

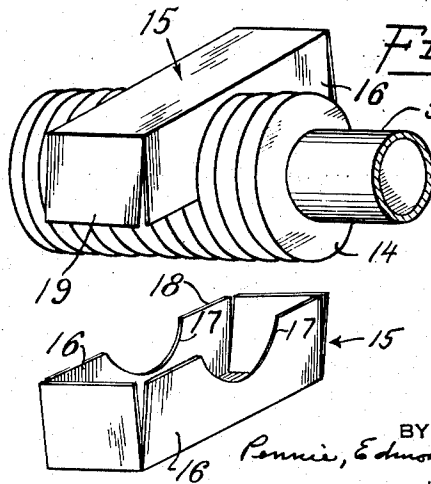
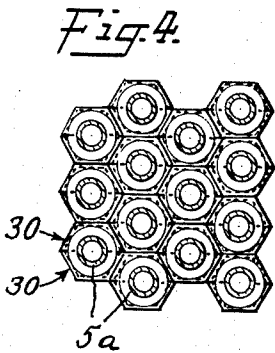
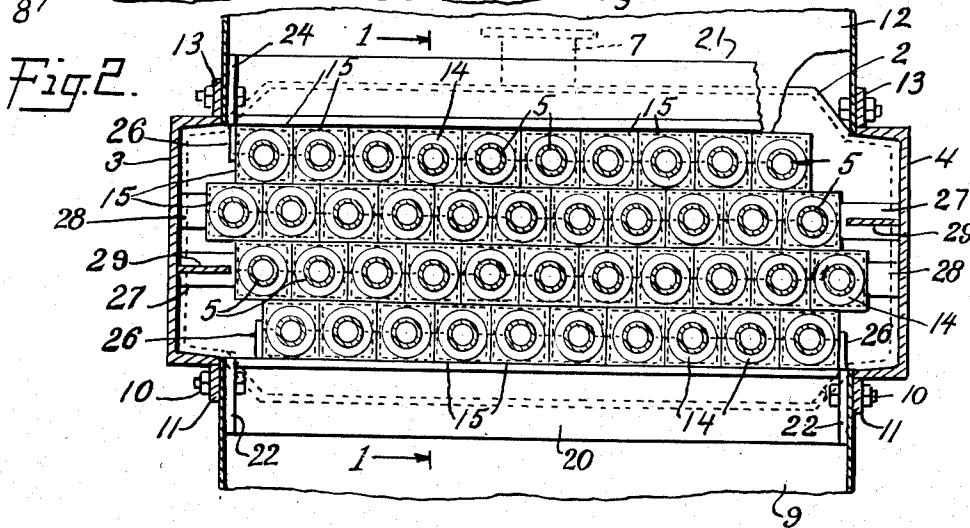
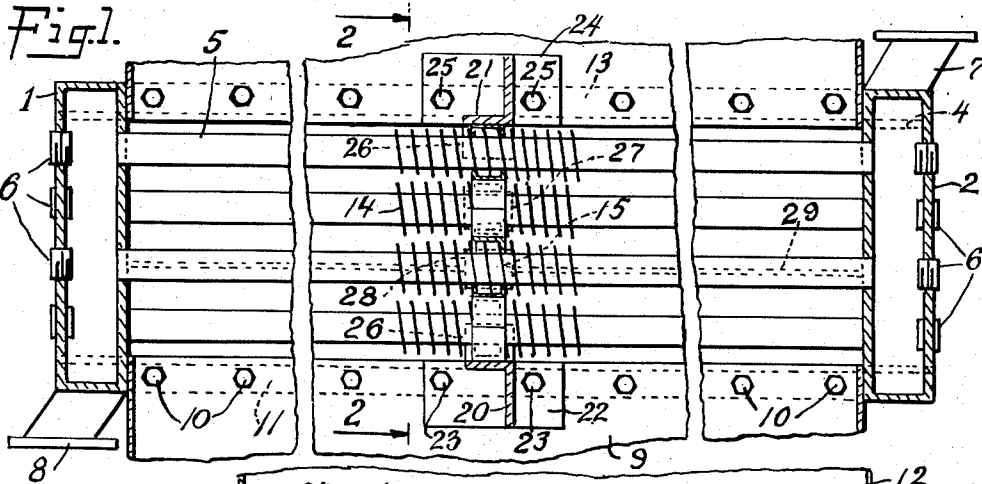
Aug. 26, 1952

