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REFRIGERATING APPARATUS

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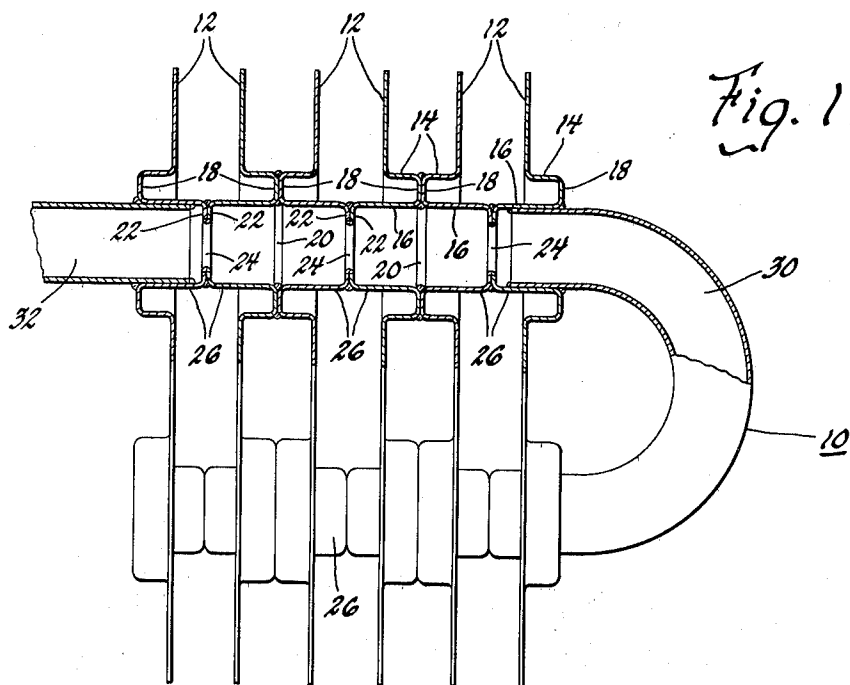


Fig. 1

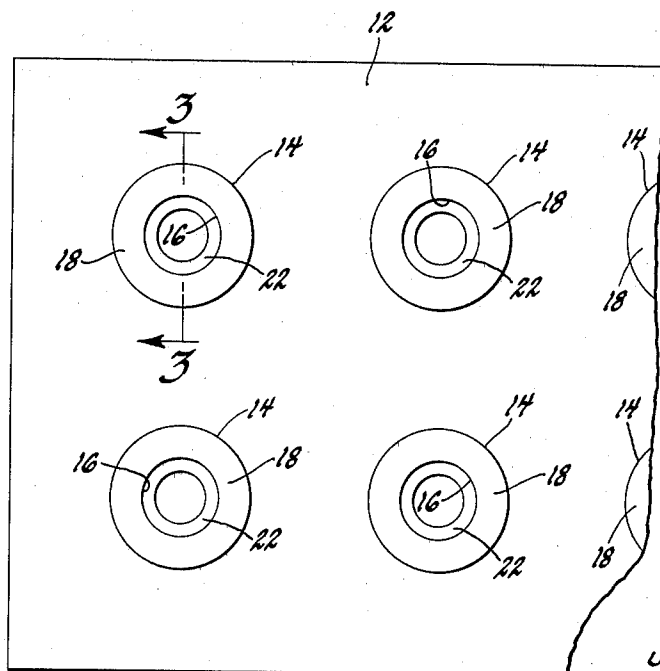


Fig. 2

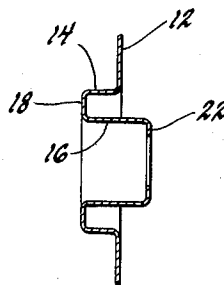


Fig. 3

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1

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REFRIGERATING APPARATUS

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10 Claims. (Cl. 165—179)

This invention relates to refrigerating apparatus and more particularly to a heat exchanger and to the method of manufacturing heat exchangers for use in refrigerating systems and the like.

