

Dec. 18, 1962

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3,068,905

EXTENDED SURFACE FINS FOR HEAT EXCHANGE TUBES

Filed March 28, 1960

3 Sheets-Sheet 1

Fig. 1.

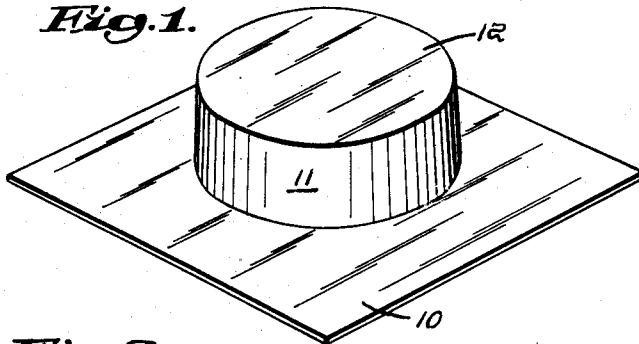


Fig. 2.

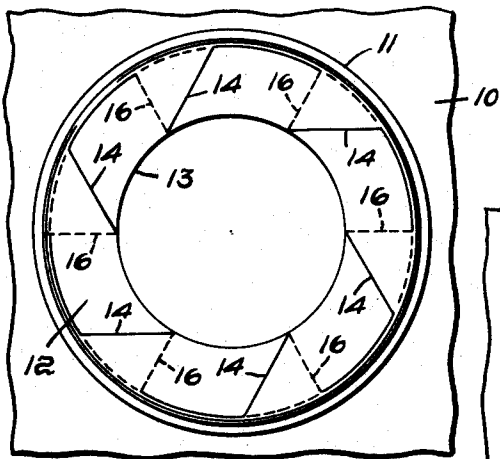


Fig. 3.

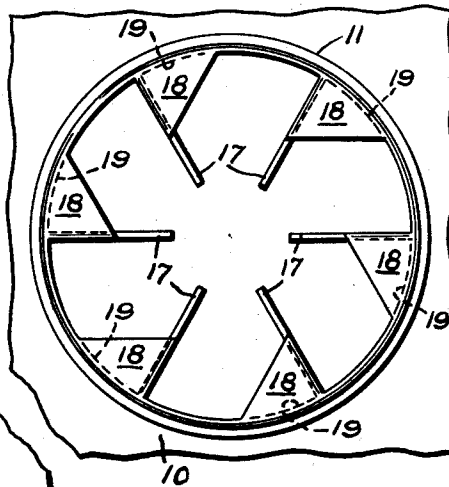
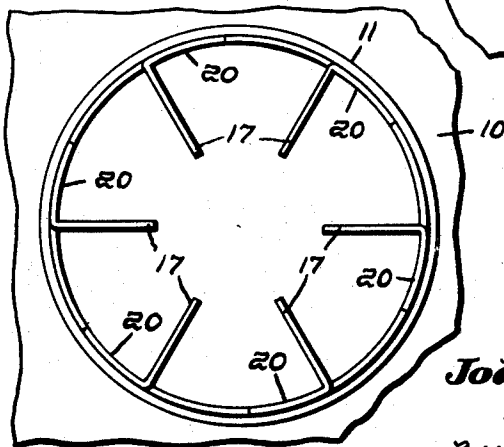


Fig. 4.



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Fig. 5.

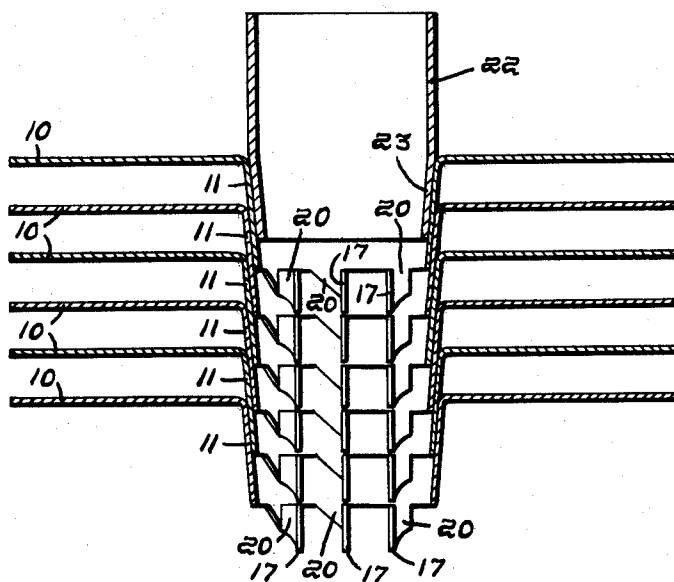
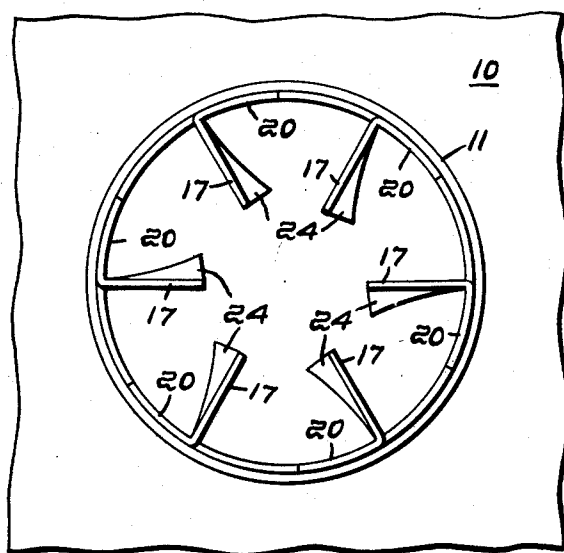


