Sept. 1, 1936. J. D. FORRER ET AL 2,053,239

MANUFACTURE OF HEAT EXCHANGE APPARATUS

Filed Oct. 5, 1934

Fig. 1

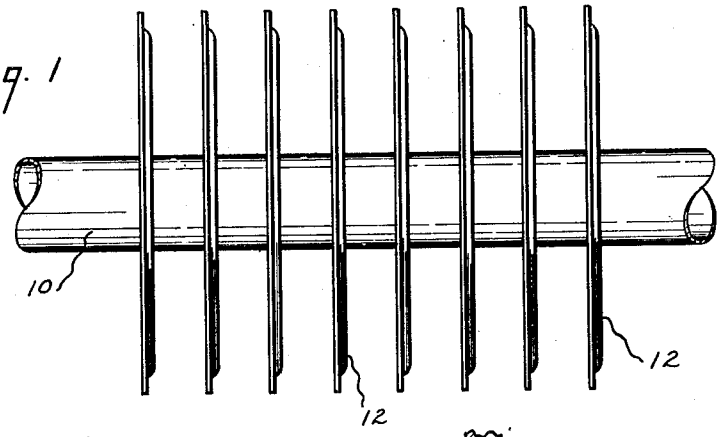


Fig. 2

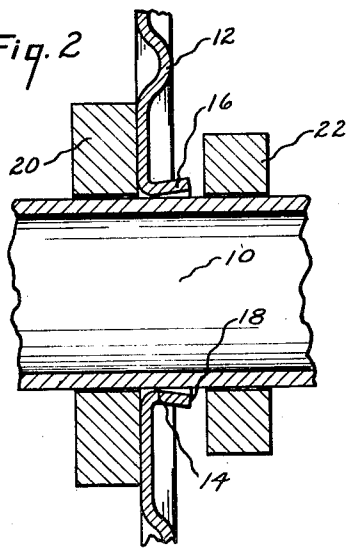
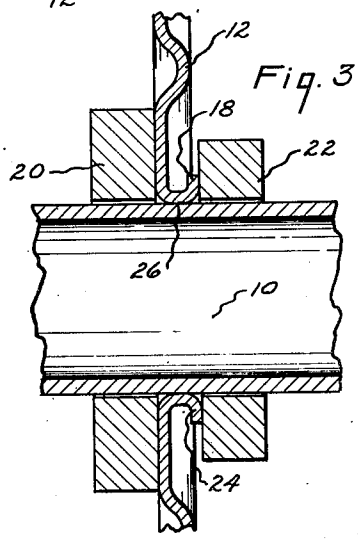


Fig. 3



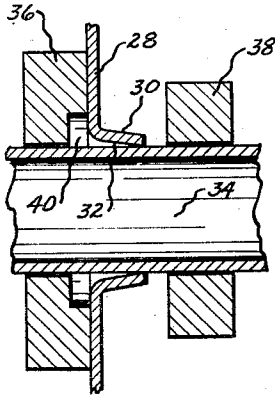


Fig. 4

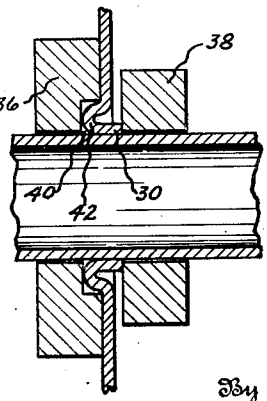


Fig. 5

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MANUFACTURE OF HEAT EXCHANGE APPARATUS

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4 Claims. (Cl. 29—157.3)

The present invention relates to the manufacture of heat exchange apparatus for heating or cooling a medium surrounding, located within, or flowing through the apparatus, as for example, a radiator for the heating of buildings, and the like, or a refrigerating or cooling unit for the lowering of temperature in rooms, cabinets and the like.

More specifically the present invention provides a method of attachment of a fin or flange or equivalent structure upon a tubing or conduit or equivalent structure of a heat exchange apparatus for increasing the efficiency of the apparatus. In addition, the present invention relates to an improved heat exchange apparatus in which flanges or fins or equivalent structures are contracted upon the body of the apparatus and are of such configuration as to provide efficient heat transfer, adequate rigidity, and permanency of attachment.

Heretofore at least one method has been provided for the attachment of fins or flanges by contraction upon tubular bodies by first expanding the fin within its elastic limit by the insertion of the tubular body into a flanged aperture of the fin, as is disclosed in U. S. Patent No. 1,787,942. Such a method necessitates relative movement between the fin and tubular body during assembly with the fin contracted upon the body and necessarily impairs the original effectiveness of the union. This method generally requires the further operation of expanding the tube with a mandrel in order to obtain sufficient binding between the fin and body with the fin in its final assembled position. Moreover, this method does not readily lend itself to spacing and affixing the fin upon tubular bodies and the like by automatic machinery.

According to the present invention, the fin, flange, or equivalent structure employed to materially increase the surface exposed to the treated medium, is preferably loosely received upon the body of the heat exchange apparatus and then through the employment of suitable forming means is contracted or shrunk upon the body to frictionally engage the same with a stressed contact giving high efficiency of heat transmission between the parts. This method of fin assembly lends itself exceedingly well to automatic handling, spacing and affixing the fins upon the tubing as the fins are loosely received thereon until the forming operation. This permits the fins to be readily manipulated axially relative to the tubing to effect proper spacing. In the preferred form of the invention, that portion of the fin structure defining the aperture takes the form of an axially extending flange and the contraction of such a flange upon the body of the heat exchange apparatus without relative axial displacement after such contraction, provides adequate contact between the parts for efficient heat transfer. In the drawing, for the purpose of illustration, two satisfactory ways of carrying out the invention are shown. Innumerable other ways of reforming or working the area of the fin or flange structure contiguous with or defining the aperture to effect an inward displacement or contraction of the aperture or portion thereof upon the body of the heat exchange apparatus will readily suggest themselves and are all considered within the range of the present invention as defined by the appended claims.

