Jan. 14, 1958 C. F. LOUTHAN 2,819,731

REFRIGERATING APPARATUS

Filed Nov. 16, 1954

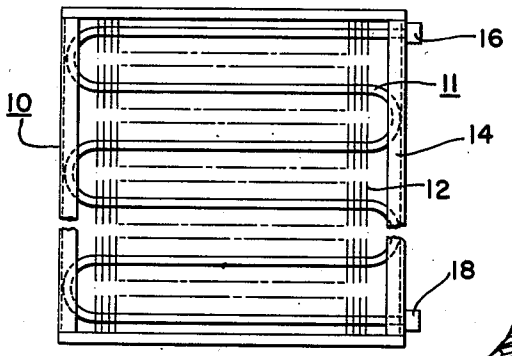
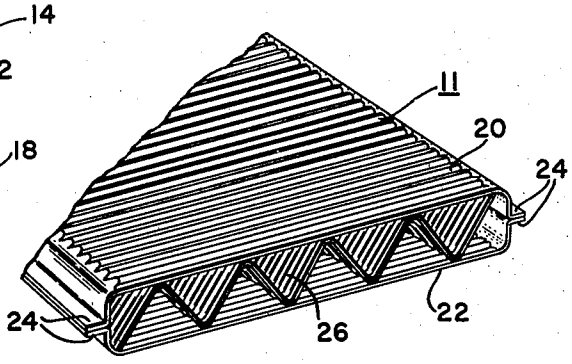


Fig. 1

Fig. 2



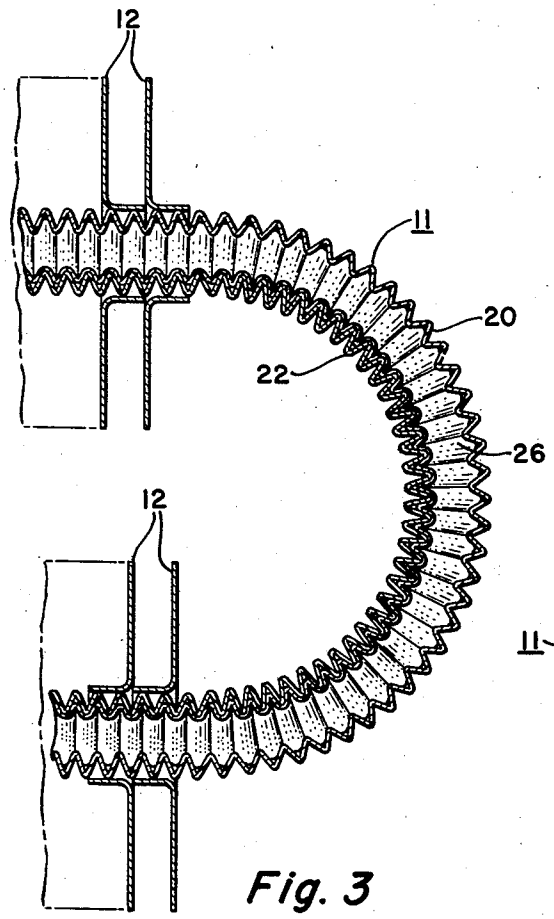
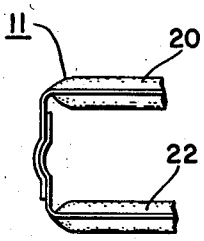


Fig. 3

Fig. 4



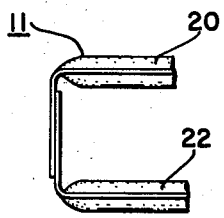


Fig. 5

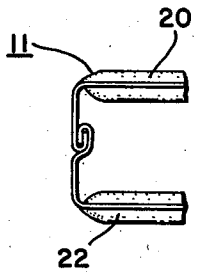


Fig. 6

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REFRIGERATING APPARATUS

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1 Claim. (Cl. 138—38)

This invention relates to refrigerating apparatus and more particularly to a heat exchanger and the method of manufacturing the same.

One object of this invention is to provide a heat exchanger having flat tubing capable of withstanding high internal pressures without distortion of the flat walls of the tubing.

