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FINNED ELEMENT FOR THERMAL OR HEAT TRANSFER PURPOSES

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FIG. 1.

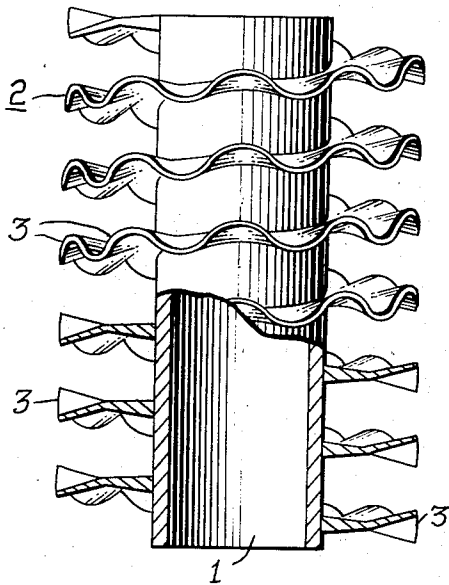


FIG. 2.

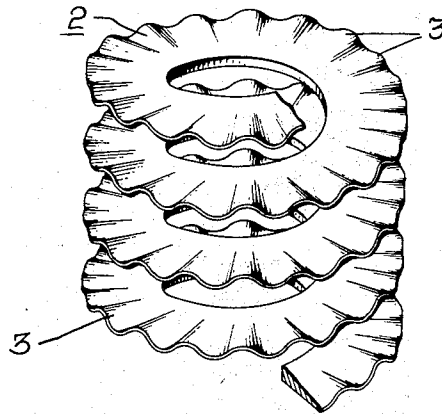


FIG. 3.

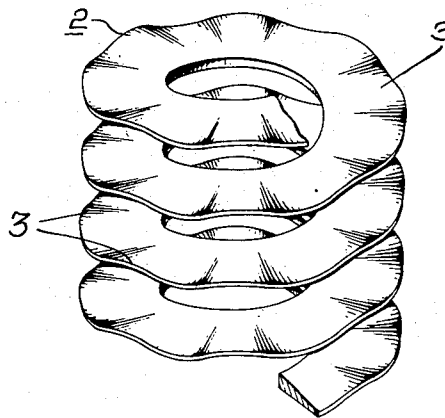
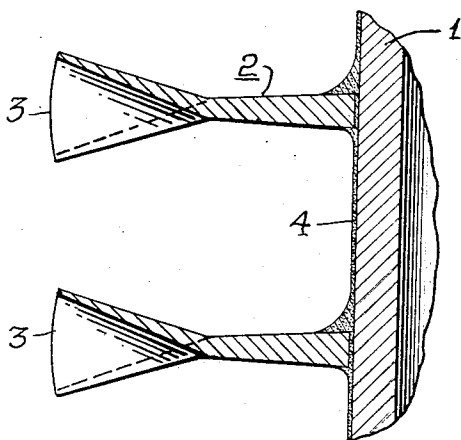


FIG. 4.



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TRANSFER PURPOSES

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3 Claims. (Cl. 257—262.20)

1

This invention relates to thermal exchange or transfer elements and more particularly to exchange elements of the helically finned tube type.

A primary object of the invention is to provide a helically finned tubular exchange element of generally improved characteristics.

A more specific object is to provide an exchange element of the stated type wherein the fin is formed in a manner calculated to set up a desirable turbulent scrubbing action of the circulating air over the finned surfaces of the element, without, however, appreciably increased pressure drop, thereby materially improving the thermal transfer characteristics of the element.

Still another object is to provide a thermal exchange element of the stated type wherein the fin is integrally bonded to the tubular element, i. e., the mating surfaces of the fin and tube are bonded over the entire mating area.

The invention resides further in certain structural and mechanical features and details hereinafter described and illustrated in the attached drawings, wherein:

Fig. 1 is a vertical elevational view partly in section of the finned tubular element of the present invention.

Fig. 2 is a detail view showing a section of the helical fin material with its radial corrugations and tapered cross-section;

Fig. 3 is similar to Fig. 2 except that the corrugations have less amplitude;

Fig. 4 is an enlarged detail of a fin brazed or soldered to the tubular element and shows the outer periphery of the element clad with a coating of brazing material.

The invention contemplates fabrication of a thermal exchange element in the form of a helically finned tube wherein the fin is corrugated radially with the corrugations having a maximum depth or amplitude at the outer edge of the fin and becoming progressively shallower and narrower and terminating within the latter at a point located at a substantial distance from said outer edge but not inwardly beyond the approximate midpoint between said two edges.

Reference is now made to the drawing and more particularly to Fig. 1 wherein a finned tubular element is illustrated which comprises a tube 1 having an helical fin 2 wound thereabout and projecting outwardly therefrom to effect efficient heat transfer between the tube and the ambient air. The fin is provided with a plurality of corrugations 3 extending radially inwardly with respect to the longitudinal axis of the tube and terminating within the width of the fin at a

2

point located a substantial distance from the outer edge but not inwardly beyond the approximate midpoint between the inner and outer edges, the fin progressively decreasing in thickness from the inner edge to the outer edge thereof. The zone of the fin adjoining the corrugated area is undistorted to provide for unobstructed flow of air adjacent the tube.

