June 3, 1930. A. A. LOCKE 1,761,733

INTEGRAL FINNED TUBING AND METHOD OF MANUFACTURING THE SAME

Filed Dec. 5, 1927

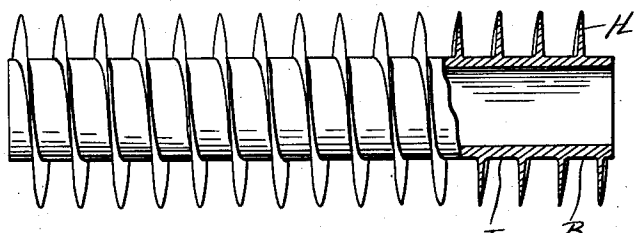

Fig. 1

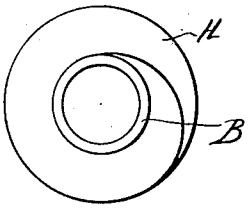

Fig. 1a

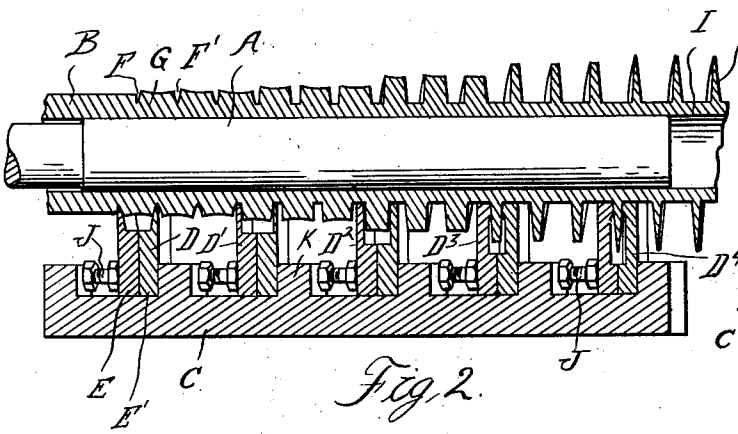

Fig. 2.

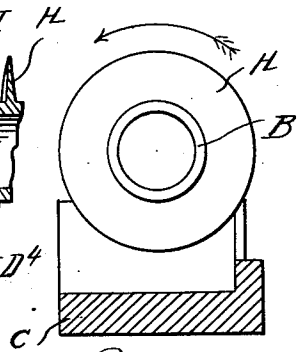

Fig. 2a

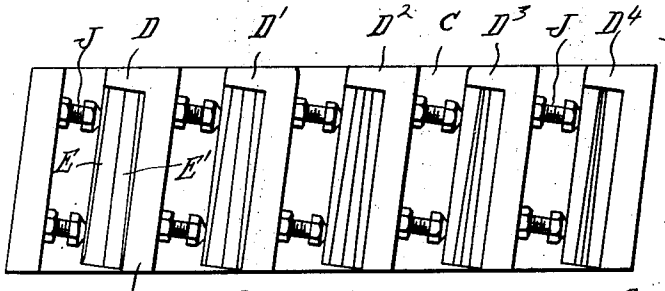

Fig. 3.

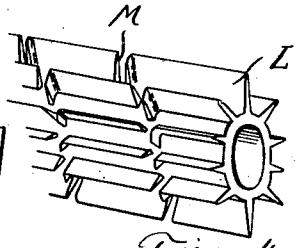

Fig. 4.

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UNITED STATES PATENT OFFICE

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INTEGRAL FINNED TUBING AND METHOD OF MANUFACTURING THE SAME

Application filed December 5, 1927. Serial No. 237,930.

The invention relates to finned tubing such as used for automobile radiators and in various other structures designed for rapid heat exchange.

In the present state of the art it is usual to form tubing of this character by spirally winding a sheet metal strip about the periphery of the tube so as to extend at right angles to the axis and then to attach the inner edge of the strip to the tube by soldering. This interposes a film of solder in the path of the heat flow and as the thermal conductivity of the solder is less than that of the metal of the tube and fin the efficiency is diminished. With certain constructions tubes with integral fins are formed by casting but these obviously can only be made in relatively large sizes and with a very considerable increase in weight.

It is the object of the present invention to obtain a construction in which the fins are integral with the walls of the tube and which can be made in all sizes.