N. B. MILLER

2,608,388

BOX SUPPORT FOR FIN TUBING

Filed Dec. 23, 1948



INVENTOR
NEIL B. MILLER

BY
Ponnie, Edmunds, Morton & Barrow
HIS ATTORNEYS

UNITED STATES PATENT OFFICE

2,608,388

BOX SUPPORT FOR FIN TUBING

Neil B. Miller, Massillon, Ohio, assignor to Griscom-Russell Company, New York, N. Y., a corporation of Delaware

Application December 23, 1948, Serial No. 67,027

6 Claims. (Cl. 257—236)

1

This invention relates to heat exchange apparatus and, more particularly, to heat exchangers employing tubes which are provided with transverse fins or gills secured to and projecting from their outer surfaces to enlarge their heat transfer capacity. The general purpose of the invention is to improve the construction of heat exchangers of this type.

In this type of heat exchange apparatus, whether of the shell and tube type or the open type where the finned tubes are exposed, it is frequently desirable to use finned tubes of considerable length. It is necessary to provide support for the finned tubes at one or more intervals intermediate their ends in order to avoid vibration effects and sagging due to the weight of the fins, which is large in proportion to the weight of the tubes alone. This invention has to do especially with improving the construction of devices for such intermediate support of the finned tubes. The presence of the fins renders it difficult to engage the surface of the tube for the purpose of supporting it, and a number of different ways of accomplishing this support have been proposed heretofore, but they are all objectionable for one reason or another.

A form of intermediate support which has been used to some extent involves omitting the fins at such points along the length of the tube as it is desirable to provide support, and arranging some form of device to engage the tube where the fins are omitted. Such a means of support is undesirable both because the required form of tube engaging device increased the weight of the apparatus considerably and because it is necessary, during application of the fins to the tubes, to interrupt the finning operation in order to leave the tube bare for a short distance wherever the points of support are required. One of the objects of the present invention is to provide a construction of intermediate support for finned tubing which does not require that fins be omitted in order to support the tube.

Heretofore the placement of the intermediate supports on the tubes has involved considerable cost since it required the welding of support parts to the surface of the tube at the points where the fins were omitted. Another object of the invention, accordingly, is to provide a construction of tube support which can be readily placed in position on the tubes during the manufacture of the heat exchanger, eliminating the necessity of using highly skilled labor for this purpose and reducing the cost of assembling the exchanger.

Another object of the invention is to provide

2

a construction of the intermediate support itself for the finned tube units which is light in weight and which can be easily and cheaply manufactured.

Another object of the invention is to provide an intermediate support for finned tubes which in turn is capable of being supported on the frame work of the heat exchange apparatus in a simple and inexpensive manner.

Another object of the invention is to provide an intermediate support for heat exchanger finned tube units which affords ample support for all of the tube units of the apparatus and in such a way that if desired the apparatus can be installed in upright edgewise position as well as in horizontal position.

A further object of the invention is to provide for the intermediate support of heat exchanger finned tube units in such a way that the individual tube units can be replaced with greater facility than heretofore.

In finned tube heat exchange apparatus as heretofore constructed each horizontal row of tubes was provided with a cross-bar secured at its ends to the frame of the apparatus to transfer the weight of the tubes to the frame. It was necessary to provide one of these cross-bars between each two rows of tubes and the weight necessitated the use of a bar of considerable thickness, for example about $\frac{1}{2}$ ". Accordingly, the presence of these bars increased one of the dimensions of the heat exchange apparatus to a substantial extent. A still further object of the invention is to provide a construction of intermediate support for the finned tubes of the exchanger which eliminates the necessity of the cross bars referred to and enables tube pitch of the exchanger, that is the distance between centers of the tubes, to be substantially reduced.

