Dec. 25, 1956 W. F. MATHENY 2,775,433

FINNED TUBE SPACING SUPPORTS

Filed Aug. 31, 1953

Fig. 1

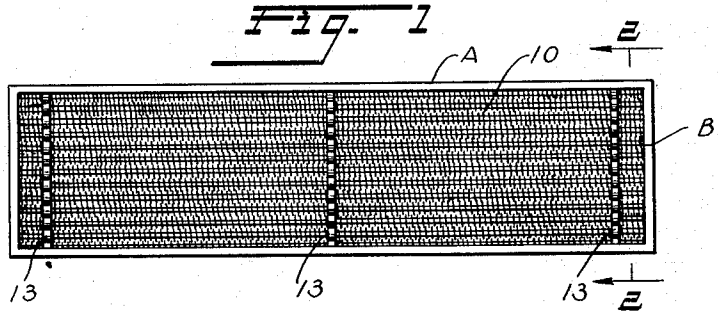
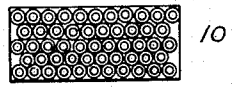


Fig. 2



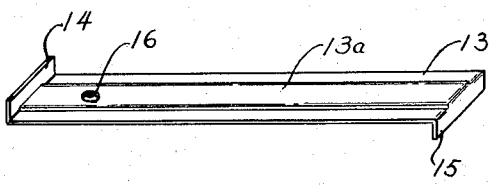


Fig. 3

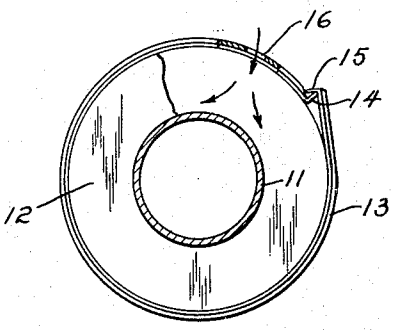


Fig. 4

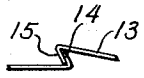


Fig. 4A

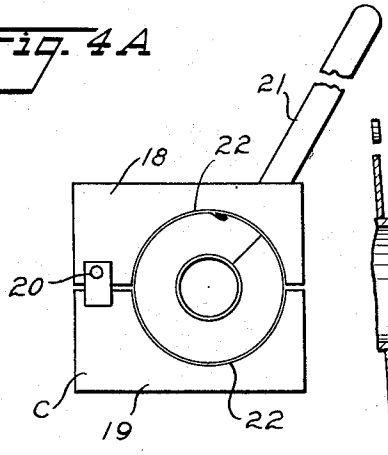


Fig. 5

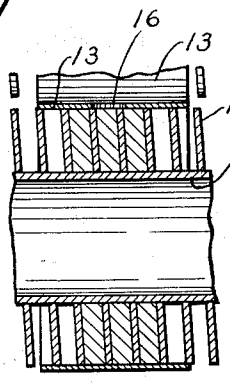


Fig. 7

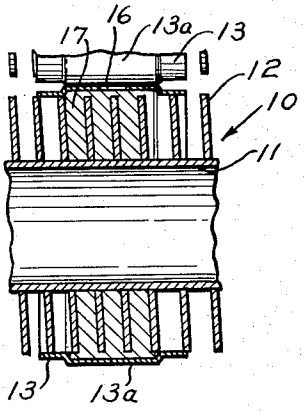


Fig. 6

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FINNED TUBE SPACING SUPPORTS

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2 Claims. (Cl. 257—262.16)

This invention relates to the art of heat exchangers of the type wherein a series of finned tubes are connected in series and arranged in superimposed rows within a housing or chamber. The fluid to be cooled is passed through this series of finned tubes while the cooling medium, usually in the form of forced air, passes through the housing and over the finned tubes.

More particularly, the present invention consists in new and useful improvements in tube spacing supports and the method of applying the same, whereby the individual tubes are maintained in uniformly spaced relation in the housing and at the same time, damage to the helical fins surrounding the tubes is prevented.

Heretofore, in heat exchangers of this general type the tubes have been supported by transverse racks arranged at spaced intervals throughout the length of the chamber and having apertures through which the finned tubes extend. In some intsances, a series of strips have been extended transversely of the chamber between the various rows of tubes in order to afford lateral support.

