United States Patent

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[54] **HEAT EXCHANGER FIN**
5 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **165/151,** 29/157.3
[51] **Int. Cl.** **F28f 1/10**
[50] **Field of Search** 165/151–153

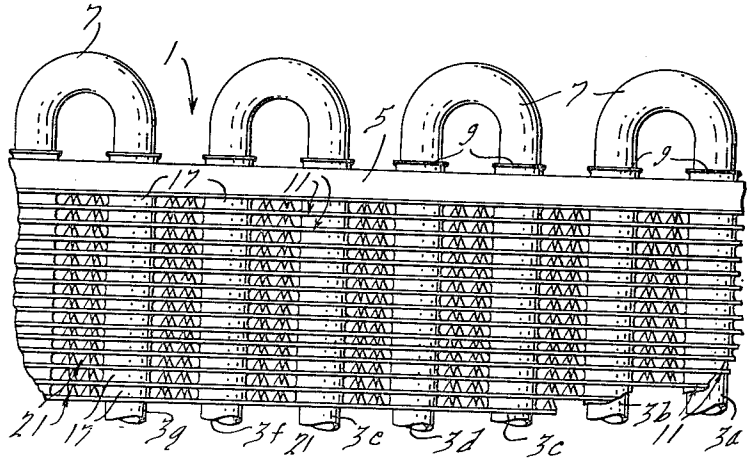
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ABSTRACT: Fin for a heat exchanger of the type having fluid-carrying tubes extending therethrough. The fins are thin strips of metal and have air diverting and diffusing sections therein formed by a plurality of triangular shaped tangs struck away from the fin.



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FIG. 1.

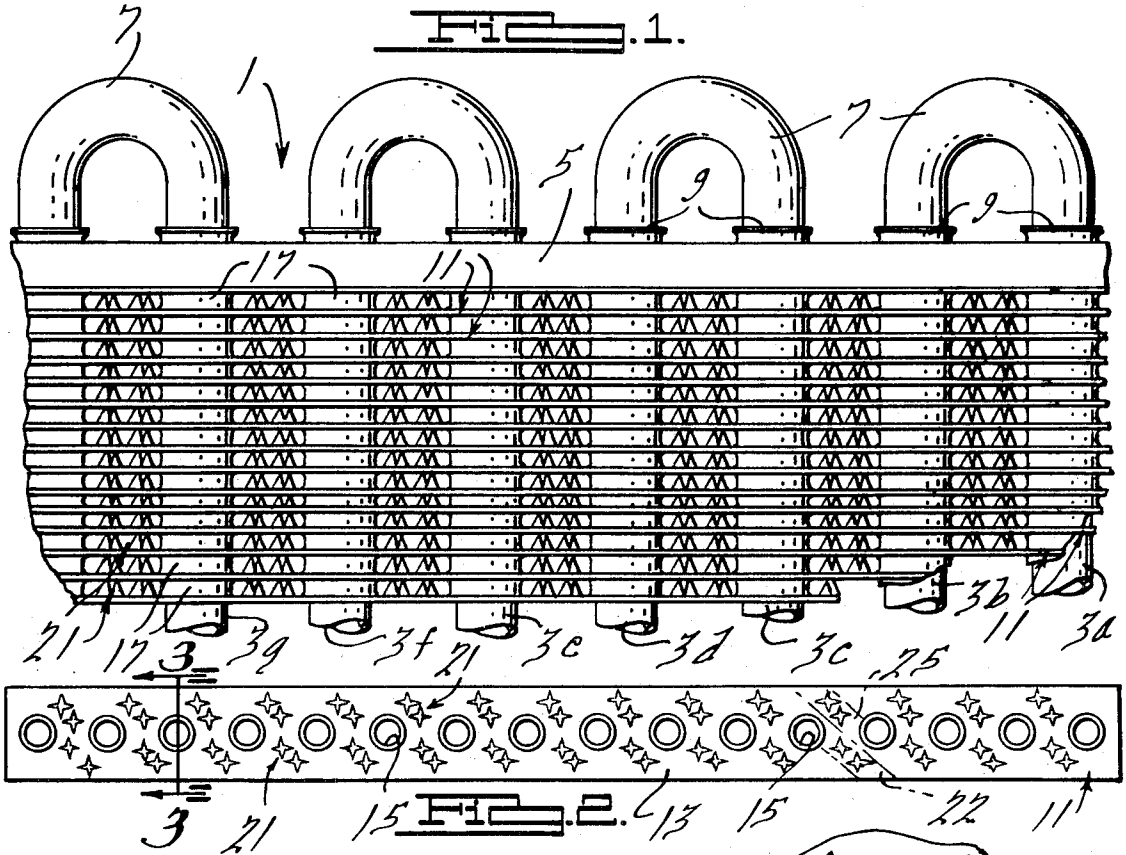


FIG. 2.

FIG. 4.