The invention will be understood from a consideration of the accompanying drawings which illustrate, by way of example, a finned tube heat exchanger in which the heat exchange takes place between a liquid passing through the tubes and a fluid, such as air, passing over the finned surfaces of the tubes. Referring now to these drawings;

Fig. 1 is a view of the exchange apparatus in longitudinal vertical section taken on line 1—1 of Fig. 2;

Fig. 2 is a view in transverse vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a projectional view of the intermediate supporting device of the invention showing the manner of its application to an individual tube unit;

Fig. 4 is a fragmentary transverse section similar to Fig. 2 showing a modification.

Referring now to these drawings the heat exchange apparatus comprising two hollow headers 1 and 2 arranged at the opposite ends of the apparatus and connected to one another along the sides of the apparatus by means of two channel bars 3 and 4. The vertical dimension of headers 1 and 2 throughout the space between the side channels 3 and 4 is considerably greater than the vertical dimension of these channels (Fig. 2) and the ends of headers 1 and 2 are reduced in vertical dimension and formed to the shape of the inside surfaces of channel bars 3 and 4 and are welded to these channels throughout their contacting surfaces, the headers and side channels thereby constituting a rigid frame structure for the apparatus.

The heat exchanger tube units 5 are mounted at their ends in the inner walls of headers 1 and 2 in any suitable manner. For example, the ends of these tubes may be expanded in the holes provided in these surfaces and for this reason plug members 6 are screwed into holes in the outer walls of headers 1 and 2 which are arranged in registry with the holes for the tubes 5. When it is necessary to replace a tube unit 5, the plug members 6 opposite the ends of this tube are removed for the admission of the appropriate tools for the removal and insertion of a new tube.

One of the heat exchange fluids, usually a liquid, is passed through the interiors of the tube units 5 and for this purpose flange connections 7 and 8 are arranged on the headers 2 and 1, respectively. The liquid may enter header 2 through flange connection 7. After passing through the several tube units 5 it is collected within header 1 and takes its exit through flange connection 8.

The air or other heat exchange fluid is to be passed over the exterior surface of tubes 5 and for this purpose may enter the bottom of the apparatus through a conduit 9. The walls of this conduit are bolted at 10 to flanges 11 on the lower sides of side channels 3 and 4, respectively. These flanges may be formed by welding rectangular bars or strips to the edges of the channel members as shown more particularly in Fig. 2.

The fluid may leave the top of the exchanger through a second conduit 12 which is similarly secured to a second pair of flange members 13 placed along the top sides of channel bars 3 and 4.

The heat exchanger tube units 5 each comprise an elongated metal tube of steel, copper, or other suitable material on the outside surface of which are heat radiating fins 14. These fins may be mounted on the tube in any suitable manner but they are usually formed by edge-wise coiling a strip of metal, such as copper or soft steel, the base of the fin strip being at the same time embedded in, or otherwise fixed in intimate heat exchange relation to the surface of the tube. Such helically wound fins are necessarily of comparatively thin gauge metal and consequently may be easily damaged in handling.

In accordance with the present invention in order to support these tube units 5 intermediate their ends, to prevent undesirable vibration and support the weight of the tubes and fins, each of the tube units 5 has applied to it at the vertical plane of support, a hollow box-like structure consisting of upper and lower complementary sections 15, these two sections preferably being

identical. These box sections 15 are made of sheet metal, such as sheet steel, of suitable and comparatively light gauge. The end walls 16 of these box sections are parallel with one another and have semicircular recesses 17 so that the box sections can be applied to the tube units, one above and one below each tube, with the end walls 16 entering between pairs of adjacent fins 14 and the recesses 17 fitting around the surface of tube 5. The box sections are constructed so that when they have been applied to the tube unit the upper edge 18 of the lower box section 15 engages the lower edge 19 of the upper box section 15. Preferably, also, the semicircular recesses 17 of both the lower and upper box sections contact the surface of tube 5.

The other two walls of the box are preferably flared outward slightly as shown in Fig. 3 so that when the boxes are assembled on the tubes, as will now be described, these walls can be pressed inwardly to varying degrees to take up irregularities in the dimensions and also to provide a snug frictional contact with the walls of adjacent boxes.

