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J. S. RODGERS
METHOD OF MAKING INTEGRAL EXTERNAL
AND INTERNAL FINNED TUBING
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FIG.2.

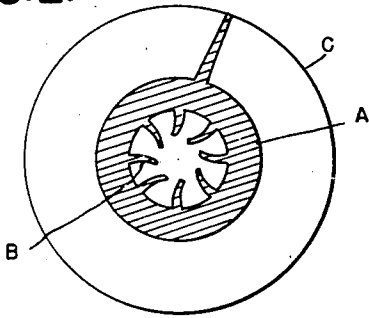


FIG.3.

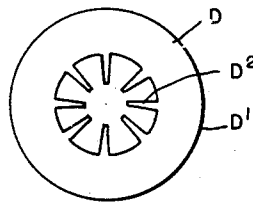


FIG.1.

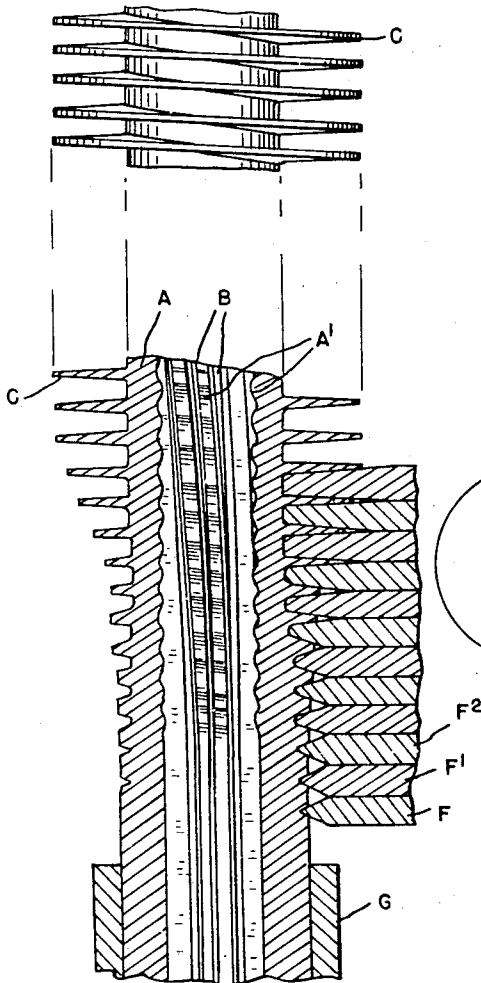
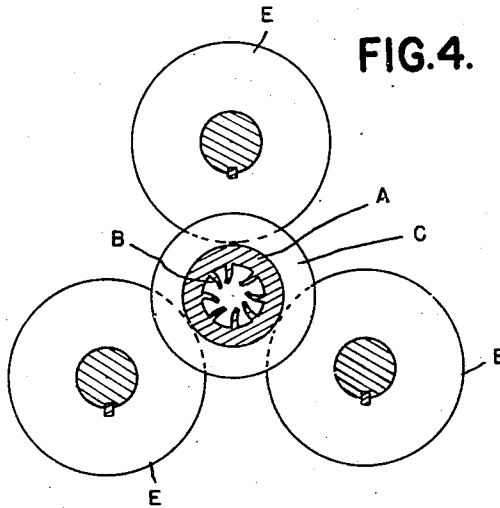


FIG.4.



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METHOD OF MAKING INTEGRAL EXTERNAL
AND INTERNAL FINNED TUBING

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1 Claim. (Cl. 29—157.3)

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The invention relates to finned tubing designed for use in heat exchange apparatus and it is the primary object of the invention to obtain a construction having higher heat exchange efficiency. In one form of finned tubing heretofore manufactured, radially extending helical fins are extruded from the peripheral portion of a plain tube. Such construction is high in heat exchange capacity due to the fact that the metal in a structure thus formed has greater thermal conductivity than that in a cast construction. However, the limiting factor is the small area of the inner surface of the tube as compared with that of the external fin surface.

