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HEAT EXCHANGER

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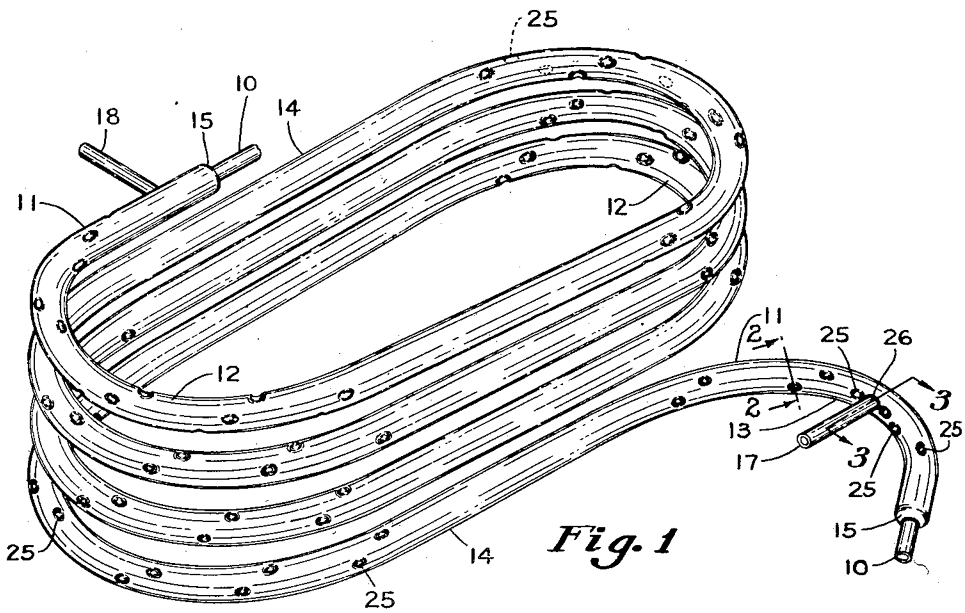

Fig. 1

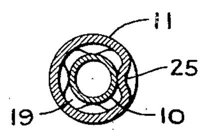

Fig. 2

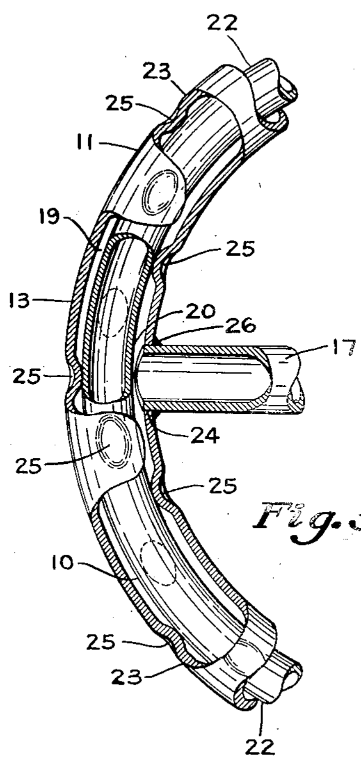

Fig. 3

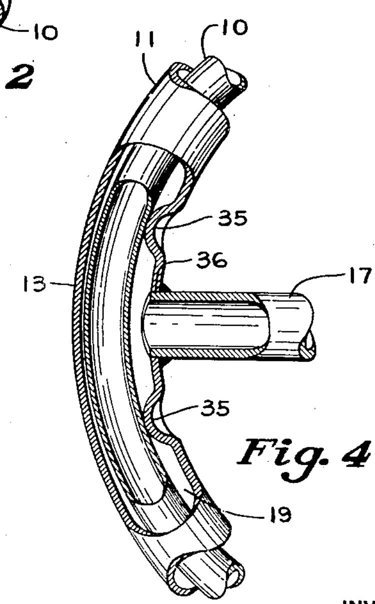

Fig. 4

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HEAT EXCHANGER

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4 Claims. (Cl. 29—157.3)

This invention relates to the art of making tubular structures and more particularly to fluid heat exchangers fabricated from standard tubing.