In assembling the heat exchanger, these box sections 15 are applied to each tube as just described and are held in place by the frictional engagement of the end walls 16 with the fins 14. When the tube units 5 have all been assembled in the exchanger the hollow box-like supports 15, 15 will be arranged in horizontal rows in contact with one another as shown in Fig. 2. Since the tubes are arranged in staggered relation the box-like supports will also be arranged in staggered relation. The box-like supports 15, 15 will be thus stacked one upon another as shown in Fig. 2 from which it appears that the vertical separation between the edges of the fins of adjacent rows need not be greater than twice the thickness of the sheet material from which box-like supports 15, 15 are made. This is for the reason that when each pair of box sections 15 is applied to each tube 5 the inner surfaces of the top and bottom walls of the box contact the edges of the fins.

Because of the fact that the box-like supports 15, 15 nest firmly against one another throughout the entire tube bundle, adequate support for the bundle as a whole is provided by supporting the lowermost row of boxes 15, 15 and the uppermost row of these boxes, and in addition by providing means for preventing displacement of the end box member of each row. For this purpose an angle bar 20 is arranged along the bottom row of box supports 15, 15 and a similar angle bar 21 in contact with the upper surface of the top row of these boxes. In other words, each of these angle bars 20 and 21 extends crosswise of the exchanger between the flanges of the side channel bars 3 and 4. To attach angle bar 20 to flanges 11 the angle bar has welded to it at each end a short metal plate 22. Plates 22 are then bolted to flanges 11 by means of two bolts 23. In like manner, plates 24 are welded to the opposite ends of the upper angle bar 21 and are secured by bolts 25 to the upper flanges 13.

The horizontal shifting of the several rows of boxes 15, 15 is prevented as follows. A small steel plate 26 is placed at each end of the lowermost row. These plates are welded to the upper surface of angle bar 20. They are shown in full lines in Fig. 2 and in dotted lines in Fig. 1. Two similar plates 26 are provided for the uppermost row of box members 15, 15 and are welded to the bottom of angle bar 21. For the two in-

5

side rows of box members small blocks 27 and 28 are welded to the interior surfaces of channel members 3 and 4, respectively. In order to prevent the passage of heat exchange fluid (air) around the sides of the tube bundle, air stop strips 29 are welded to the interior surfaces of these side channels 3 and 4 throughout their length.

Fig. 1 shows tube units 5 of the tube bundle as being supported at only a single vertical plane or region, that is, a single point intermediate the headers 1 and 2. The lengths of the tube units 5, that is to say, the distance between their headers, is, however, indeterminate and depends upon the particular installation. It will be understood, therefore, that the tube units may be supported at a plurality of points throughout their length, the spacing between these support points depending upon the conditions attending each installation, such as length and weight of tube units, including the fins, tendency for the tubes to vibrate, etc.

Referring now to the modification shown in Fig. 4, the purpose of this modification is to reduce still further the tube pitch, that is, the center to center distance between tubes. In the apparatus of Figs. 1 and 2, the tops of the fins in one row lie in a horizontal plane below the bottoms of the fins in the next row above. In the apparatus of Fig. 4 the tops of the fins in one row lie in a horizontal plane which is above the bottoms of the fins in the next higher row. This makes for a more compact arrangement of the heat exchanger and to support the tubes the box-like supports 30, 30 are hexagonal in end view, that is to say the end walls of these box-like supports are hexagonal instead of square as in the case of the box-like supports 15, 15. Supports 30, 30 are made in upper and lower complementary sections 30 which correspond in all respects to the box-like sections 15 except for the difference in geometrical shape of their end walls. They are applied to the tube units 5a in precisely the same manner. It will be understood that tube units 5a are provided with helical fins similar in all respects to the fins 14 of the tube units 5. It will also be understood that angle bars 20 and 21 can be used along the bottom and top rows of the heat exchanger bundle, and that devices similar to the small plates 26 and blocks 27 and 28 can be used to prevent shifting of the box-like supports 30, 30 in each row.

By the present invention there has been provided a construction for supporting individual finned tubes intermediate their ends in a most simple and practical manner. Either of the box-like hollow structures 15, 15 or 30, 30 consists merely of sheet metal. Both types may be manufactured in half sections which are identical the one half with the other. Both may be cheaply made by the press work method of manufacture. The use of this type of support facilitates not only the assembly of the heat exchanger tube bundle as a whole, but also the manufacture of the helically finned tubing inasmuch as the tubing can be finned throughout its length without interruption. This makes for greater standardization. While these are among the numerous advantages of this invention an extremely important advantage is in reducing the spacing of pitch of the heat exchanger tubes so as to enable an exchanger of a given heat transfer capacity to occupy a smaller space.