It is the object of the instant invention to increase the efficiency of such finned tubing by providing the same with inwardly projecting integral fins so as to greatly increase the area of contact with the fluid medium passing through the tube. However, as heretofore manufactured, the tubing has been supported on a mandrel within the same during the process of forming or extruding the external helical fins. Consequently, the presence of internal fins might interfere with the use of such a mandrel. On the other hand, if the structure were to be formed by some other process, such as casting, then the thermal conductivity of the metal would be lowered reducing efficiency as a heat exchange medium.

In view of the conditions just described, my invention consists in a process or method by which external transversely extending fins can be extruded from the peripheral portion of tubing which is also provided with integral internal fins.

The invention further consists in the method of forming the internal fins slightly helical but with such a small helix angle as to have negligible resistance to the flow of fluid therethrough.

The invention further consists in a method of imparting a wavy form to the internal surface of the tubing for increasing efficiency in heat exchange.

The invention further consists in the novel product as hereinafter set forth.

In the drawings:

Fig. 1 is a central longitudinal section through my improved finned tubing showing a portion thereof in elevation;

Fig. 2 is a cross section;

Fig. 3 is an end elevation of the extruded blank prior to forming the external fins thereon; and

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Fig. 4 is a diagrammatic view illustrating the method of forming the external fins.

As illustrated in Figs. 1 and 2, my improved finned tubing has a body portion A provided with a plurality of radially inwardly projecting and longitudinally extending fins B which are slightly twisted or of helical form. C are the external fins which may be either annular or helical but with a relatively large helix angle. The inner surface of the body portion A of the tubing has depressions A' intermediate the fins C which impart a wavy or serpentine form to such surface.

The method of forming such finned tubing comprises essentially two steps. In the first step a tubular blank D is formed by extrusion or other means, said blank having a cylindrical outer surface D' and inwardly and longitudinally extending ribs D². In the second step the blank D is externally finned by the use of suitable apparatus such, for instance, as shown in the patent to Locke 1,865,575 of July 5, 1932. This is illustrated in Fig. 4 in which a plurality of rollers E are arranged around the blank with their axes at a slight angle to the blank axis. Each of these rollers is formed of a series of disc portions F, F', F², etc. The first disc F has a relatively sharp cutting edge which penetrates into the peripheral portion of the blank to a predetermined depth cutting a groove therein. The succeeding discs F', F², etc. are progressively increased in width so as to axially compress the metal of the blank therebetween to extrude it radially. For directing the blank into engagement with the rollers it passes through a tubular external guide G. If the blank were not provided with the internal ribs D² it would not have sufficient rigidity to withstand the radially inward stresses produced by the rollers F. However, the trussing or reinforcement of these ribs will to a great extent resist such stresses while the external fins are being axially compressed and radially extruded. Nevertheless, there will be a slight inward displacement of the wall of the tubing between the external fins while the latter hold the portions in line therewith from such displacement. This will produce the wavy inner surface A' previously described.

During the formation of the external fins the blank will be subjected by the forming mechanism to certain internal stresses which result in a slight twisting about its axis. This will change the shape of the internal fins from a form parallel to the axis of the tubing to a slightly helical form.

It is also possible during the extrusion of the

3 blank to impart a helical form to the inwardly projecting fins. The amount and the direction of twisting of these fins can also be controlled so that if it is desired to have the internal fins of a particular helix angle, this may be controlled, first, by imparting a predetermined helix angle to the extruded blank and, second, by modifying this through the twisting of the blank which occurs when the external fins are being formed. In other words, if the helix angle imparted by the external fin forming mechanism is greater than desired, then the blank may be extruded with a negative helix angle and the two operations will give just the angle desired.

What I claim as my invention is:

In a method of forming finned tubing, including the step of extruding a tubular blank with internally projecting longitudinally extending integral fins and the step of developing by a transverse rolling operation external transversely extending fins from the peripheral portion of said extruded blank and simultaneously imparting a slight twist to the blank and the internal fins thereof; the step of imparting a predetermined helix angle other than zero to the internal

4 fins during the extrusion of the blank to control the final helix angle of said internal fins at the completion of the external fin forming operation.

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