Jan. 12, 1943. M. J. STANTON 2,308,319

HEAT EXCHANGE SURFACE

Filed Nov. 25, 1939

Fig. 1.

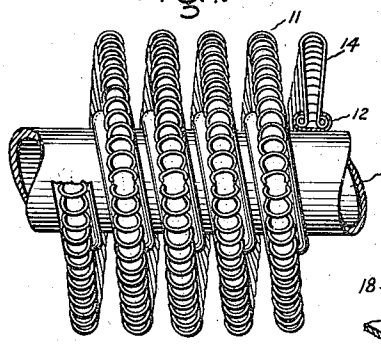


Fig. 6.

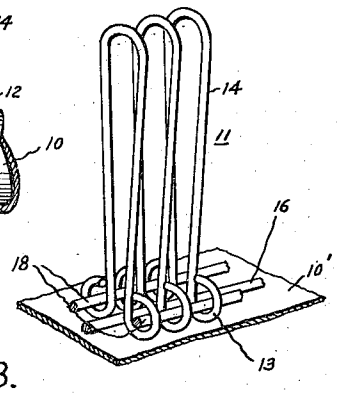


Fig. 2.

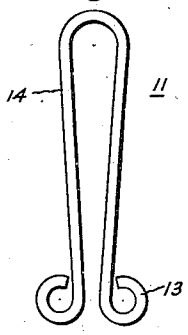


Fig. 3.

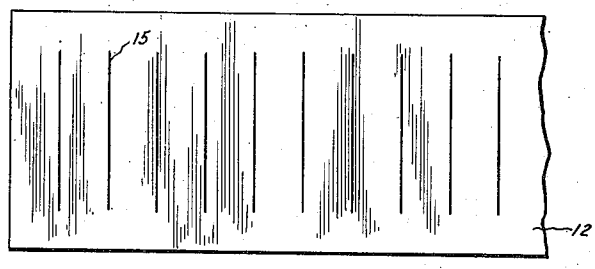


Fig. 5.

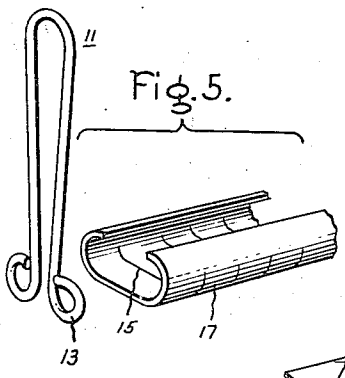
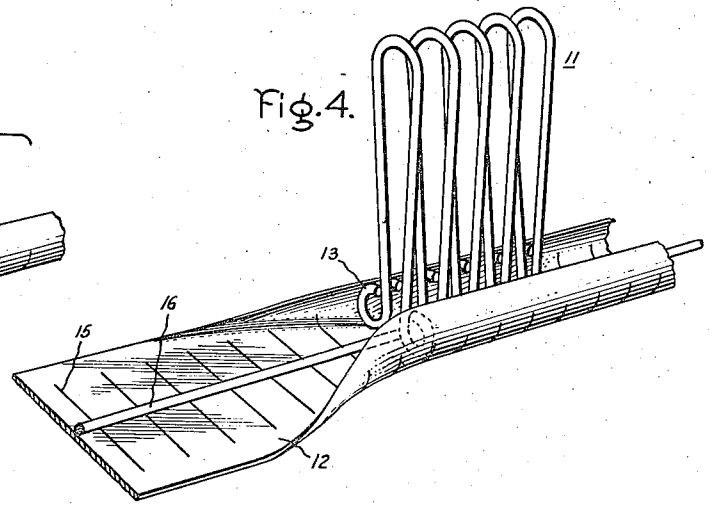


Fig. 4.



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2,308,319

HEAT EXCHANGE SURFACE

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Application November 25, 1939, Serial No. 306,089

4 Claims. (Cl. 29—157.3)

My invention relates to heat exchange surfaces.

Objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the accompanying drawing in which Fig. 1 is a view showing a fluid conveying conduit equipped with a heat exchange surface formed according to my invention; Fig. 2 is a view of one of the heat exchange members shown in Fig. 1; Fig. 3 is an enlarged detail view of a part used in the assembly of the heat exchanger shown in Fig. 1; Fig. 4 is an enlarged perspective view of a portion of the heat exchange element illustrating the method of assembly; Fig. 5 is a view of a modification of the arrangement illustrated in Figs. 1 to 4; and Fig. 6 illustrates another embodiment of the invention.

I have provided a heat exchanger or body to or from which heat is to be transferred such as a fluid conducting member 10 having heat transfer members 11. The heat transfer members 11 are fastened to the member 10 as by means of a base member or securing strip 12, the edges thereof being rolled over the securing or anchoring portions 13 of the heat transfer or fin members 11, the assembly being soldered or otherwise suitably secured to the fluid conducting member 10.

A large portion of the temperature drop from the temperature of a fin surface to the temperature of the fluid flowing in contact with the fin surface occurs in the region immediately adjacent the fin, this region often being called the boundary layer. The thickness of this layer is a function of the distance from the leading edge of the fin in the direction of fluid flow. The heat flow in this region decreases as the thickness of the boundary layer increases. For high rates of heat exchange it is desirable to keep the boundary layer thin and to mix frequently the boundary layer and the main body of fluid. This may be accomplished by providing a plurality of spaced-apart fins of relatively small perimeter or cross section at various angles to the air flow and arranged to present as many edges as possible to mix or divide the flow of fluid into a large number of thin strata. The accomplishment of these purposes is described hereinafter.