In heat exchangers of the type employing air as the cooling medium, it is desirable to maintain the tubes in relatively close proximity so that all of the cooling air will pass through the fins, taking maximum advantage of the cooling medium. In some instances, it is desirable that this spacing of the tubes be as close as .030 inch. At the same time, any two adjacent finned tubes must be held apart a sufficient distance to permit the tubes to be moved longitudinally with respect to one another during assembly and to prevent the fins on adjacent tubes from locking together.

Experience has shown that when using a series of supporting sheets or racks with perforations to receive the finned tubes, it is practically impossible to arrange the apertures in sufficiently closely spaced relation to take full benefit of the maximum flow of cooling air and also afford a sufficiently strong rack to give adequate support to the tubes.

A further disadvantage of heat exchangers employing transverse racks or those with supporting bars between each row of tubes, has been the difficulty of removing and replacing individual tubes. The tubes must always be taken out from between the headers and if for example, a tube in the second or third row is defective, all of the tubes in the rows above, must first be removed in order to remove the rack or spacing bars and gain access to the defective tube.

It is therefore the primary object of the present invention to overcome these disadvantages and to this end I have provided a tube banding device which is adapted to embrace the peripheral edges of the helical fin at predetermined spaced intervals on the heat exchanger tubes. A strip of metal of a width to embrace several convolutions of a helical fin is secured around the finned tube. Molten lead, solder, or other suitable metal having a low melting point, is poured into a hole in the strip and flows into the spaces between certain of the helical fins so as to provide a cylindrical body within the bounding strip which completely encircles the tube between the fins, after solidification. This solidified metallic body and the strip which bounds it forms a rigid support between the fins and the tube proper, relieving the fins of all strain at these points. Furthermore, these metal-filled bands eliminate the need of other spacing and supporting means and greatly facilitate the removal of defective tubes from a heat exchanger unit by minimizing the number of other tubes which must be removed to gain access to the defective tube.

Another object of the invention is to arrange tube banding devices such as just described, at uniformly spaced intervals on each of a series of tubes to be used in a heat exchanger chamber, so that when the tubes are arranged in superimposed rows, the corresponding banding devices of adjacent tubes lie in abutting relation, the peripheries of the helical fins of adjacent tubes being spaced apart laterally for a distance determined by the thickness of the banding strip.

A further object of the invention is to provide a banding strip of modified cross sectional profile, for use when it is desired to space the tubes laterally a distance greater than the thickness of the banding strip.

With the above and other objects in view which will appear as the description proceeds, the invention consists in the novel features herein set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views,

Figure 1 is an end view of a heat exchanger chamber showing a series of finned tubes and their supporting bands.

Figure 2 is a transverse sectional view taken on line 2—2 of Figure 1, showing the lateral relationship of a series of tubes supported in accordance with this invention.

Figure 3 is a perspective view showing one form of banding strip before it is applied to the tube.

Figure 4 is an enlarged transverse sectional view through a finned tube, showing the banding strip in the course of application.

Figure 4A is detail view showing the joined ends of the strip after a preliminary bending and before compressing.

Figure 5 is a diagrammatic illustration of one form of clamping device which may be employed in applying and locking the banding strip on the periphery of the helical fins.

Figure 6 is a longitudinal sectional view through a section of finned tubing, showing a channeled banding strip of the type used to increase the distance between two adjacent tubes and

Figure 7 is a similar view showing a plain banding strip.

In the drawings, the numeral **10** generally represents a conventional helical finned tube consisting of the central tube proper **11**, the periphery of which is encircled from end to end by a helical fin strip **12** which is firmly secured to the tube proper by various known methods. In accordance with this invention a series of layers or horizontal rows of these tubes **10** are superimposed in a heat exchanger chamber A, the wall B of which is open to expose the finned tubes so that cooling air may be forced or drawn through the chamber, over the tubes and between the spaces and convolutions of the helical fins. It will of course be understood that these parallel rows of tubes **10** are connected in series so that the fluid to be cooled can be drawn or forced continuously back and forth through the tubes until the entire series has been encountered.

