Jan. 16, 1934. L. RUTHENBURG ET AL 1,943,557

HEAT EXCHANGE DEVICE

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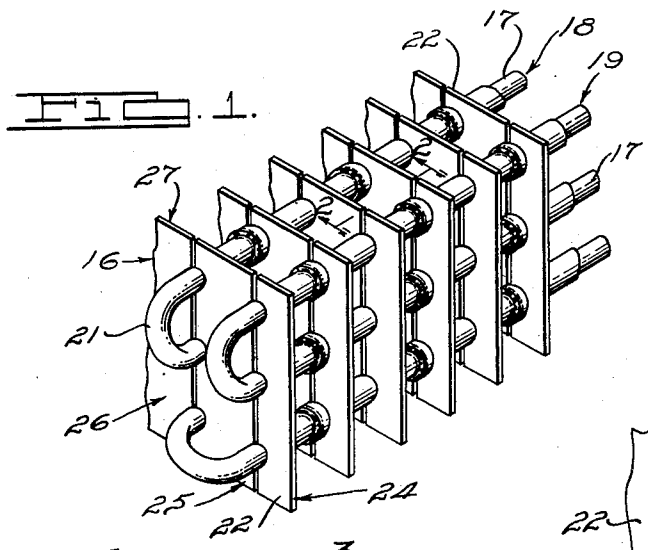


Fig. 1.

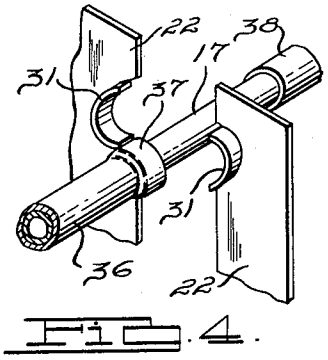


Fig. 4.

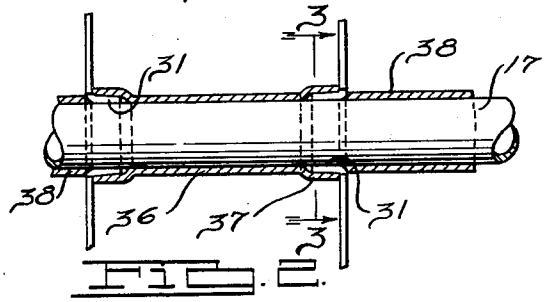


Fig. 2.

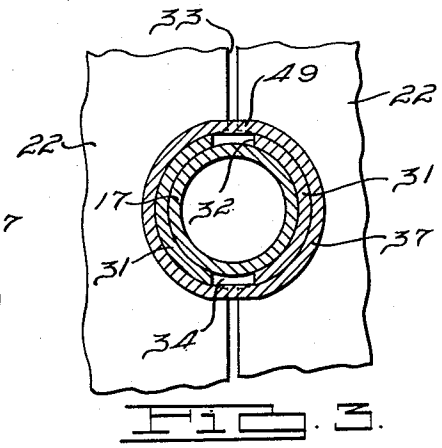


Fig. 3.

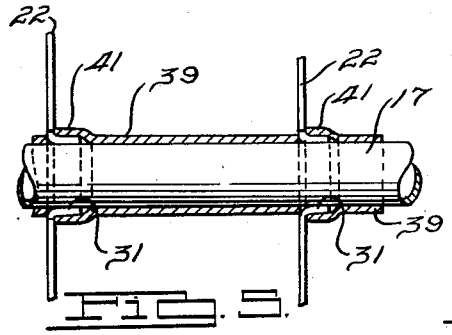


Fig. 5.

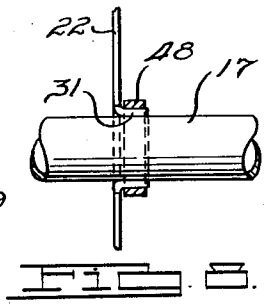


Fig. 6.

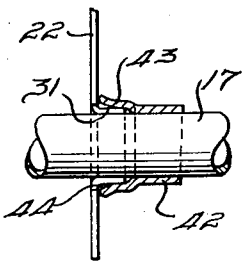


Fig. 9.