It is a further object to so construct these finned tubes as to obtain the maximum of heat dissipating surface with a minimum of weight and a high rate of conductivity from the tube walls to the fins. With these objects in view the invention consists in the construction and the method and apparatus for forming the same as hereinafter set forth.

In the drawings:

Figure 1 is a side elevation of a spirally finned tube of my improved construction a portion being shown in longitudinal section.

Figure 1 (*a*) is an end elevation thereof.

Figure 2 is a longitudinal section showing the method and apparatus for forming the fins.

Figure 2 (*a*) is a sectional end elevation thereof and

Figure 3 is a plan view showing the dies for forming the fins.

Figure 4 is a perspective view showing a modified construction having longitudinally extending fins.

Briefly described my improved method comprises the following steps, first, forming a plain tube having walls of greater thickness than in the finished product; second, subjecting said tube to the progressive action of a series of dies or forming tools which first form spaced grooves around the periphery of the tube and then laterally compress the metal between said grooves to force the same radially outward. The grooves are preferably formed in a spiral path and by the relative rotation of the tube and the dies while the former is supported upon a mandrel.

As specifically shown in Figures 2 and 2a, A is a mandrel forming a support for a portion of a tube B which is revolved thereon and progressively fed forward in the direction of its axis. C is a stationary frame adjacent to the mandrel providing a mounting for a series of dies or forming tools D, D′, D^2, D^3, D^4 etc. Each of these dies comprises a pair of members E, E′ having spaced pressure surfaces extending transversely of the axis of the tube at an angle corresponding to the pitch of the helix. The die member D has its portons E, E′ with substantially knife edge entering portions which cut the initial grooves F, F′ in the wall of the tube B. The surfaces of these portions E, E′ are nonparallel and are slightly converging in the forward direction of rotation of the tube so as to produce a wedge for squeezing the metal G between the grooves to decrease the width thereof. The succeeding dies D′, D^2 etc. continue the squeezing action for reducing the metal between convolutions of the grooves and these dies are so positioned as to come successively into action in the spiral advance of the tube. Thus the metal between convolutions is gradually forced radially outward until it finally produces the finished fin H which is wider at the point of integral attachment to the tube and tapers to a substantial knife edge. This same action reduces the thickness of the wall of the tube as indicated at I.

An integral finned tube constructed as above described has greatly increased efficiency in the transference of heat, first because there is no break in the cross section; second, the thermal conductivity of the metal is high; third, the cross section of the fin is largest at the point where it merges into

the tube and gradually diminishes from that point to the periphery.

Various forms of apparatus may be used for carrying out my improved method but the construction shown is one which is well adapted for the purpose. The die plates E, E′ are preferably separate from the member C and are attached thereto by suitable means such as clamping screws J which press each pair of dies against a rib or shoulder K on the base.

Figure 4 shows a modified construction of finned tube in which the fins L extend longitudinally instead of circumferentially around the tube. This construction is formed in a similar manner to the process above described in that the walls of the tube have first formed spaced grooves therein, the material between the grooves being then compressed to diminish its width and increase its radial dimension. As the fins extend longitudinally of the tube the whole process may be carried out in suitably fashioned drawing dies. If desired the fins may be severed at intervals as indicated at M to interrupt the longitudinal flow of heat therethrough.

What I claim as my invention is:

1. A finned tube having the fins thereof integral with and developed from the outer surface portion of the wall of the tube by the axial compression and radial deflection thereof.

2. A seamless finned tube comprising a plurality of longitudinally spaced fins integral with the wall of the tube and developed therefrom by axial compression and radial deflection of the outer surface portion thereof.

3. A finned tube comprising a helical fin integral with and developed from the outer surface portion of the body of the tube by axial compression and radial deflection thereof.

4. The method of forming finned tubes comprising initially forming spaced grooves in the wall of the tube and in progressively compressing the metal between said grooves to reduce the thickness thereof and to increase the radial dimension.

5. The method of forming finned tubes comprising initially forming spaced grooves in the wall of the tube and subsequently progressively compressing the metal between said grooves axially of the tube to reduce the thickness and to increase the radial dimension thereof.

6. The method of forming finned tubes comprising initially forming a helical groove in the periphery of the tube and subsequently compressing the metal between successive convolutions of the helix to reduce the thickness and increase the radial dimension thereof.

7. The method of forming finned tubes comprising progressively flowing the metal in the outer surface portion of the tube in an axial and radially outward direction to produce an integral fin.

In testimony whereof I affix my signature.

ARTHUR A. LOCKE.