It is commonplace to utilize tubing of different diameters to make heat exchangers by inserting a smaller tube in a large tube, and then bending the telescoped tubes into a desired shape. Such constructions are easily made from standard, readily obtained materials. This form of heat exchanger is very efficient, inexpensive and free from sharp bends.

However, prior art heat exchangers of this type are subject to certain disadvantages. One of the chief difficulties is that in making the concentric tube heat exchanger, the operator has no control over the inner tube. Consequently, in bending the tubes into a desired shape, the bending operations are directly applied to the outer tube, and only indirectly to the inner tube. As a result, the inner tube is not coaxially positioned within the outer tube, and the inner tube may lie closely against the inside wall of the outer tube adjacent the bends. Therefore, the fluid passing between two tubes is greatly impeded where the tubes lie close together, and the heat exchange is poorest where the inner wall of the outer tube is furtherest from the inner tube.

According to this invention, I propose simple modifications in the constructions heretofore known which permit the retention of the many desirable characteristics of concentric tube heat exchangers and yet entirely avoid the disadvantages hereinabove pointed out, as well as others of lesser importance.

It is accordingly an object of my invention to provide a new and improved heat exchanger. More specifically it is an object of my invention to provide a heat exchanger having inner and outer tubes and means for spacing the tubes with respect to each other. Another object is to provide means for spacing the curved sections of telescoped tubes with respect to each other. A further object is to provide means for connecting a transverse tube to curved telescoped tubes. Another object is to provide methods of making heat exchangers. Other objects and advantages of the invention will be apparent in the specification and drawing, wherein:

Fig. 1 is a perspective view of the heat exchanger;

Fig. 2 is a section along the line 2—2 of Fig. 1;

Fig. 3 is a section along the line 3—3 of Fig. 1;

Fig. 4 is a section similar to Fig. 3 illustrating another embodiment of the invention.

The heat exchanger shown in Figures 1 through 3 comprises telescoped metal tubes 10 and 11 coiled as indicated in Fig. 1 to provide arcuate bends 12 and 13 and straight portions 14. The outer tube 11 has its ends 15 sealed to the projecting ends of the inner tube 10. Welded to the outer tube 11 along the inner arc of the bend 13 is a transverse pipe 17, and a pipe 18 is welded to the opposite end of the outer tube 11, and which communicate with an annual passageway 19 formed between the telescoped tubes 10 and 11 to provide passage for the fluid therethrough.

The arcuate bends 12 and 13 are formed by bending the telescoped tubes as a unit. In the bending operation the operator has control of the outer tube 11 and can bend it into any desired degree of curvature. The inner tube 10, however, is not under the control of the operator but is bent by the pressure exerted thereon by the outer tube 11. In forming, for example the bend 13 as shown in Figure 3, the inner tube 10 tends to take a flatter arc than the outer tube 11, so that the center portion 20 in the bend of the inner tube 10 tends to bear against the center of the inner arc of the outer tube 11, and the opposite ends 22 on the outer arc of the inner tube 10 tend to bear against the opposite ends 23 on the outer arc of the outer tube 11, to thereby interrupt flow of fluid in the passageway 19 and to the transverse tube 17.

One method of correcting this objectionable construction is shown in Figures 1 to 3, wherein the outer tube 11 is provided with longitudinally circumferentially spaced indentations 25 throughout the curved or arcuate portions thereof. These indentations bear against the inner tube 10 to space it in concentric relation with respect to the outer tube 11 throughout the curved portions 12 and 13. If inner tube 10 is co-axially positioned in outer tube 11 at the curved portions of the exchanger, the straight sections of tubes 10 and 11 will be retained in co-axial relation in the unbent portions 14 of the heat exchanger. The transverse tube 17 is welded, as indicated at 26 in the opening 24 to the outer tube 11, and due to the indentations 25 communicates freely with the annual passage 19.