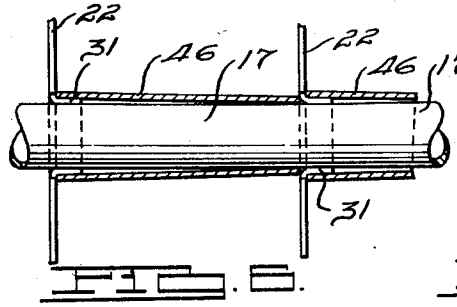


Fig. 8.

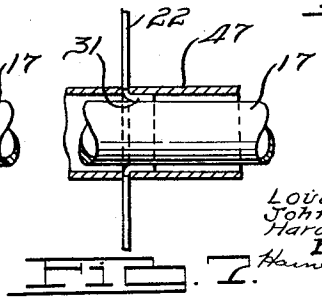


Fig. 7.

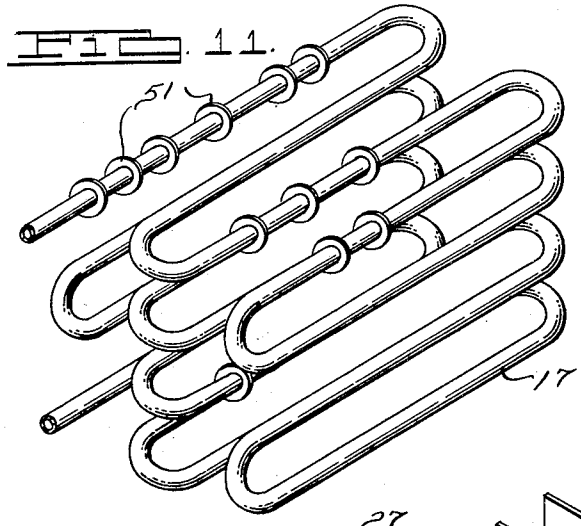
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Fig. 11.



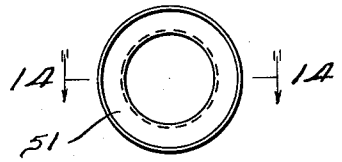


Fig. 13.

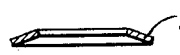


Fig. 14.

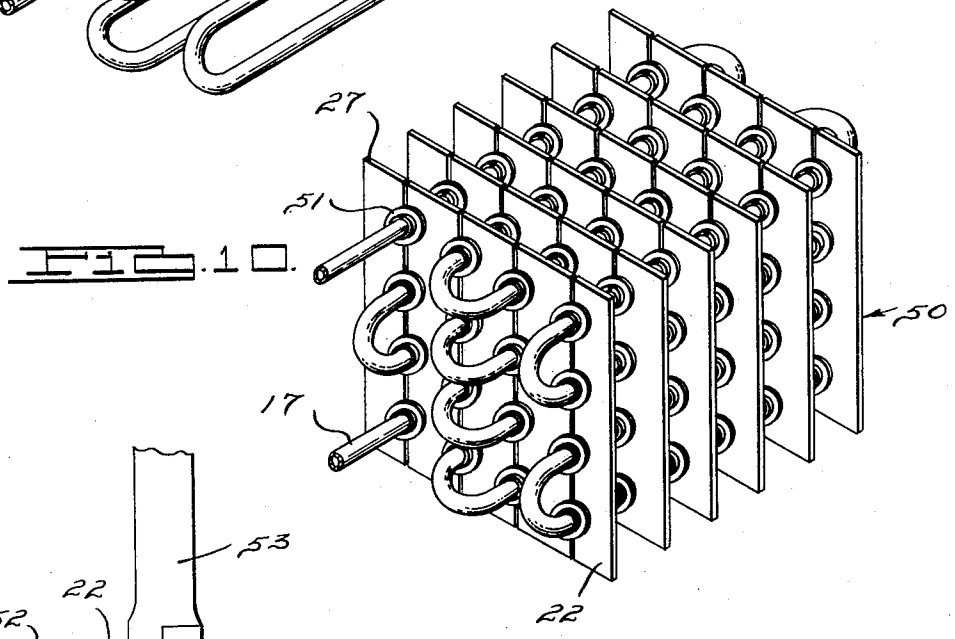


Fig. 10.