As previously indicated, in order to obtain the maxi-

mum benefit of the cooling air drawn through the chamber A, it is desirable to have the tubes **10** arranged as closely together as possible while at the same time permitting sufficient space between the tubes to accommodate the passage of air therethrough. It is to facilitate this arrangement of tubes in close proximity, that the improved tube banding device or spacing support of the present invention is employed.

In its simplest form, as illustrated in Figure 7 this tube spacing support consists of a metal strip **13** of a length to completely encircle a finned tube in close engagement with the peripheral edges of of its helical fin and of sufficient width to overlie several of the convolutions of the fin. One particular method of applying and locking these banding strips around the peripheries of the helical fin will be described later on but at this point it is sufficient to note that a plurality of strips **13** are arranged in predetermined longitudinal spaced relation on each of the tubes to be placed in the chamber A, such spacing being uniform on all tubes so that when the tubes are superimposed the supporting contact between the tubes is borne by the peripheries of adjacent bands **13**. In other words, each tube is supported by the engagement of its bands with the corresponding bands of adjacent tubes and the tubes are spaced apart laterally a distance determined by the thickness of the strip **13**.

The metal of the strips **13** may vary in thickness to meet requirements of use, but it has been found that a strip .016 inch in thickness is generally satisfactory for this type of installation.

Each of the strips **13** is provided at a point intermediate its longitudinal edges, with an aperture **16** which as will later appear, is adapted to permit the pouring of molten lead or solder into the area bounded by the strip, which flows around the periphery of the tube proper **11** and fills the space between the convolutions of one or more of the fins with a metal mass or body **17**. When the molten metal is introduced at substantially the central portion of the bounding strip, it has a tendency to initially flow beyond the longitudinal limits required. However, the metal cools rapidly and progressively dams up the narrow spaces between the fins, so that the ultimate mass **17** fills only the desired number of spaces. It will be apparent that when this body of metal **17** has solidified, it forms a rigid supporting bushing or washer which extends radially from the tube **11** to the periphery of the helical fin and together with the surrounding strip **13**, is adapted to bear considerable weight without in any way deforming the helical fins of adjacent tubes. Thus, in order to take full benefit of the area of the chamber A, the various rows of tubes **10** can be arranged in staggered relation as shown in Figure 2, without danger of injury to the helical fins of any of the tubes.

Ordinarily the bands or strips **13** have a plain cross-sectional profile as shown in Figure 7 as the spacing afforded by the thickness of two contacting bands is sufficient. However, in some instances it is desirable to space the tubes as much as ¼ inch apart. This cannot practically be accomplished by the use of thicker bands because bands of the required thickness would offer such a resistance when applied to the fins, that the fins would be deformed.

To increase the spacing between the individual tubes a greater distance than that afforded by the thickness of two contacting strips **13** I have designed a band of modified cross-section and in this connection attention is directed to Figures 3 and 6 of the drawings. Here it will be seen that the strip **13** is provided intermediate its longitudinal edges, with an outwardly directed channel **13***a* which extends the length of the strip and when applied to the periphery of the helical fin provides an annular rib which extends radially beyond the fin engaging edges of the strip as best seen in Figure 6.

With this structure, the radical ribs **13***a* of any two adjacent bands, serve as lateral abutments and support

the tubes at a spacing distance determined by the depth of the channels **13***a*. In this form, the body of metal **17** fills the space between the tube **11** and the web of the channel **13***a* and provides an extended rigid supporting washer or bushing.

With either form of band, the transverse thickness of the metal body **17** may vary from the distance between two adjacent fins, to the convolutions of several fins, depending upon the quantity of molten metal poured into the band.

While the strips may be applied to the tubes and locked in place in various ways, one method which has proven satisfactory, is illustrated in Figures 3, 4 and 5. Here it will be seen that the longitudinal extremities of the strip **13** are bent transversely to provide oppositely directed right angular connecting flanges **14** and **15**. The straight strip as shown in Figure 3 is first placed in any suitable die or fixture to form a U-shape having a radius to accommodate the peripheral edges of a helical finned tube. The U-shaped band is then applied to the tube and its opposite ends are bent around the tube until the angular flanges **14** and **15** are brought into operative engagement as seen in Figure 4. At this point, a pair of suitable pliers, is applied to the engaging flanges **14—15**, to bend the ends over slightly at reversed, coacting acute angles as shown in Fig. 4A. As will later appear, this angular arrangement facilitates the clamping of the band in tight engagement with the fins.