The fin of Fig. 1 is not bonded to the tube but rather is wrapped tightly around the tube in the course of manufacture of the finned tubular element. The fin, however, may be removed after the wrapping operation and may be used separately for other purposes. As shown in Fig. 4 a bonding medium 4 may be employed to secure the fin to the outer surface of the tube. The bonding medium disclosed extends throughout the mating area of the surface of the tube, i. e. between each successive convolution of the helical fin.

In Fig. 3 a modified form of an helical fin is disclosed in which the amplitude of the corrugations is less than that shown in Fig. 2. It will be understood that the fin of Fig. 3 may be substituted for the fin of Fig. 1 if a fin having such characteristics should be desired.

In order to bend a strip edgewise around a tube, either the metal at the inside radius must be thickened, resulting in a contraction of the inside edge, or the metal at the outer radius must be thinned, resulting in a lengthening of the metal circumferentially. This latter action is employed in the present instance to bend the strip around the tube. The thinning action is produced preferably by compression through the medium of a roll and anvil and the resulting curvature of the strip will vary in accordance with the amount of thinning. If the outside edge is compressed and thinned to a greater extent than is necessary for bending the strip to the required radius—in the present instance the radius corresponding to the outer cylindrical surface of the tube—the metal in the outer edge portion of the strip, being longer than necessary for the desired radius, will be forced to assume the wrinkled or corrugated form. In other words, the over-stretching of the metallic fibers is taken up by the increased circumferential length of the corrugated outside edge of the strip.

As illustrated, the corrugations or waves decrease progressively in both width and depth toward the inner edge of the strip and terminate short of said inner edge at points located a substantial distance from the outer edge but not inwardly beyond the approximate midpoint be-

tween the inner and outer edges so that the inner edge defines a smooth helical curve, this smoothly curved inner edge, which by reason of the characteristic tapered cross-sectional form of the strip is of substantial thickness, being pressed firmly against the surface of the tube. This tapered form is desirable in that it constitutes the most efficient shape for thermal transfer and is therefore more economical in that for any given requirement a fin with this formation will use less metal than would be necessary with another shape.

It is to be noted that in forming the strip as described above, it is not necessary that the strip be upset against the surface of the tube, since a corrugated strip can be produced without the tube or equivalent bearing for the inner edge of the strip by causing the over-extended metal at the outer edge to upset in effect against the inner portion of the strip.

The aforescribed invention provides a finished product of highly favorable characteristics in both structural and functional respects. The establishment of the integral bond between the fin and the base member wherein the mating surfaces of the fin and member are bonded over the entire mating area through the medium of a brazing alloy having characteristics to withstand deterioration at elevated temperatures constitutes in itself a material improvement in the art, both as to the strength and durability of the bond and the efficiency of heat flow between the fin and the base element to which the fin is attached. The gentle corrugations near the outer edge of the fin which terminate at points located a substantial distance from the outer edge but not inwardly beyond the approximate midpoint between the inner and outer edges so that an undistorted surface of substantial width is presented inward of the corrugated area, produce in the use of the finished article a turbulent scrubbing action of the air without appreciably higher pressure drop that accounts for additional thermal transfer for the same equivalent area of an additional twelve or more per cent over a straight fin or one corrugated at the inner edge thereof.

It is to be understood that there may be further substantial modification in the details of both apparatus and method without departure from the invention.

I claim:

1. In a heat exchanger comprising a tubular member having a cylindrical surface, a length of strip material forming a continuous helical fin secured on said member and projecting outwardly from said cylindrical surface, the outer edge

of the fin provided with a plurality of spaced transverse corrugations, each of said corrugations extending inwardly from the outer edge of the fin and terminating within the latter at a point located a substantial distance from said outer edge but not inwardly beyond the approximate midpoint between said two edges so that the zone of the projecting portion of the fin adjoining said surface is undistorted, said corrugations decreasing progressively in both width and depth from said outer edges to their points of termination.

2. A heat exchanger in accordance with claim 1 wherein said helical fin decreases in thickness from said cylindrical surface to the outer edge of said fin.

3. In a heat exchanger, a length of strip material forming a continuous helical fin, said strip material decreasing in thickness from the inner edge thereof to the outer edge thereof, the outer edge of the fin provided with a plurality of spaced transverse corrugations, each of said corrugations extending inwardly from the outer edge of the fin and terminating within the latter at a point located a substantial distance from said outer edge but not inwardly beyond the approximate midpoint between said two edges so that the zone of the fin adjacent the inner edge thereof is undistorted, said corrugations decreasing progressively in both width and depth from said outer edges to their points of termination.

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