The invention has been illustrated in connection with only a single type of heat exchanger.

6

It will be understood that changes in the construction and arrangement of the hollow box-like supports may be made to suit other types of heat exchangers without departing from the spirit of this invention, and that the scope of the invention is set forth in the appended claims.

I claim:

1. In a heat exchanger comprising a bundle of tubes having external transverse fins, and headers for receiving the opposite ends of said tubes, means for supporting the individual finned tubes of said bundle intermediate said headers comprising a stack of boxes, each of said boxes having its end walls perforated and having one of said finned tubes extending therethrough, the end walls of each box projecting between the fins to engage and support one of said tubes at two spaced points, and supports for confining the four sides of said stack.

2. In a heat exchanger comprising a bundle of tubes having external transverse fins, and headers for receiving the opposite ends of said tubes, means for supporting the individual finned tubes of said bundle intermediate said headers comprising a stack of boxes of uniform size, each having its height and width dimensions approximately corresponding to the diameter of said fins, and each of said boxes having its end walls perforated and having one of said finned tubes extending therethrough, the end walls of each box projecting between the fins to engage and support one of said tubes at two spaced points, and supports for confining the four sides of said stack.

3. In a heat exchanger comprising a rectangular bundle of tubes having external transverse fins, and headers and side members joined together to form a frame therefor, means for supporting the individual finned tubes of said bundle intermediate said headers comprising a stack of boxes of uniform size, each having its height and width dimensions approximately corresponding to the diameter of said fins, and each of said boxes having its end walls perforated and having one of said finned tubes extending therethrough, the end walls of each box projecting between the fins to engage and support one of said tubes at two spaced points, cross-bars secured to said side members and disposed in engagement with two opposite sides of said stack, and projecting lugs secured to said side members and engaging the remaining sides of said stack.

4. In a heat exchanger comprising a bundle of tubes having external transverse fins, and headers for receiving the ends of said tubes, means for supporting the individual finned tubes of said bundle intermediate said headers comprising a stack of hollow box-like structures of uniform size, each having its height and width dimensions corresponding approximately to the diameter of said fins, each of said structures consisting of complementary sections disposed on opposite sides of one of said finned tubes, the end walls of each of said structures projecting between the fins to engage and support said tube at two spaced points, and supports for confining the sides of said stack.

5. In a heat exchanger comprising a rectangular bundle of tubes having external transverse fins and headers and side members joined together to form a frame therefor, means for supporting the individual finned tubes of said bundle intermediate said headers comprising a stack of sheet metal boxes of uniform size, each having its height and width dimensions correspond-

7

ing approximately to the diameter of said fins, each of said boxes consisting of complementary sections disposed on opposite sides of one of said finned tubes, the end walls of each box projecting between the fins to engage and support said tube at two spaced points, cross-bars secured to said side members and disposed in engagement with the opposite sides of said stack, and projecting lugs secured to said side members and engaging the remaining sides of said stack.

6. In a heat exchanger comprising a bundle of tubes having external transverse fins, and headers for receiving the opposite ends of said tubes, means for supporting the individual finned tubes of said bundle, intermediate said headers comprising a stack of boxes, each of said boxes having its end walls perforated and having one of said finned tubes extending therethrough, the end walls of each box projecting between the fins and in frictional engagement therewith, the side walls of each box frictionally engaging the walls

8

of the adjacent box, and supports for confining the four sides of said stack.

NEIL B. MILLER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,704,097	Muhleisen	Mar. 5, 1929
1,769,963	Price	July 8, 1930
1,869,967	Jorgensen	Aug. 2, 1932
1,886,403	Jones	Nov. 8, 1932
1,907,867	Potter	May 9, 1933
1,909,704	Morseth	May 16, 1933

FOREIGN PATENTS

Number	Country	Date
551,564	France	Jan. 11, 1923