Jan. 20, 1959 C. C. WHISTLER, JR 2,869,222

REFRIGERATING APPARATUS

Filed Sept. 12, 1955 2 Sheets-Sheet 1

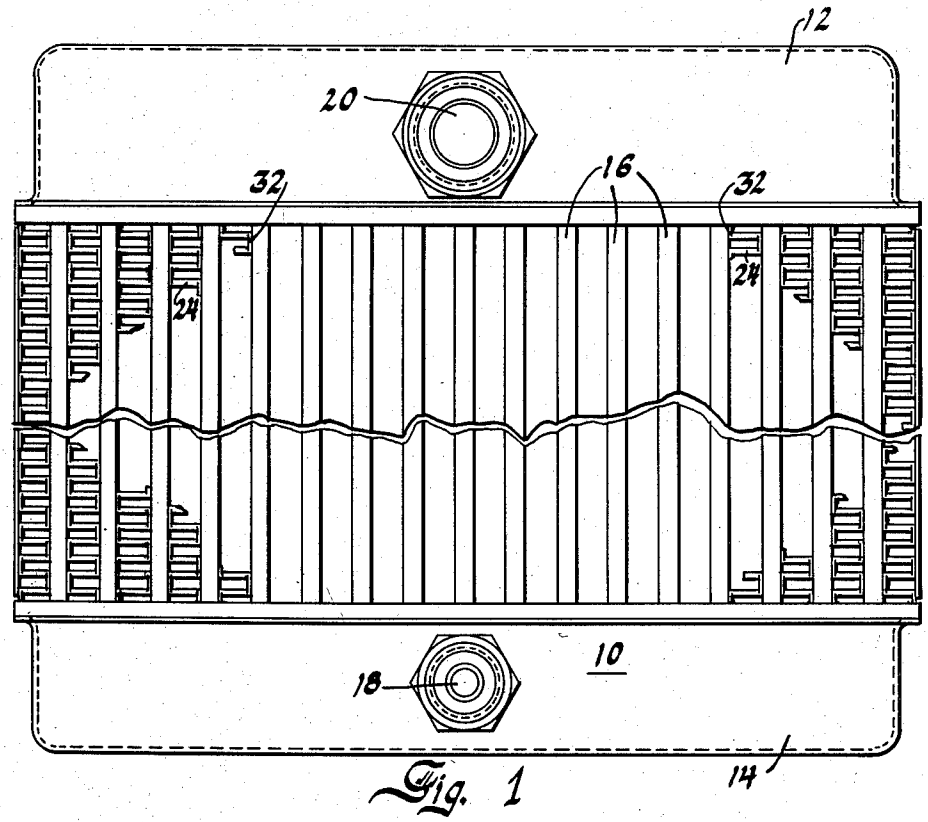


Fig. 1

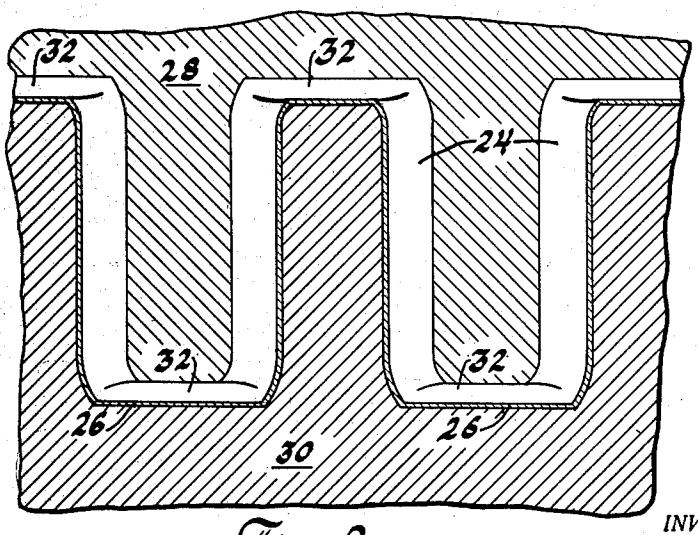


Fig. 2

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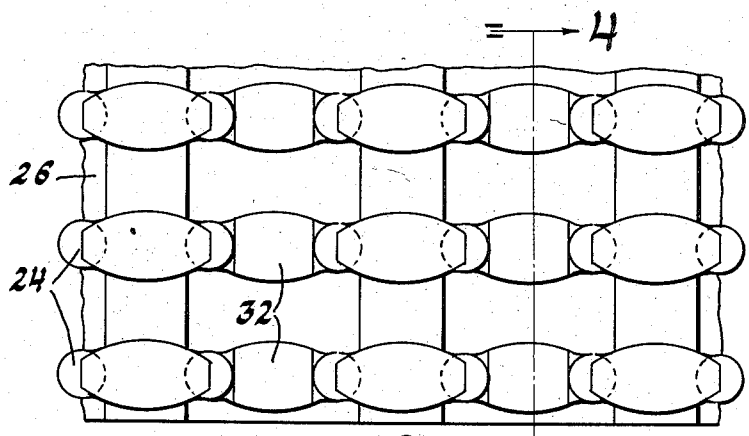


Fig. 3

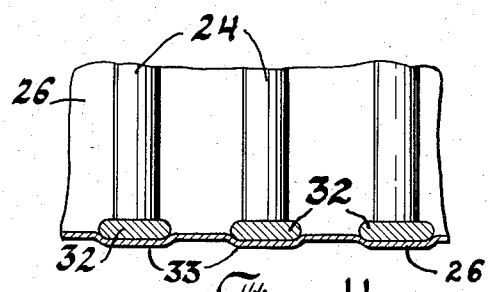


Fig. 4



Fig. 6

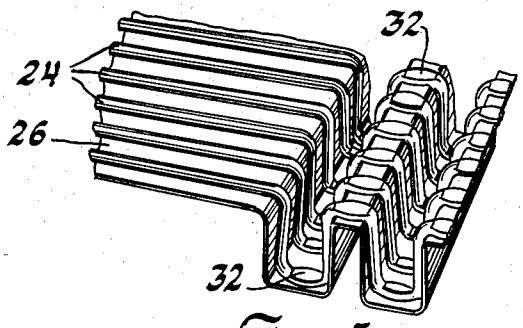


Fig. 5

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REFRIGERATING APPARATUS

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Application September 12, 1955, Serial No. 533,736

6 Claims. (Cl. 29—157.3)

This invention relates to refrigerating apparatus and more particularly to an improved form of heat exchanger and the method of making the same.

It is an object of this invention to provide a heat exchanger having increased efficiency.

More particularly, it is an object of this invention to provide an improved fin construction for a heat exchanger which is not only highly efficient but offers a minimum amount of resistance to the flow of air thereover.

Still another object of this invention is to provide an improved method of constructing a wire fin type evaporator.

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 a side elevational view of a heat exchanger constructed in accordance with the invention;

Figure 2 is a fragmentary sectional view on an enlarged scale showing the wire fins and a brazing sheet in fin forming dies;

Figure 3 is a fragmentary plan view of the fins and brazing sheet prior to attachment to the tubing;

Figure 4 is a fragmentary sectional view taken substantially on line 4—4 of Figure 3;

Figure 5 is a pictorial view of the brazing sheet and the wire fins prior to attachment of the tubing; and

Figure 6 is a sectional view of a modified type of wire fin.

For purposes of illustration, there is shown a heat exchanger of the type suitable for use as an evaporator in an automobile air conditioning system whereas the invention is equally applicable to heat exchangers of other types.

One of the big problems in designing a heat exchanger is that of providing an adequate amount of fin surface to rapidly transfer the heat between the fluid within the tubing to the fluid, such as air, flowing over the fins. This problem is greatly aggravated when it is necessary to conserve on the space occupied by the heat exchanger. Another problem is that of maintaining the resistance to air flow over the fin surfaces at a minimum. It has long been recognized that wire fins are efficient and afford less restriction to the flow of air than most other types of fins but prior wire fin arrangements have been impractical for various reasons. One problem has been that of arranging the fins in the most practical manner and another has been that of attaching the fins onto the fluid conduits without needlessly obstructing the air flow, but these problems have been overcome by the invention disclosed herein.

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 pair of headers 12 and 14 between which a series of fluid conduits 16 are arranged as shown. A conventional refrigerant inlet 18 communicates with the lower header 14 and an outlet 20 is provided in the upper header, as shown.