Fig. 6.



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Fig. 7.

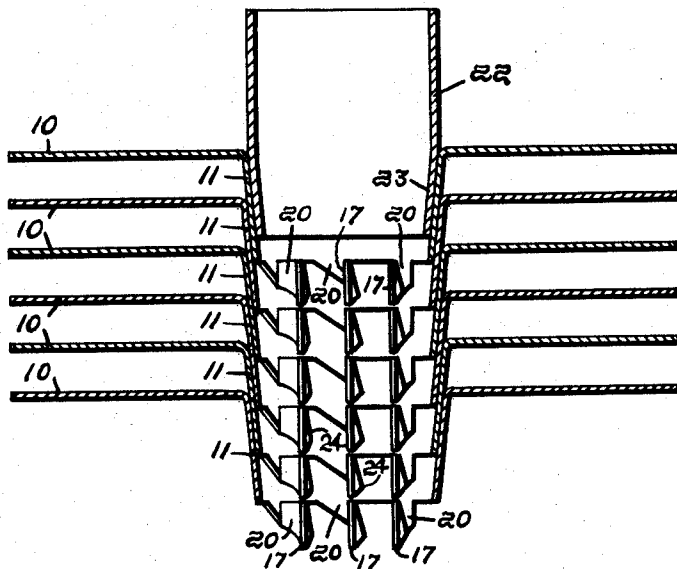
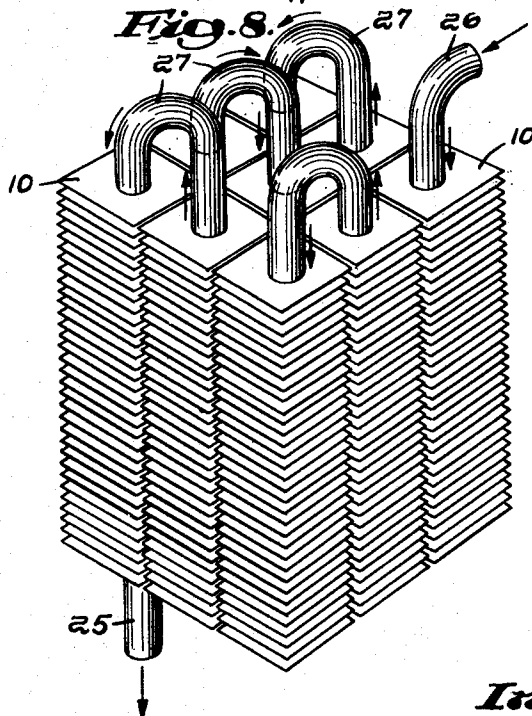


Fig. 8.



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EXTENDED SURFACE FINS FOR HEAT EXCHANGE TUBES

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2 Claims. (Cl. 138—38)

This invention relates to heat-exchange tubes having internal and external, extended surface fins.

It has been proposed as disclosed in the U.S. Patents Nos. 1,718,361; 1,810,215; 2,065,515 and 2,212,242 to form an externally-finned, heat-exchange tube by providing tapered flanges, circular in section, on fins, and to place the small end of the tapered flange on each fin into the large end of the tapered flange on an adjacent fin, the contacting flanges then being joined as by brazing.

This invention adds to an externally-finned tube so constructed, internal fins. In one embodiment of this invention, this is accomplished by forming the tapered flanges as cups, the bottoms of which have central, circular portions removed, the remaining bottom portions being slit and then bent to form internal fins. The external and internal fins increase heat transfer, and enable the sizes of heat-exchange coils to be greatly reduced.