It is an object of this invention to provide a heat exchanger having fluid conduits and integrally formed fins made from relatively flat sheet stock.

It is another object of this invention to form flanged tubular projections on relatively flat sheets, which projections abut and are bonded to complementary projections on adjacent flat sheets to form fluid conduits.

More specifically, it is an object of this invention to reduce the amount of metal drawing necessary to join the fin structures together to form a gas-tight fluid passageway.

These and further objects and advantages of the present invention will be apparent from the following description, reference being had to accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

FIGURE 1 is a fragmentary side elevational view with parts broken away showing a heat exchanger embodying my invention;

FIGURE 2 is an elevational view showing one of the sheets used in making the heat exchanger shown in FIGURE 1; and

FIGURE 3 is a fragmentary sectional view taken substantially on line 3—3 of FIGURE 2.

Referring now to the drawing wherein a preferred embodiment of the invention has been shown, a heat exchange unit, generally designated by the reference numeral 10, is formed from a plurality of flat sheets 12 which not only form the heat radiating fins but also form fluid passages.

As shown in the drawings, each of the flat sheets 12 is provided with a plurality of relatively large diameter tubular projections 14 which are integral with the sheet and extend in one direction from the sheet. Each of the relatively large tubular projections is provided with a relatively small diameter internal projection 16 which is joined to the relatively large diameter tubular projection 14 by means of a relatively flat surface 18. The relatively flat surfaces 18 on adjacent pairs of sheets 12 are bonded to one another as shown so as to form bonded joints 20 between adjacent sheets. The terminal ends of the relatively small diameter tubular projection 16 are provided with internal flanges 22 which are bonded together as shown to form bonded joints 24. By virtue of the above described arrangement, a plurality of parallel fluid passages are formed which, in effect, have integrally formed heat radiating fins. The necessary number of return bend elements, such as the element 30, are provided for connecting the ends of adjacent fluid passages 26. Suitable inlet and outlet connectors, such as the connector 32, may be provided as shown. The elements 30 and 32 telescope into the fluid passages 26 as shown.

By virtue of the above described construction it will be obvious that the draw necessary to form the tubular portions 14 and the reentrant portions 16 is not greater than the distance between two adjacent sheets. This is an important feature in the manufacture of heat exchangers as it greatly reduces the number of leaks resulting from tears in the metal due to excessively long draws.

The sheets are preferably made of basic aluminum to which is bonded on each side thereof a lower melting tem-

2

perature aluminum brazing or bonding material. The assembly is clamped together and dipped brazed in the presence of flux whereby all joints are simultaneously brazed in accordance with well known brazing procedures.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A heat exchanger unit comprising in combination, a plurality of substantially flat sheets, each having a plurality of relatively large diameter tubular projections integral therewith, each relatively large diameter tubular projection having a relatively small diameter tubular projection therein extending in a direction substantially opposite said first named tubular projection and forming a tube section, adjacent tube sections on adjacent flat sheets with terminal end portions thereof being located in abutting relationship, and means for bonding such abutting tube sections together for forming continuous fluid conduits.

2. A heat exchanger unit comprising in combination, a plurality of substantially flat sheets, each having a plurality of relatively large diameter tubular projections integral therewith, each relatively large diameter tubular projection having a relatively small diameter tubular projection therein extending in a direction substantially opposite said first named tubular projection and forming a tube section, the ends of said tube sections having substantially radially extending flanges thereon, said flanges on adjacent tube sections being located in abutting relationship, means for joining said abutting flanges to form said tube sections into continuous fluid conduits.

3. A heat exchanger unit comprising in combination, a plurality of substantially flat sheets, each having a plurality of relatively large diameter tubular projections integral therewith, each relatively large diameter tubular projection having a relatively small diameter tubular projection therein extending in a direction substantially opposite said first named tubular projection and forming a tube section, adjacent tube sections on adjacent flat sheets being located in abutting relationship, means for bonding said abutting tube sections together to form continuous fluid conduits, each of said relatively large diameter tubular projections being joined to said relatively small diameter tubular projections therein by means of a substantially flat portion said flat portions of adjacent sheets being bonded to one another.