One method of making a heat exchanger of this type consists of forming the openings 24 at desired point or points in the outer tube 11 for the desired number of transverse tubes 17 and 18, inserting the smaller tube 10 in the outer tube 11, forming groups of spaced-apart dimples or indentations 25 longitudinally and circumferentially around the outer tube 11 wherever the same is to be bent or curved, bending both tubes as a unit into a coil so that a group of indentations is located at each bend as shown in Fig. 1, and then welding the transverse pipes 17 and 18 to the outer pipe 11. If desired the dimples may be formed in the outer tube prior to inserting the smaller tube, and the transverse pipes may be welded to the outer pipe prior to bending the tubes into a coil.

In the modification of the invention shown in Fig. 4 the indentations 35 are provided only along the inner arc of the bend 13 at the point where the transverse pipe 17 is connected to the outer tube 11, to space the inner tube from the opening 36 to provide an uninterrupted path for fluid between the transverse pipe 17 and the annular passage 19. If desired, indentations may be provided at substantially the opposite ends of the outer arc on the outer tube 11 to space the inner tube 10 from the outer tube 11 throughout the length of the bend.

If it is desired to form a heat exchanger employing this construction the outer tube 11 is provided at a certain point or points with the desired number of openings 36 and the smaller tube 10 is arranged within the larger tube 11 and the indentations 35 are formed in the outer tube 11 in the vicinity of the openings 36. The two tubes are then bent as a unit into the desired shape. Due to the indentations 35 the inner tube 10 will be spaced from the inner arc of the outer tube 11 at the opening 36.

Although the indentations have been described as located at the bent or curved portions of the tubes, it will be understood that the indentations may be distributed over straight sections of tubing as well to assure co-axial positioning of the tubes throughout the length of the heat exchanger. Where the straight sections of tubing are short, as in Figure 1, it is not usually necessary to locate indentations in the straight portions.

It will thus be apparent that the present invention provides a new and simple method of constructing a concentric tube type heat exchanger especially suited for mass production. A minimum number of dies, tools, implements, and operations are required. The only change required in going from one size of heat exchanger to another, or from one shape or form to another, is that change required to handle the different sizes of conduits in the bending operation. Furthermore, the invention provides a heat exchanger construction which is very simple, economical, and highly efficient in operation, as well as one in which the heat exchange fluids flow freely to and from the exchanger, as well as through the respective passages of the exchanger.

I claim:

1. A heat exchanger, comprising an outer tube, an inner tube disposed in and spaced from said outer tube, said tubes being bent to form a coiled heat exchanger, a tube connected to and extending laterally from said outer tube along the inner arc of one of said bends, and indentations in the wall of one of said tubes along said inner arc of said tube bend for spacing said inner tube from said outer tube to provide a passageway between said spaced pipes and said transverse tube to facilitate the free passage of a fluid between said laterally extending tube and said heat exchange coil.

2. That method of constructing a fluid heat exchanger which comprises cutting lengths of tubing of different diameters into sections of predetermined length, the sections of smaller diameter tubing being longer than the sections of larger diameter tubing, inserting a section of smaller diameter tubing into a section of larger diameter tubing until the ends of the smaller tubing project beyond both ends of the larger tubing, placing groups of indentations in the surface of the larger tubing at spaced points therealong which indentations are of sufficient size and spaced in such manner as to retain said smaller and larger sections in a definite position with respect to one another, and then bending said tubing sections at said groups of indentations to form a coil having a substantially continuous annular fluid passage between said tubing sections from the inlet to the outlet thereof.

3. A heat exchange device comprising two continuous conduit sections one of which is of smaller diameter than the other, said smaller section being positioned within the larger section so as to provide two fluid passageways one of which is through the smaller section and the other of which is between said smaller and larger conduits, said smaller conduit being longer than the larger conduit so as to extend beyond the ends of the latter, said conduit sections being bent into a coil, and groups of indentations in said larger conduit positioned so as to prevent the smaller conduit from contacting the inner surface of the larger conduit except at said indentations, said groups of indentations being located at the coil bends.

4. A heat exchange device as defined in the preceding claim in which the larger conduit has an opening through the side thereof, a conduit joined to the larger conduit over said opening, and indentations in said larger conduit adjacent said opening to hold the inner, smaller conduit away from said opening to permit the free passage of fluid through said opening.

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