While heat-exchange tubes having both external and internal fins have previously been proposed, the internal fins have been formed by grooving the inner surfaces of the tubes, or by placing separately formed fins within the hollow tubes. This invention greatly reduces the cost of manufacturing internally-finned tubes.

An object of this invention is to increase the heat transfer of a heat-exchange tube.

Another object of this invention is to reduce the cost of manufacturing internally-finned, heat-exchange tubes.

Another object of this invention is to reduce the sizes of heat-exchange tubes.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a projected view of a fin having a tapered flange formed as a cup according to this invention;

FIG. 2 is an enlarged, fractional, top plan view of the fin of FIG. 1, showing a central, circular portion removed from the bottom of the cup, and showing the remainder of the bottom of the cup as being slit preparatory to forming internal fins;

FIG. 3 is a view similar to FIG. 2 except that the slit portions are bent inwardly along radial lines;

FIG. 4 is a view similar to FIG. 3 except that peripheral portions of the cup bottom are bent outwardly so as to bring the radially bent portions outwardly;

FIG. 5 is a fragmentary side view, partially in section, of a heat exchange tube formed from the fins of FIG. 4;

FIG. 6 is a view similar to FIG. 4 except that the radially extending, inner fins have outer portions turned out of radial lines;

FIG. 7 is a fragmentary side view, partially in section, of a heat exchange tube formed from the fins of FIG. 6, and

FIG. 8 is a projected view of a heat exchanger formed from the tubes of FIG. 5 or 7.

At the start of the tube forming operation, the necessary number of flat, sheet metal, fin blanks are cut from stock, and then formed, as by drawing, each to have a tapered flange 11 formed as a cup having a circular bottom 12 at the center of a flat outer portion forming an external fin 10 as shown by FIG. 1.

Next, as shown by FIG. 2, each cup bottom 12 around a concentric circle 13, is slitted along equally spaced-apart lines 14 which depart about 30° from tangents to

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the circle 13. The cup bottom portion within the circle 13 is then removed although this may be done before the remainder of the cup bottom is slitted.

The cup bottom portions at the slits are then bent along radial lines 16 of FIG. 2, radially inwardly to form radially extending, inner fins 17 of FIG. 3, the remainder of the cup bottom portions 18 remaining as shown by FIG. 3.

Next, the cup bottom portions 18 are bent along peripheral lines 19 of FIG. 3 to form substantially cylindrical segments 20 of FIG. 4. This moves the fins 17 on the cup bottom portions 18 outwardly as shown by FIG. 5. The flange now has at its outer end, spaced-apart, circular, peripheral portions, with portions 20 between its circular portions, extending outwardly beyond the cup bottom, and having radially extending fins 17.

The fins are then assembled as shown by FIG. 5, with the outer ends of tapered flanges 11 inserted within the inner ends of adjacent flanges 11, and forced together to fit snugly. An outer flange 11 at one end of a formed tube has a pipe section 22 with a tapered inner end 23 fitted in the outer flange at that tube end as shown by FIG. 5.

The tapered end 23 of the pipe section 22 is then brazed or otherwise suitably secured to the outer flange 11 at that tube end, and the inner flanges 11 are likewise attached to each other for forming a leak proof tube with good heat exchange contact at its joints, the tube having external fins 10 and internal fins 17.

It may be desired to generate turbulence in the fluid flowing through such a tube as for removing insulating films of fluid from inner fins. This can be accomplished by causing the lines 16 of FIG. 2 to depart from radial lines, or, as shown by FIG. 6, the inner fins 17 which extend radially on FIGS. 4 and 5, may have portions 24 bent away from the remaining radial portions. FIG. 7 shows a tube assembly having internal fins with the non-radial portions 24 of FIG. 6.

FIG. 8 shows an assembled heat exchanger using the tubes of either FIG. 5 or FIG. 7. A pipe 25 at one end of the heat exchanger forms a fluid outlet. A pipe 26 at the other end of the heat exchanger forms a fluid inlet, and return bends 27 at both ends of the heat exchanger connect adjacent tubes as is conventional.

What is claimed, is:

1. A heat exchange tube comprising a generally cup-shaped flange having a circular open top and having a circular bottom concentric with said top, said flange having extending outwardly beyond said bottom, a plurality of spaced-apart portions formed substantially as segments of a cylinder concentric with said flange and forming extensions of said flange, said bottom having between said portions peripheral edges only, said spaced-apart portions having inner fin portions extending radially therefrom towards the axis of said flange, whereby said bottom except for said inner fin portions is open.

2. A heat exchange tube as claimed in claim 1 in which said inner fin portions have portions extending at angles to radial lines.

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