In making a heat exchanger in accordance with this invention, a plurality of individual straight wires 24 are laid lengthwise on a thin sheet or strip of copper brazing material 26 and are then passed between corrugating dies 28 and 30 which form corrugations in the wires 24 and the brazing strip 26 simultaneously. An adhesive material may be used to glue the wires to the brazing strip in side-by-side relationship, as best shown in Fig. 5, so as to facilitate handling all of the wires 24 and the strip 26 as one element. The brazing strip and the glue form a heat fusible web material which holds the wires in proper relationship. The dies used in corrugating the wires 24 and the strip 26 tends to stretch the wires and the strip a slight amount and to form flat portions 32 in the wires at the vertexes of the corrugations. The wires imbed themselves into the strip 26 when the wires are flattened, as shown at 33 in Fig. 4. This helps to hold the wires properly spaced during subsequent operations. After the brazing strips and the wires have thus been corrugated, they are inserted between adjacent fluid passages 16 of a heat exchanger, as shown in Fig. 1. The brazing strip serves to hold the wires in the proper spaced relationship during assembly and subsequent handling. After the corrugated strips have been placed between the adjacent tubes 16 which form the core of the heat exchanger, the assembly is heated in a brazing furnace so as to cause melting of the brazing strip 26 which then serves to braze the flat portions 32 of the wires 24 to the adjacent tubing 16.

In the manufacture of heat exchangers by the above described method, one can supply the strips of brazing material and the wires from large rolls so as to form continuous lengths of corrugated fin elements for subsequent cutting to length and assembly with suitable lengths of tubing. The corrugated fin strips are preferably cut to length after the corrugations have been formed therein, but if desired the strips can be cut to length before the corrugations are formed.

By virtue of the flattened portion of the wire fins, the contact area between the base of each fin and the fluid conduit is much greater than if the wires were not flattened. This not only improves the rate of heat transfer but it also serves to reduce the obstruction to the air flowing over the heat exchanger.

Insofar as certain aspects of this invention are concerned, any means could be used to hold the wires 24 and the strip 26 in the desired relationship to one another during the corrugating process, but glue has been found to be the most practical means for this purpose.

Any suitable type of glue or paste can be used in the preliminary step of attaching the round wires to the brazing strip but it is preferable to use an acetate base glue or some other glue which decomposes during the brazing operation so as not to leave any objectionable residue on the surface of the wires or the heat exchanger tubes.

For purposes of illustrating the invention, there is shown a wire which is round in cross-section whereas it is within the purview of this invention to utilize wires having a cross-sectional area similar to that shown in Fig. 6 so as to further reduce the resistance to air flow over the wires.

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 claims which follow.

What is claimed is as follows:

1. The method of manufacturing a heat exchanger which comprises arranging a plurality of wires adjacent a strip of brazing material securing said wires to said strip, simultaneously forming corrugations in said strip and said wires, assembling the resulting corrugated strip and wires adjacent a fluid conduit, and thereafter heating said assembly in a brazing furnace so as to melt said brazing strip and fuse said wires to said conduit.

2. The method of manufacturing a heat exchanger which comprises placing a plurality of wires adjacent a sheet of brazing material, securing said wires to said sheet and forming corrugations in said wires and said brazing material simultaneously, assembling the resultant corrugated wires and brazing material with conduit means and thereafter heating the assembly so as to fuse said wires to said conduit means.

3. The method of manufacturing a heat exchanger which comprises attaching a plurality of wires to a sheet of brazing material, forming corrugations in said wires and flattening the base portions of said corrugations, and thereafter placing the flattened base portions of said corrugations adjacent fluid conduit means and applying heat to the assembly so as to fuse said brazing material.

4. The method of manufacturing a heat exchanger which comprises arranging a plurality of wires in parallel spaced relationship and holding said wires in said spaced relationship by means of a heat fusible web material so as to form a strip unit comprising a plurality

of parallel wires, forming transverse corrugations in said strip unit, assembling the resulting corrugated strip unit adjacent a fluid conduit in the presence of a brazing material, and thereafter heating said assembly for the purpose of fusing said web material and brazing said wires to said conduit.

5. A heat exchanger fin subassembly comprising a plurality of parallel wires, and heat fusible web material holding said wires in spaced parallel relationship, said material and said wires having transversely extending corrugations formed therein.

6. The method of manufacturing a heat exchanger which comprises holding a plurality of wires in spaced parallel relationship by means of heat fusible web material, forming corrugations in said wires and simultaneously flattening the base portions of said corrugations, and thereafter placing the flattened base portions of said corrugations adjacent fluid conduit means in the presence of brazing material and applying heat to the assembly so as to fuse said wire holding material and substantially simultaneously to braze said wires to said fluid conduit means.

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