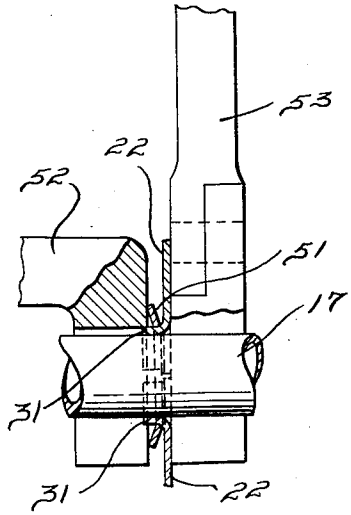


Fig. 15.

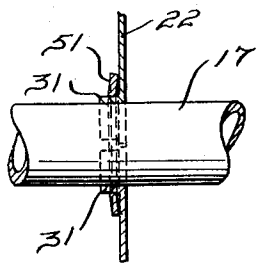


Fig. 12.

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Patented Jan. 16, 1934 1,943,557

UNITED STATES PATENT OFFICE

1,943,557

HEAT EXCHANGE DEVICE

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Application June 13, 1932. Serial No. 616,856

3 Claims. (Cl. 257—263)

This invention relates to heat exchange devices and has particular relation to heat exchange devices applicable for employment in refrigerating systems.

An object of the invention is to provide an inexpensive but efficient heat exchange structure suitable for employment as an evaporator in refrigerating systems for commercial purposes.

Another object of the invention is to provide a heat exchange device in which preformed fins can easily be assembled or disassembled upon a plurality of tubes or conduits disposed in parallel relation to provide a unitary bank of tubes and fins capable of transferring a large amount of heat from one fluid to the other in proportion to the space occupied by the structure.

Another object of the invention is to provide a unitary heat exchanging unit employing fins and tubes made of different kinds of metal and of securing the fins and tubes together to provide such unit without providing a metallic bond of the soldered or brazed type between the elements thereof as is common in such structures.

Another object of the invention is to provide a heat exchange device in which aluminum fins can be secured upon tubes of different metal to provide a good thermal contact therebetween.

Another object of the invention is to secure parallel fins upon the opposite sides of a row of conduits arranged in parallel relation and in such manner that fin sections on opposite sides of the tube will align with one another to provide a continuous fin unit.

Another object of the invention is to provide spacing members for disposition between fins arranged in parallel relation upon rows of conduits in order that the fins will not rattle or become displaced after once being arranged in the desired position.

Another object of the invention is to employ tubular spacing members upon conduits employed for heat exchanging purposes and by which fin sections disposed upon the opposite sides of the conduits may be secured thereto to provide a relatively efficient thermal contact therebetween.

Another object of the invention is to provide a heat exchanging device consisting of fins and tubes in which the fins are provided with flanged openings for receiving the tubes and in which externally disposed clamping devices are employed for securing the flanged edges of the fins to the tubes.

Another object of the invention is to provide a heat exchanging device embracing fin sections and tubes with the fin sections arranged in pairs and provided with openings having flanges formed laterally thereof which are engaged by clamping devices for securing the fins rigidly against the exterior surface of the tubes.

The embodiment of the invention disclosed for the purpose of illustration comprises a heat exchange unit consisting of a plurality of rows of tubes arranged in parallel relation and with the tubes in each row being parallel to and aligned with the tubes of an adjacent row. In order to provide a large amount of heat exchange surface for conducting heat to or from the tubes, each row of tubes of the unit has a plurality of fin sections disposed on opposite sides thereof and with each fin section provided with openings having flanges extending laterally therefrom and clamped in pairs upon the tubes by clamping sleeves or members disposed upon the tubes before the fins are positioned thereupon. The clamping members may merely engage the flanges of the fins or may extend along the tubes to adjacent fins for spacing one row of fins from another or for engaging in such regions the clamping flanges of such adjacent fins.

Referring particularly to the drawings:

Figure 1 illustrates a fragmentary perspective view of a heat exchanging device embracing the principles of the invention;

Figure 2 is a fragmentary sectional view taken through the heat exchange device substantially in the plane of line 2—2 of Figure 1;

Figure 3 is a cross-sectional view through one of the tubes and is taken substantially on line 3—3 of Figure 2;

Figure 4 is a fragmentary exploded perspective view of one of the fins and tubes embraced in the heat exchange device.

Figures 5, 6, 7, 8 and 9 are fragmentary views of the tubes and fins of heat exchanging devices constructed according to the principles of the invention and illustrating the structures in regions corresponding to that through which Figure 2 is taken.

