

Aug. 17, 1954

W. W. SWARTHOUT

2,686,353

METHOD OF ASSEMBLING TUBES IN SPACER PLATES

Filed June 6, 1950

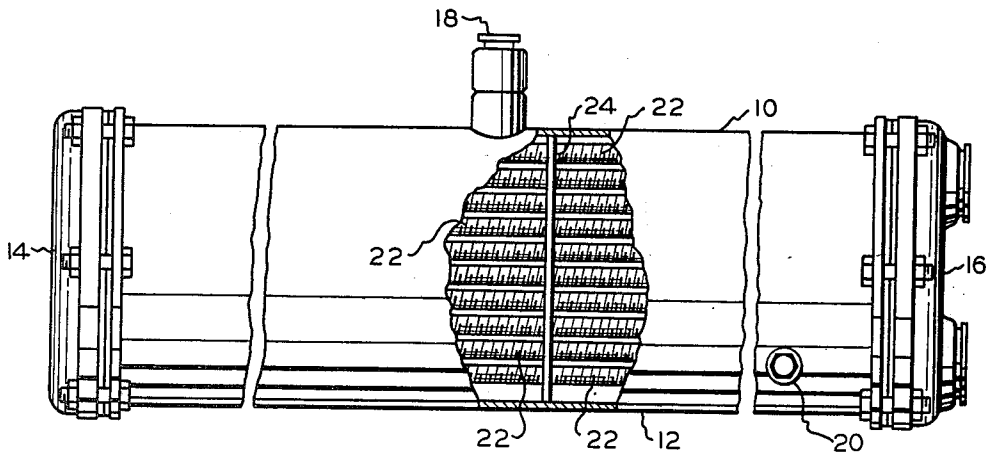


FIG. I.

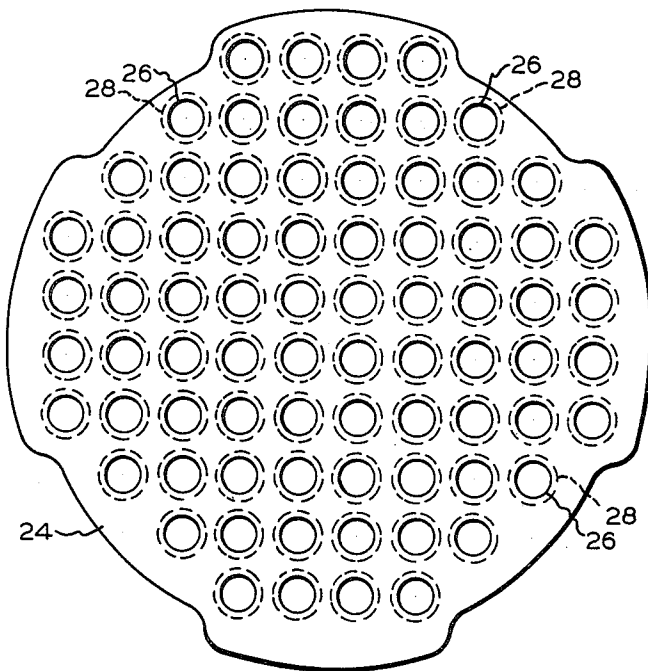


FIG. II.

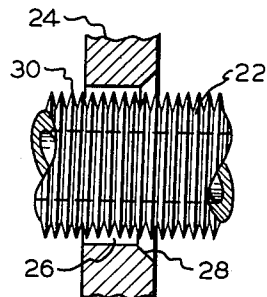


FIG. III.

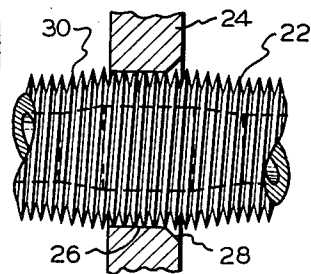


FIG. IV.

INVENTOR

WARD W. SWARTHOUT

BY *James F. Beaman*

ATTORNEY

UNITED STATES PATENT OFFICE

2,686,353

METHOD OF ASSEMBLING TUBES IN
SPACER PLATESWard W. Swarthout, Jackson, Mich., assignor to
Acme Industries, Inc., Jackson, Mich., a corpo-
ration of Michigan

Application June 6, 1950, Serial No. 166,345

1 Claim. (Cl. 29—157.5)

1

This invention relates to shell and tube type heat exchangers, and more particularly to the provision of a method for attaching and assembling a helically finned tube with a spacer plate in a vibrationless joint as needed in such heat exchangers.

Shell and tube heat exchangers are employed for a variety of purposes, including their use as condensers in refrigeration systems. In such uses the heat exchanger is constructed of a hollow shell having suitable enclosure means, and carrying therewithin a number of tubes mounted parallel to the horizontal axis of the shell. A refrigerant in a gaseous state is allowed to enter the shell of the heat exchange unit, while some cooling medium, such as water, is pumped through the tubes.