Having specific reference to the illustrated forms of the invention,

Fig. 1 is a side elevation of a section of a heat exchange apparatus,

Figs. 2 and 3 are enlarged fragmental cross sectional views of the reforming operation of the area of the fin structure defining its aperture to contract the same upon the tubing, and

Figs. 4 and 5 are views similar to Figs. 2 and 3 of a modified form of the invention.

As illustrated, the body of the heat exchange may take the form of a tube 10 of suitable material which does not necessarily have to possess mandrel expandable characteristics as has been heretofore necessary in methods requiring the expanding of the tube to prevent the fins from shifting upon the same and to provide adequate contact between the fins and the tube. Thin sheet metal fins or flanges 12 of suitable configuration are shown spaced along the tube 10 and affixed in position avoiding shifting during ordinary use in a manner to be hereinafter explained.

Referring to Fig. 2, the fin 12 is shown loosely embracing the tube 10 passed through an aperture 14 defined therein by an integral flange 16. Preferably at the time the fin 12 is punched to provide the aperture 14 and drawn to provide the flange 16, the latter is formed slightly conical to facilitate the radially rolling of the outer edge 18 as shown in Fig. 3. Suitable forming tools 20, 22 are diagrammatically shown for reforming the flange 16, with the fin 12 properly positioned upon the tube 10, to shrink or contract the aperture 14 defined by the flange. In practice the tools 20, 22 are made up of two sections which are moved in toward the tube from opposite direc-

tions to encircle the same. The tool 22 may be fixed against movement axially of the tube and its thickness determines the minimum spacing of the fins 12 upon the tube 10. With the fin 12 preferably loosely positioned upon the tube 10, the fin 12 may be urged toward the fixed tool 22 by the tool 20. As the edge 18 of the flange 16 engages the tool 22 the same is rolled to form a radial outwardly turned annular flange 24. With the flange 16 confined and supported circumferentially and axially of the tube 10 by the tool 20 and 22, the rolling of the edge 18 causes a flowing of the metal located between the tools 20, 22 radially inward in all directions to shrink or reduce the diameter of the aperture 14. This action is carried out until the fin 12 has been shrunk or contracted upon the tube sufficiently to prevent shifting of the fin under ordinary use and a pressure or stressed contract has been provided between the fin and tube. As is shown in Fig. 3 the area of contact between the fin 12 and tube 10 extends axially of the tube a considerable distance as at 26; the flange being flattened by pressure exerted against the tube. It should be readily apparent that in a heat exchange apparatus with the fins shrunk or contracted upon the tubes in the foregoing manner efficient transmission of heat between the tubes and fins will result. It will also be apparent that the flange 16 is stiffened and strengthened by the turning of the edge 18 to provide a more rigid and durable fin.

In the modification of the invention shown in Figs. 4 and 5, a fin 28 has a slightly conical flange 30 defining an aperture 32 through which the tube 34 passes. Tools 36, 38 which may function in the manner of the tools 20, 22 reform the flange 30 upon the tube 34 giving it the final configuration shown in Fig. 5. As illustrated, the tool 36 is relieved as at 40 to effect the return bend 42. The reforming of the flange 30 in this manner results in a radial contraction of the aperture 32 defined by the flange upon the tube 34 with rigid frictional contact.

Obviously the shape and form of the tools and fin construction may be varied materially within the scope of our invention. Thus, without limitation as to form of the tools or fins, we consider the dominant feature of the present invention resides in the contraction or displacement of that area of the fin defining or adjacent the aperture upon the body of the heat exchange apparatus to provide adequate frictional contact between the parts; in the preferred form of the invention the contracted area of the fin taking the form of an axially extending flange.

Having thus described our invention what we claim as new and desire to protect by Letters Patent is:

1. A heat exchange apparatus comprising a supporting body and a fin engaging said body, said fin having a flanged portion extending axially of the body in frictional engagement with said body, said portion having its outer end spaced from said fin and upturned, extending outwardly in a direction substantially parallel to said fin whereby the rigidity of the fin is enhanced.

2. A heat exchange apparatus comprising a tubular supporting body and a fin mounted upon said body, said fin having an aperture for receiving said body defined by an axially extending flange, a portion of said flange extending radially from said body and spaced from said fin to stiffen the flange.

3. The method of making tubes for refrigeration coils and the like having fins comprising forming thin sheet metal fins each with an aperture defined by an integral annular flange, said apertures being of a diameter to receive the tube, locating the fins in place upon the tube, and while supporting each of the flanges circumferentially upon opposite sides of their fins, reforming one circumferential portion of the respective flanges to cause a contraction of another circumferential portion of the same flange, said other portion being unreformed whereby the diameter of said apertures are reduced and the fins are secured to the tube.

4. The method of making tubes for refrigeration coils and the like having fins comprising forming thin sheet metal fins each with an aperture defined by an integral annular flange, said apertures being of a diameter to receive the tube, locating the fins in place upon the tube, and while supporting the flanges circumferentially upon opposite sides of their fins, turning the edges of said flanges to provide radially outward extending annular portions, whereby said flanges are contracted upon said tube and the fins and flanges are stiffened by said portions.

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