It is an object of this invention to provide a heat exchanger made from multiple passage tubing capable of being bent into serpentine shape with sharp bends.

Still another object of this invention is to provide a multiple passage tubing which may be bent without using complicated or expensive dies or other devices for preventing collapse of the tubing at the return bends.

More particularly it is an object of this invention to provide a relatively flat tube having a corrugated separator disposed within the tube.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is an elevational view showing a heat exchanger constructed in accordance with the invention;

Figure 2 is a fragmentary pictorial view showing the construction of the multiple passage flat tubing used in making the heat exchanger shown in Figure 1;

Figure 3 is a fragmentary sectional view on an enlarged scale showing the construction of one of the return bends;

Figure 4 is a fragmentary end elevational view showing a modified type of joint between the upper and lower side walls of the tube;

Figure 5 is a view similar to Figure 4 showing still another modification; and,

Figure 6 is a view similar to Figures 4 and 5 showing a rolled and brazed joint.

Referring now to the drawings wherein a preferred embodiment of the invention has been shown, reference numeral **10** generally designates a heat exchanger having a fluid conduit comprising a flat walled tube **11** which has been bent into serpentine shape as shown and in which button type fins **12** have been slipped over the outside of the straight portions of the tubing so as to increase the effective heating radiating surface. A frame element **14** serves as a support for use in mounting the heat exchanger in an air duct or the like. Reference numerals **16** and **18** designate the usual headers for use in making connection to the interior of the serpentine tube.

As best shown in Figure 2 of the drawing, the preferred embodiment of tubing consists of upper and lower strips **20** and **22** respectively which have transversely extending corrugations arranged as shown and which are provided with side flanges **24** which are roll-welded together so as to form one continuous section of relatively flat walled tubing. Figures 4 through 6 show alternate type of joints which may be provided between the edges of the strips. The alternate joints are preferably brazed

joints. A corrugated insert **26** has been provided as shown and this insert serves to separate the interior of the tube into a plurality of parallel passages. The insert **26** as well as the flat side walls of the tubing are corrugated transversely for a purpose to be described more fully hereinafter. The insert is formed by first forming the relatively shallow transverse corrugations in a sheet and then forming the relatively deep longitudinal corrugations.

The insert **26** is placed between the corrugated strips **20** and **22** before the edges **24** are roll-welded together. Suitable brazing material (not shown) which may be either in powder, sheet, slurry, or wire form is placed within the tubing and also between the fins and the outer walls of the tubing so that after the fins **12** have been placed on the appropriate portions of the tubing and the tubing has been bent into serpentine shape and fitted with the headers **16** and **18**, the assembly may be heated so as to braze the fins **12** to the outer walls of the tubing and so as to braze the insert **26** to the side walls of the tubing along the lines where the insert **26** contacts the side walls **20** and **22**. By virtue of the fact that the insert **26** is provided with transversely extending corrugations which are complementary to the corrugations formed in the side walls **20** and **22**, it is obvious that when the brazing material is melted it will serve to anchor the insert in place so as to form a plurality of longitudinally extending passages. The insert as well as the corrugations in the side walls of the tube help to add rigidity to the tubing as well as to facilitate the transfer of heat between fluid in the tube and fluid outside the tube.

The corrugations also make it possible to form sharp return bends in the tubing without danger of any collapsing of the tube at the return bends. As best shown in Figure 3 of the drawings, the corrugated portions adjacent the inside edge of the return bend becomes slightly compressed whereas the corrugations adjacent the outside edge of the return bend are slightly elongated. By virtue of the above described construction and method of manufacture, it is possible to form integral return bends in multiple passage tubing without causing undue restriction at the return bends.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claim which follows.

What is claimed is as follows:

A return bend construction for use in a heat exchanger comprising in combination, a fluid conveying conduit having a plurality of spaced apart substantially parallel and arcuate wall portions, a divider element interposed between said wall portions and comprising a single strip of metal arranged in zigzag form to provide a plurality of internal fins extending between said spaced apart portions of said conduit and disposed in intimate thermal contact therewith, each of said walls and said divider element having registering transversely extending corrugations, said corrugations being closer together at the inside of each return bend than at the outside of the return bend.

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