The finned tube **10** and the partially locked band **13** are then placed in a suitable fixture generally indicated by the letter C, to complete the locking of the strip on the helical fins. This fixture C preferably consists of a pair of upper and lower jaw members **18** and **19**, hingedly connected as at **20** and having a handle **21** fixed to the upper jaw. The opposed faces of the jaws are respectively provided with concave recesses **22**, having a radius to accommodate the peripheries of the finned tube with a band encircling the same. With the engaging ends **14—15** of the banding strip in the relationship shown in Fig. 4A, the recess **22** of jaw member **18** embraces the overlapping end of the strip and as the fixture jaws are closed, a lever action is started on the connected flanges of the strip. The closing jaws bend the connected flanges of the strip and as the underlying angular flange **14** is bent in a counter-clockwise arc about the base of its angle, it pulls the over-lying angular flange **15** with it and tightens the band around the tube. Simultaneously with this constricting leverage action, the angular flanges **14—15** are flattened and embedded slightly into the periphery of the adjacent finned tube so as to slightly deform the fin at this point. This not only locks the ends of the strip **13** together but by embedding them slightly into the periphery of the fin tube, longitudinal movement of the strip on the fin, is prevented during the metal pouring operation.

This method of applying and locking the bands on the tube makes it possible to employ band materials such as aluminum, which do not readily lend themselves to soldering. Furthermore, it avoids the lumps of solder which would result from the use of a soldere djoint at the ends of the encircling band.

After the strip **13** has been applied in this manner, molten lead or solder is poured into the opening **16** and flows around the fin **12**, completely filling one or two of the convolutions of the fin as previously described.

The channel **13***a* may be applied to the strip **13** in any suitable manner such for example as by a die or by rolling the channel into the strip and the depth of the channel can be predetermined to give the required tube spacing.

It will thus be seen that with the present invention, the difficulties heretofore encountered by the necessity of employing transverse spacers in the form of perforated sheets or racks, are eliminated and a maximum benefit of cooling surface for a given chamber area can be made available. Furthermore, these supporting bands or spac-

ers greatly facilitate the installation and removal of individual finned tubes, as only those tubes immediately above a defective tube need be taken out to gain access to the tube to be removed and replaced.

While this invention was primarily designed for the purpose of spacing helical finned tubes in a heat exchanger chamber, it will be apparent that the use of these banding strips will also make it possible to transport tube sections from place to place, either in or out of containers, without injury to the fins.

From the foregoing it is believed that my invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disclosed, without departing from the spirit of the invention as set forth in the following claims.

What I claim is:

1. In a finned tube for heat exchangers, including a tube portion having a series of radial fins, a radial spacing support forming device, comprising a band of flexible metal encircling a portion of said tube and engaging the peripheral edges of a group of adjacent fins, a central annular channel extending around said band, spaced radially from the peripheral edges of said fins, the meeting edges of said band being interconnected by overlapping, transverse flanges bent upon one another, and an opening through the web of said channel to facilitate the flowing of molten metal within the band and between said fins, to provide when hardened, a mass of metal extending radially from the tube to the inner face of said web.

2. In a heat exchanger, including a chamber having a series of parallel finned tubes arranged in superimposed rows, at least two radial spacing supports at longitudinally spaced intervals on each tube, each support comprising a flexible metal band encircling said tube and engaging the peripheral edges of a group of adjacent finned portions, a central annular channel extending around each band, radially spaced from the peripheral edges of said fins, an annular mass of metal surrounding the periphery of the tube proper between said tube and the web of each channel, and embracing at least two of said fin portions, the outer faces of the webs of each channel being in peripheral supporting engagement with the corresponding channel webs of an adjacent tube support, the engaging channel webs and underlying mass of metal, forming the sole spacing means for said series of tubes, to thereby prevent radial displacement and vibration of the latter.

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