sheet flanges **36** equipped with openings **46** which telescope onto the endmost fluid tubes; it is this arrangement which causes the framework components to be rigidly connected together as a part of the process of locking the tubes onto the fins and the tube sheets. The fluid tubes are of larger diameter, e.g., ⅝ inch, than connector screws or bolts, so that the instant connections are more rigid and permanent than the corresponding prior art connections.

Preferably the openings **44** and **46** in the tube sheet flanges and baffle flanges are circular openings completely enclosed by the flange material, i.e., the edge of each opening is endless. It is contemplated however that certain ones of the openings could be U-shaped slots or cut-outs in an edge of each flange. In that event the tube would grip the edge of the flange opening for over one

hundred eighty radial degrees, sufficient in many cases to form a locked connection of adequate strength.

I claim:

1. A heat exchanger comprising two spaced parallel apertured tube sheets; a plurality of fluid tubes extending through the apertures in said sheets; heat exchange fins having gripping engagement with the tubes in the space between the sheets; and two baffle sheets interconnecting the corresponding ends of the tube sheets to cooperate therewith in forming a rectangular framework; each baffle sheet having flanges at the ends thereof which connect with the respective tube sheets; each flange being turned onto a face of the tube sheet and being provided with an opening aligning with one of the sheet apertures; selected ones of the tubes having gripping engagement with the surfaces of the flange openings and aligned apertures, whereby to lock the baffles and tube sheets together for defining a rigid framework; said selected tubes constituting the sole means for connecting the tube sheets with the baffle sheet flanges.

2. The heat exchanger of claim 1 wherein each flange engages the outer face of a tube sheet.

3. The heat exchanger of claim 1 wherein the fins are equipped with collars telescoped onto the fluid tubes; said tubes having gripping engagement with the collars.

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