Figure 10 illustrates a perspective view of a slightly different form of the heat exchanging device embracing the principles of the invention;

Figure 11 is a perspective view of a tube with clamping means arranged thereon such as would be employed in the construction of the heat exchanging device illustrated by Fig. 10;

Figure 12 is a fragmentary cross-sectional view of the heat exchanging device illustrating upon

a larger scale the manner in which the fins and tubes are secured together;

Figure 13 is a plan view of one of the clamping members employed in the structure illustrated by the preceding figure;

Figure 14 is a sectional view through the clamping member illustrated by Fig. 13 as it might appear in the plane of line 14—14 thereon;

Figure 15 is a view illustrating the manner in which the clamping members are applied for securing together the fins and tubes.

Referring particularly to Figures 1, 2, 3 and 4, the invention comprises a heat exchanging unit 16 formed by the arrangement of tubes 17 in parallel relation and in rows 18 and 19 disposed in spaced relation with the tubes of each row aligned with the tubes in an adjacent row. The tubes may be arranged in any other desired relation and any number of such tubes or rows may be employed.

The tubes 17 are connected together at opposite ends or in any suitable relation by separate or integral bends 21.

To each of the rows of tubes, a pair of rows of fins 22 are connected, as in the illustrated structure, the fins 22 are arranged in rows, 24, 25 and 26 with the row 25 arranged between the tubes in the rows 18 and 19 and contacting therewith. The fins in the different rows are arranged in any suitable manner as, for example, in alignment with one another to provide continuous or composite fins 27.

The fins 22 each are provided with a plurality of openings or recesses from which flanges 31 project laterally from the fins, as is disclosed by any of the figures of the drawings from 2 to 9. As is disclosed by Figures 3 and 4, the opposite extremities of the flanges are cut off, as is indicated at 32 in order to provide spaces between the flange ends and the edges of the fins. Each of these fin openings is adapted to receive somewhat less than half of one of the tubes 17, thus providing spaces 33 between pairs of the fins on opposite sides of the tubes and, by reason of the flange ends terminating a short distance from the edges of the fins, considerably greater spaces 34 are provided between the adjacent ends of the flanges 31 on adjacent fins.

As is indicated by Figures 2 and 4, the fins 22 are assembled in pairs upon the pipes 17 by employing fastening sleeves or members 36 having flanges 37 formed at opposite ends thereof under which the flanges 31 of the fins 22 are securely clamped by lateral movement of the fins or sleeves upon the tubes. The central portions of the fastening members 36 closely fit the tubes 17 and likewise hold the flanges 31 of the fins in good thermal contact with the tubes.

Tubular spacing sleeves or members, such as that indicated at 38, may be employed between the rows of fins secured to the tubes by the fastening members 36 to insure against the possibility of the fins becoming loosened or disengaged from beneath the flanges of the fastening members. It is to be understood that these spacing members may be eliminated when not required.

As is illustrated by Figure 5, fastening members such as that indicated at 39 and provided with securing flanges 41 only at one of the ends thereof may be employed for securing the fins upon the tubes. With such fastening members the fins are all secured upon the tubes with the flanges 31 extending in the same direction and the fastening members not only serve for securing the fins upon the tubes but serve as spacing members between the succesive rows of fins.

As is illustrated by Figure 9, fastening members such as that indicated at 42 may be employed with flared flanges 43, in order to permit the fins and tubes to be more easily assembled.

As is indicated by Figure 6, the fastening members may be formed as tapering tubes indicated at 46, the larger ends of which are substantially equal to the fin flanges 31 in diameter, and the smaller ends approximately fitting the tubes 17. In such structure the fastening members also are employed, if desired, as spacing members between the several rows of fins upon the tubes.

In the structure illustrated by Figure 7 the fastening members are formed of sleeves 47 of substantially the same diameter from one end thereof to another and just large enough to receive the flanges 31 of the fins thereunder and to tightly clamp the latter against the tubes 17.

In the structure illustrated by Figure 8 the fins 22 are secured upon the tubes 17 by annular rings 48 which may be pressed upon the flanges 31 as are the sleeves disclosed by the other figure.

In the structure illustrated by Figs. 10 to 15 inclusive the fins 22 also are secured in rows upon the conduit or tube 17 with a row of fins on each side of a plurality of parallel sections formed by bending the tube as is illustrated in Fig. 11. The fin sections in the rows on opposite sides of the conduit sections are likewise disposed in alignment to provide a plurality of composite fins 27 extending across the tube sections in perpendicular relation thereto. The fin sections 22 employed in this structure embrace the flanges 31 formed adjacent the edges thereof around substantially semi-circular openings for receiving between two adjacent fins the sections of the tube 17.