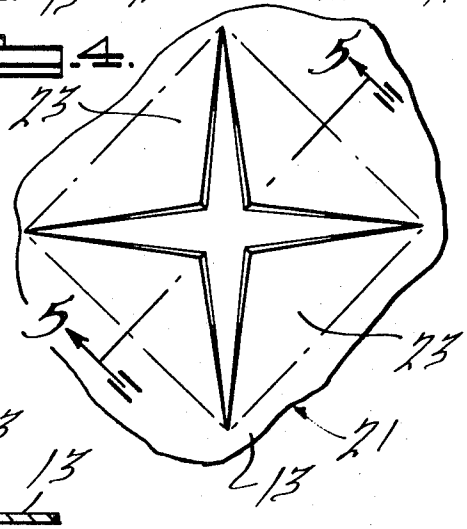
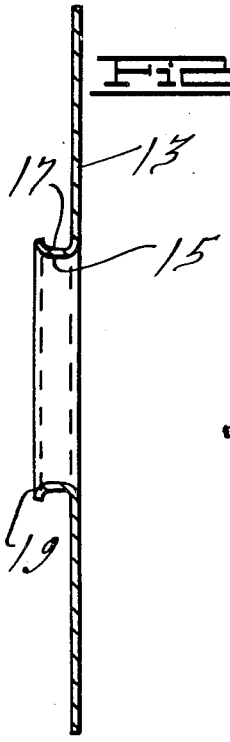


FIG. 3.



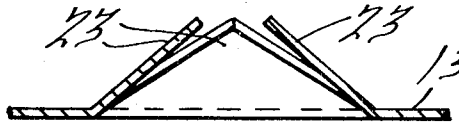


FIG. 5.

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HEAT EXCHANGER FIN

BACKGROUND OF THE INVENTION

This invention relates to heat exchangers, and more particularly to a fin for a heat exchanger.

In automotive air conditioning systems, for example, it is not uncommon for the heat exchangers thereof, such as the condensers, for example, to be formed with two or more rows of tubes extending through several strip-shaped fins spaced slightly apart from one another to permit the flow of air therethrough. As will be understood, heat from the refrigerant flowing through the rows of tubes is transferred through the tube walls to the fins and is then transferred from the fins to the air flowing thereover.

The present invention is directed to the fins used in such heat exchangers.

BRIEF SUMMARY OF THE INVENTION

Briefly, this invention comprises a fin having a plurality of air diverting and diffusing sections formed therein, the sections including a plurality of tangs struck from the fin.

Among the several objects of this invention is to provide a fin for a heat exchanger which permits the number of rows of tubes thereof to be reduced.

Another object of this invention is to provide a fin of the type described which is adapted to modify the flow of air through the heat exchanger in such a manner that the heat transfer capacity of the exchanger is increased.

A further object of this invention is to provide a fin such as described which is so constructed that air flowing through the heat exchanger is diverted from a straight line path and removes more heat from the fin.

Another object of this invention is to provide a fin of the class described in which a substantial portion of the surface thereof between adjacent tubes is deformed to cause air flowing through the heat exchanger to follow a circuitous route through the exchanger.

Still another object of this invention is to provide a fin for a heat exchanger which is effective in operation.

Other objects and advantages of this invention will become apparent as the description progresses.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, in which one of various possible embodiments is illustrated,

FIG. 1 is an elevation view of a fragmentary portion of a heat exchanger utilizing a fin of this invention;

FIG. 2 is a plan view of one of the fins used in the heat exchanger shown in FIG. 1;

FIG. 3 is an enlarged section taken along line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary view of FIG. 2; and

FIG. 5 is a section taken along line 5—5 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, a heat exchanger 1, such as an automotive air conditioning condenser, for example, is shown in FIG. 1 to include a plurality of elongated refrigerant carrying tubes 3*a*–3*g* connected to a framing member 5. Return bends 7 are connected to the ends of each tube of adjacent pairs of tubes. As will be understood, the tubes identified as 3*a* and 3*b* are joined by a return bend at one end of the heat exchanger. The remaining ends of the tubes at the opposite end of the heat exchanger are similarly joined by return bends 7 so that the refrigerant follows a serpentine path through the heat exchanger. The framing member 5 has annular flared flanges 9 through which the tubes 3 and bends 7 pass.

A plurality of elongated fins 11 extend from one end of the heat exchanger 1 to the other. Each of these fins comprises a thin, generally rectangular strip 13 of heat-conducting material, such as aluminum, for example. Each fin 11 has a plurality

of holes 15 therein, these being one hole for each tube 3. Surrounding each hole is a flared annulus or annular flange 17. When the fins are assembled on the tubes 3 the outer flared or edge portion 19 of each annulus 17 seats against the next adjacent fin, and is turned back slightly toward the fin to which it is connected when all of the fins are packed in a framed assembly.