If these heat exchangers could be constructed with a relatively short length and utilizing relatively large diameter internal tubes, it would not be necessary to support the tubes between the ends of the unit where they are fastened in operative position. However, the tube banks run to great length, such as ten feet or more, and especially in the case of exchangers utilizing a large number of tubes, it is important to provide a suitable support or supports for the individual tubes, intermediate the ends of the heat exchanger.

It is, likewise, well known in this art to utilize a tube having an outside peripheral fin for maximum heat transfer. At the present time, these fins are usually rolled on the outside wall of the tubing in the process of manufacture thereof, are generally triangular in cross-section and terminate in a knife edge.

It has been, heretofore, thought that the expansion of the finned tube against the bore of an aperture in a support plate would not provide a sufficient frictional grip between the two articles to prevent longitudinal movement of the tubing therein, particularly when the heat exchanger is subject to vibration, as occurs under certain usages. This may be seen in United States Letters Patent No. 2,362,694. This has been complicated by the fact that excessive vibration and relative movement between the tube and the support plate may cause wear which will eventually result in a break in the tubing.

Heretofore, various mediums have been adapted to provide a solution for this problem. As shown in United States Letters Patent No. 2,241,209, wire of various cross-sectional shapes has been soldered between the helical fins to provide a flat outer surface, and threaded collars have been screwed onto the helical fin to be engaged by a

2

supporting plate. Another expedient shown in Patent No. 2,362,694 is the provision of a specially formed tube having a fin formed throughout most of its length, and having the fin omitted at the point of support by the support plate. Patents Nos. 2,288,598, 2,256,993 and 2,460,580 show other means for producing the required joint.

The largest single advantage springing from my invention lies in the fact that, by utilizing this invention, the inventory of finned tubing can be all standard, and at random lengths, without a specially formed tubing to provide the supporting joints, and without the use of special adaptor means to provide a supporting surface to form the joint.

It is an object of this invention to provide a method of assembling a finned tube with an apertured support or spacer plate without the use of special adaptor means to provide a supporting surface on the finned tube.

A further object is to provide a method of assembling such tubes and support plates with standardized tube finned throughout its length.

Further objects and advantages of this invention will be apparent from a consideration of the following specification in connection with the appended claim and the accompanying drawings in which

Fig. I is a broken view in elevation of a typical heat exchanger condenser,

Fig. II is a view in elevation of the support plate,

Fig. III is a view showing the finned tube in elevation and the support plate in section, the tube not having been expanded the size of the aperture in the plate being exaggerated for clarity of presentation, and

Fig. IV is a view similar to Fig. III with the tube in its expanded condition, with the expansion being exaggerated for clarity of presentation.

I have shown in the drawings, my invention as it relates to the construction of a condenser type heat exchanger, although the method here to be described has many other applications. The condenser 10 is formed with an external cylindrical shell 12 and is closed by the rear head 14 and the front head 16. The shell 12 is fitted with an inlet 18 and an outlet 20 which provides fluid passage means for the material to be contained by the shell 12.

Mounted within the shell 12 is a plurality of finned tubes 22, being held in sealed engagement with the tube sheets, not shown. The tubes 22 may be joined to the tube sheets by any well known manner, such as with silver solder.

The tubes 22 are supported by one or more

3

spacer plates 24 positioned intermediate the ends of the shell 12, the plates 24 being formed with a plurality of apertures 26 having a chamfered edge 28 to simplify the assembly of the tubes 22 into the apertures 26.

The tubes 22 are shown as having upstanding helically formed fins 30, although the method herein described is applicable to fins other than those formed helically.

In assembly, the tube 22 is inserted through the aperture 26 and positioned as described with respect to the longitudinal movement of the tube 22. Thereupon, an expander tool, not shown, but being any variety of cam operated or roller type of expander, is inserted to a point substantially in the median plane of the support plate 24. The expander tool is then actuated and a sufficient pressure is employed to deform the tube 22 only a slight amount. The deformation of the tube 22 is sufficient to obtain intimate pressure contact between the fin 30 and the bore of the hole 26, and to slightly flatten the peripheral edge of the fin 30. The flattening required amounts to only a slight superficial deformation, and is not sufficient to cause the weakening or fracture of the tube 22.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

The method of assembling long finned tubing in heat exchanger structure plates for supporting the tubing intermediate its ends comprising

4

steps of providing a said plate with an aperture having a bore of uniform cylindrical shape throughout its major thickness and of slightly greater diameter than the diameter of the tubing to be assembled therein, inserting into said bore a length of tubing of uniform construction throughout its length and having upon its outer surface continuous relatively sharp edged helical fins of a cross-section generally triangular with a relatively broad base and integrally formed from the body of the tubing with said fins being of slight pitch as compared to the thickness of said plate whereby to position a substantial number of said fins within said bore, and internally expanding radially outward that portion of said tubing within said aperture sufficiently to cause the fins of said tubing to contact the bore of said aperture and be slightly deformed at their sharp edged extremities without establishing a permanent lock of the tubing in the aperture of said plate yet providing a vibration-free joint between the tubing and the plate.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
789,622	McCullough	May 9, 1905
1,179,853	McCullough	Apr. 18, 1916
2,412,886	Huston	Dec. 17, 1946
2,508,517	Hill	May 23, 1950