4. A heat exchanger unit comprising in combination, a plurality of substantially flat sheets, each having a plurality of relatively large diameter tubular projections integral therewith, each relatively large diameter tubular projection having a relatively small diameter tubular projection therein extending in a direction substantially opposite said first named tubular projection and forming a tube section spaced from said relatively large diameter tubular projection, adjacent tube sections on adjacent flat sheets being located in abutting relationship to form continuous fluid conduits, means for bonding said abutting tube sections together, each of said relatively large diameter tubular projections being joined to said relatively small diameter tubular projections therein by means of a substantially flat portion, said flat portions of adjacent sheets being bonded to one another.

5. A heat exchanger unit comprising in combination, a plurality of substantially flat sheets, each having a plurality of relatively large diameter tubular projections integral therewith, each relatively large diameter tubular projection having a relatively small diameter tubular projection therein extending in a direction substantially opposite said first named tubular projection and forming a tube section, adjacent tube sections on adjacent flat sheets being located in abutting relationship to form continuous

fluid conduits, means for bonding said abutting tube sections together, each of said relatively large diameter tubular projections being joined to said relatively small diameter tubular projections therein by means of a substantially flat portion, said flat portions of adjacent sheets being bonded to one another, the terminal ends of said relatively small diameter projections having flanges thereon arranged in abutting relationship with complementary flanges on adjacent relatively small diameter projections, said means for abutting said tube sections together also serving to bond said complementary flanges together.

6. In combination, a pair of spaced sheets, each of said sheets having embossed portions having flat surfaces arranged in abutting relationship at a point between said sheets so as to hold said sheets in a predetermined spaced relationship, said embossed portions having integrally formed reentrant tubular projections arranged concentrically within said flat surfaces extending in opposite directions from the point at which said embossed portions abut one another in sealing relationship so as to form fluid passages.

7. In combination, a pair of spaced sheets, each of said sheets having embossed portions having surfaces arranged in abutting relationship at a point substantially midway between said sheets so as to hold said sheets in a predetermined spaced relationship, said embossed portions having integrally formed reentrant tubular projections arranged concentrically of said abutting surfaces and extending in opposite directions from the point at which said embossed portions abut one another into abutting sealing relationship with adjacent tubular projections so as to form fluid passages.

8. In combination, a pair of spaced sheets, each of said sheets having embossed portions having surfaces arranged in abutting relationship at a point between said sheets so as to hold said sheets in a predetermined spaced relationship, said embossed portions having integrally formed reentrant tubular projections extending in opposite directions from the point at which said embossed portions abut one another, said tubular projections abutting one another, means for bonding said abutting tube sections to form fluid passages, and a second pair of spaced sheets similar to said first named pair of sheets and having its tubular projections in alignment with and bonded to the tubular

projections on said first pair of sheets so as to form continuous fluid passages.

9. In a heat exchanger unit the combination of, a plurality of substantially flat sheets, each having a plurality of cuplike duplex projections, each of said projections having a first relatively large tubular portion extending to a uniform distance from the major plane of its sheet, each of said cuplike projections having an oppositely directed relatively smaller projection arranged interiorly and concentrically of said large tubular portion and extending past the major plane of said sheet to a distance from the face of said sheet opposite from which said relatively large projection extends, which distance is about equal to the extended distance of said relatively large projections.

10. In a heat exchanger unit the combination of, a plurality of substantially flat sheets, each having a plurality of reversely drawn projections, each of said projections having a first relatively large tubular portion extending from the major plane of its sheet, each of said cuplike projections having an oppositely directed relatively smaller projection arranged interiorly and concentrically of said large tubular portions and extending past the major plane of said sheet to a distance from the face of said sheet opposite from which said relatively large projection extends, which distance is about equal to the extended distance of said relatively large projection.

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