The fins 11 are provided with a plurality of diverting and diffusing sections 21 between each of the openings or holes 15. As shown, four such diverting and diffusing sections 21 are shown between each hole. The sections may be defined as arranged in two rows 22 and 25 parallel to one another and located in planes which are not perpendicular to a plane extending through the centers of all of the holes. Alternatively, the sections may be defined as being in four elongated rows extending the length of the fin, with the sections in the two outside rows being offset longitudinally with respect to the adjacent sections in the adjacent inside rows, the adjacent sections in the two inside rows being transversely aligned with one another. The sections between two holes 15 overlap one another in a longitudinal direction and the four sections between two holes substantially span the distance between such holes.

Each diverting and diffusing section 21 is formed by stamping four triangular-shaped tangs 23 upwardly from the flat surface of the fin. The upwardly struck tangs 23 are in the form of isosceles triangles with the bases thereof in each section extending at an angle of approximately 90° to the next adjacent base so as substantially to form a square. The vertices of the triangle are spaced apart from one another by substantially equal distances, thereby forming a four-pointed star-shaped space between the triangular tangs. The bases and a line joining the vertices of each section 21 form polygons, and in the form shown, such polygons are squares. When the fins are installed in a heat exchanger, the sections 21 of each fin nest with the sections in the adjacent fin next above.

The star-shaped openings in the section 21 cause air flowing through the heat exchanger to be diverted, diffused and agitated into a turbulent condition and brought into intimate contact with the metal of the fins and the tubes. Since the air removes heat from the fins and tubes, the more air that is brought into contact with these parts, the better the efficiency of the heat exchanger. In this regard, it has been found that in certain heat exchangers the number of rows of tubes 21 can be reduced, such as from two to one, by using fins of this invention instead of conventional flat fins or fins employing other forms of louvers or struck tangs.

The height of the tangs and the length of the equal sides of the tangs may vary, of course, but care must be taken to not unduly weaken the fins by the size of the tangs. I have found that tangs having an originally stamped or struck height above the fin of approximately 10–15 times the thickness of the fin to be particularly advantageous.

In view of the foregoing it will be seen that the several objects and other advantages of this invention are attained.

Although only one embodiment of the invention has been disclosed and described, it is apparent that other embodiments and modifications of the invention are possible.

I claim:

1. In a heat exchanger having a plurality of fluid-carrying tubes, a plurality of thin, generally strip-shaped and generally planar fins, each of said fins having a plurality of openings therein through which said tubes pass, each of said fins having flared portions surrounding said openings and in engagement with said tubes, each fin having a plurality of diverting and diffusing sections with at least two sections located entirely between adjacent openings, each of said sections comprising a plurality of triangular-shaped tangs struck outwardly from the fin, the ends of one side of each of said triangular-shaped tangs being adjacent the ends of sides of two other triangular-shaped tangs, the vertices of the triangular-shaped tangs opposite the aforementioned sides being spaced apart, a line joining the ends of said vertices forming a geometrical polygon similar in

shape to and smaller than the geometrical polygon formed by the aforementioned sides, the distance between two adjacent tangs of one said section decreasing from the vertices thereof to the said sides thereof, said diffusing sections overlapping one another in a directional along the length of said strip-shaped fins and substantially spanning the distance between adjacent openings in said overlapped relationship.

2. In a heat exchanger as set forth in claim 1 wherein said each fin has four of said sections between adjacent openings, said four sections being arranged in two rows with two sections in each row, the rows being substantially parallel to each other and located in planes which are less than a 90° angle with respect to a plane extending through the center of all of the openings, each of said sections including four isosceles triangles the said sides of which substantially form a square.

3. A heat exchanger having a plurality of spaced tubes and a plurality of fins, each of said fins comprising a thin, elongated substantially rectangular and substantially planar piece of metal, said fin having a plurality of openings therein, air diverting and diffusing sections extending away from the plane of said fin, each section comprising a plurality of tangs struck outwardly from the fin, each tang being substantially in the shape of an isosceles triangle with the equal sides thereof extending away from the fin and the base thereof joining the inner ends of the equal sides together, the ends of the bases of

said triangular tangs being adjacent one another and forming an equilateral polygon, the vertices of said triangular tangs being spaced apart with a line joining said vertices forming a polygon substantially similar in shape to the polygon formed by said bases, the distance between adjacent tangs decreasing from the vertices thereof to the bases thereof, said sections between adjacent openings overlapping one another in a longitudinal direction relative to said fin, said sections between adjacent openings substantially spanning the space between the adjacent openings and extending substantially across the width of said fin with at least some of said sections overlapping one another across such width.

4. A heat exchanger as set forth in claim 3 wherein said each of said fins has four of said sections between adjacent openings, said four sections being arranged in two rows with two sections in each row, the rows being substantially parallel to each other and located in planes which are less than a 90° angle with respect to a plane extending through the center of all of the openings, each of said sections including four isosceles triangles the bases of which substantially form a square.

5. A heat exchanger as set forth in claim 4 wherein said tangs of each fin have a height above said fin in the range of 10–15 times the thickness of said fin.

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