I have illustrated a suitable type of fin, best shown in Fig. 2, having an inverted substantially U-shape. The fin 11 is provided with a heat transferring portion 14. The free ends of the fin 11 are formed into anchoring portions 13 in any suitable manner as loops, for example. The fin 11 as illustrated in the drawing may be formed of wire, the anchoring portions 13 being illustrated in the form of eyelets. A fin such as that illustrated in the drawing may be suitably formed in an automatic wire bending machine. Any suitable material may be used for the fin 11, copper being particularly suitable for it is easily fastened to a heat exchange body 10 such as a tube as by soldering and is a relatively good heat conductor.

In order to secure the fins 11 to a heat exchange member such as the conduit 10, I have provided strips 12 of suitable material, such as copper for example. The strips 12 are provided with longitudinally spaced openings 15, illustrated as transverse substantially parallel slits, for purposes to be described, the slits or openings 15 being disposed so as to leave a margin around the edges of the strip 12. As shown in Fig. 4, the edges of the strip 12 are suitably bent, as by a rolling process in an automatic machine, into engagement with the eyelet or anchoring portion 13.

Thus, in assembling the heat exchanger according to my invention, a plurality of fins or heat transfer members 11 are arranged in spaced-apart substantially parallel positions as by means of a suitable fixture having slots therein to receive and support fins 11 in the desired positions. The slotted strip 12 is then placed in engagement with the anchoring portions 13. Next, the edges of the strip 12 are shaped as by rolling or bending around the anchoring portions 13 in order to secure the fins 11 to the base member or strip 12. A strip of solder 16 is placed transversely of the slits 15 and extending through the aligned fins 11 adjacent the anchoring portions 13 thereof.

The above described assembly may be formed of any length and wound on reels, if desired. The assembly may be placed on a heat exchange member, such as the tube 10, in any suitable arrangement, as a helically wound one, at any suitable pitch, as illustrated in Fig. 1. At this stage, the assembly is heated until the solder 16 melts and runs through the slits 15 thereby soldering the base member or strip 12 to the heat exchange member 10.

In Fig. 5 I have illustrated a modification of the above-described invention in which strips 17 are rolled at the edges thereof before the fins 11 are

applied. The fins 11 may be formed as above and slid along the troughs formed at either edge of the strip 17. It will be seen that the finished product will be similar to that illustrated in Figs. 1 to 4, inclusive, although it may be desirable to press the edges of the strip 17 into more positive engagement with the anchoring portions 13 after the fins 11 have been slid to the desired positions with respect to the strip 17.

In Fig. 6 I have illustrated a modification of my invention having the same heat transfer elements 11 illustrated in Figs. 1 to 5, inclusive. Instead of using a strip 12 to assist in assembling the heat exchanger and to help maintain the members 11 in intimate thermal association with the body 10' to which or from which heat is to be transferred, I provide wires 18 which, during assembly, are associated with the anchoring portions 13 of the elements 11. In the form of my invention illustrated in Fig. 6, the elements 11 are preferably arranged with portions 13 in the form of eyelets or loops in alignment, as by means of a suitable slotted fixture, and wires 18 passed through the loops. The assembly is then deposited on the surface of the body 10, a strip of solder 16 passed between the ends of the members 11 adjacent the body 10' and securing portions 13 and the assembly heated until the solder flows into engagement with portions 13, wires 18 and body 10'. The portions 13 may be of any suitable design, and if the eyelet form is chosen, the wire defining the eyelet or loop may be pressed into engagement with wires 18, and thereby hold the assembled members 11 in the desired spaced-apart relationship following which the assembly may be soldered to the body 10'.

While I have shown a particular embodiment of my invention, I do not desire my invention to be limited to the particular construction shown and described and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A method of forming a heat exchanger including a body to or from which heat is to be transferred comprising forming a plurality of heat transfer members with heat transfer portions and anchoring portions, providing a strip of heat conductive material with a plurality of longitudinally spaced openings, assembling a plurality of said members in spaced-apart relationship, bending the edges of said strip into engagement with said anchoring portions of said members, placing solder adjacent said openings and said anchoring portions, disposing said assembled members and strip adjacent said body and fastening said assembly to said body by heating said assembly until said solder runs through said openings into contact with the surface of said body.

2. A method of forming a heat exchanger including a body to or from which heat is to be transferred comprising forming a plurality of heat transfer members with heat transfer portions and anchoring portions, providing a strip of heat conductive material with a plurality of transverse substantially parallel slits, assembling a plurality of said members in spaced-apart relationship, bending the edges of said strip into engagement with said anchoring portions of said members, placing solder adjacent said slits and said anchoring portions, disposing said assembled members and strip adjacent said body and fastening said assembly to said body member by heating said assembly until said solder runs through said slits into contact with the surface of said body.

3. The method of forming a heat exchanger including a heat exchange member having a helically wound heat transmitting element comprising, forming a plurality of wire members into an inverted substantially U-shape with anchoring portions on the ends thereof, providing a strip of relatively good heat conductive material with a plurality of transverse substantially parallel slits, assembling a plurality of said members in spaced-apart relationship, enclosing said anchoring portions of said members in said strip by bending the edges of said strip into engagement with said portions, placing a strip of solder along said strip and adjacent the open ends of said members, winding said assembly on said heat exchange body to the desired length, and fastening said assembly to said body, said last-mentioned step comprising heating said assembly and melting said solder whereby said solder runs through said slits into contact with the surface of said body adjacent said strip.

4. In a heat exchanger comprising a fluid conveying conduit, a base element disposed in intimate thermal association with said conduit and having edges, and a plurality of spaced-apart wire members bent to form substantially U-shaped heat transfer members, the ends of said members being provided with anchoring portions, the edges of said base member being constructed and arranged to engage said anchoring portions, said anchoring portions and said base member being fastened by soldering or the like to said conduit.

MYLES J. STANTON.