The fins in this instance are secured upon the tube sections by the employment of clamping members 51 which consist of arcuate, annular members or rings, the inner edge portions of which are just large enough to receive therein the flanges 31 formed on an adjacent pair of the fins 22. The outer edges of the rings 51 are of considerably greater diameter than the inner edges thereof and can be forced across the neutral axis of the rings by the application of tools such as are indicated at 52 and 53 in Fig. 15.

In applying one of the rings 51 a pair of fins 22 is disposed in opposite relation upon a section of the tube 17 with the flanges 31 of the fins disposed in contact with the tube on opposite sides thereof. The tool 53 is then clamped upon the tube section on the side of the fins 22 opposite the flanges 31 and one of the rings is placed over the flanges with the outer edge of the ring disposed more remotely from the fins than the inner edge thereof. The tool 52 is then placed upon the conduit 17 with the operating surface thereof engaging the outer edge of the ring 51 and by applying pressure to or by striking the tool 52 the material of the ring at the outer and inner edges thereof is expanded and contracted respectively as the outer edge of the ring moves across the neutral axis thereof and engages the surface of the fins as is indicated in Fig. 12.

When placing the ring upon the flanges 31 the inner edge thereof is so located relative to the

fins 22 that the outer edge of the ring will engage the surface of the fins before the internal stresses created by moving one edge of the ring across the other are relieved. Under such conditions the stresses within the ring tend to clamp the flanges 31 tightly against the tube section 17 to provide a good thermal contact between the tubes and fins and to secure the latter rigidly in position.

As is illustrated by Fig. 11, the heat exchange device may be constructed by first bending the tube 17 in any suitable manner to provide the required number of aligned sections therein and after which the rings 51 are threaded upon the tube sections until each section supports as many rings as fin sections are to be applied to one side thereof. The fins are then properly arranged upon the conduit or tube section and after the rings 51 are moved in proper position upon the flanges 31 of the fins the tools 52 and 53 are employed as heretofore described in securing the fins rigidly in position.

In all of the structures illustrated the fastening members are adapted to be pressed upon the flanges 31 as is indicated at 49 in Figure 3, to slightly flatten the fastening members in the regions opposite the spaces between the adjacent ends of the fin flanges 31. Thus flattened the fastening members apply an extremely large force against the ends of the flanges of the fins and thus hold the fins securely against displacement on the tubes 17. By such expedient all portions of the fin flanges are pressed tightly enough against the tubes 17 to provide a good thermal contact therebetween, while the ends of the flanges are pressed much harder against the tubes to insure against dislocation of the fins. In assembling the fins upon the tubes, the sleeves or fastening members may be threaded upon the tubes prior to the bending of the latter and the fins assembled or secured in position in pairs, or, all the fins may be secured together simultaneously by pressing the fins all in the same direction against a rigid abutment or stop.

While the structures as herein disclosed constitute preferred forms and applications of the invention, it is to be understood that numerous other modifications and equivalent structures are within the scope of the invention as defined by the accompanying claims.

We claim:—

1. A heat exchange device comprising a pair of oppositely disposed fins having flanged openings formed in the adjacent edges thereof, the flanges of said fins terminating in spaced relation with the edges thereof, a tube extending through a pair of said openings between said fins and a tubular member surrounding said flanges and tube for holding said flanges in contact with said tube and for pressing the ends of said flanges rigidly against said tube for preventing displacement of the fins thereon.

2. A heat exchange device comprising a pair of fins having flanged openings formed therein, a tube extending through said flanged openings, a spacing member surrounding said tube, and disposed between said fins, said spacing member being adapted to engage the flanges of said fins for securing the latter rigidly against said tube.

3. The method of constructing heat exchange devices which comprises forming upon a fin a flange for supporting the fin upon a tube, thereafter bringing said flange into thermal contact with the tube, inserting over said tube and flange an annular ring having an outer edge portion disposed at one side of an inner edge portion thereof and with said outer edge portion at a greater distance from said fin than the inner edge portion thereof, and then compressing said flange against said tube by forcing the outer edge of said ring across the neutral axis thereof and into engagement with said fin.

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