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TURBULENCE STRIP FOR HEAT EXCHANGERS

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The present invention relates to turbulence and internal fin strips adapted to be placed in flattened tubes in order to greatly increase heat exchange between the fluid passing through the tubes and the tubes without greatly increasing the resistance offered to the passage of the fluid through the tubes.

An object of the present invention is to provide means whereby certain well known temperature controlling devices for the oil of an internal combustion engine may be more efficiently served or for low conductivity fluids such as ethylene glycol.

Another object of my invention is to enable the use of lighter gauge tube walls by forming a multiplicity of connections between the flat sides of the tubes.

My improved strips are particularly adapted for use where a large number of strip equipped tubes are associated with a few open tubes having common fins so heat exchange takes place between the low and high resistance tubes through the fins.

To these and other useful ends, my invention consists of parts, combinations of parts, or their equivalents, and mode of operation, as herein-after set forth and claimed and shown in the accompanying drawing in which:

Fig. 1 is a diagrammatic drawing of a section through a full size fraction of a tube taken in line with the flat sides of the tube.

Fig. 2 is a diagrammatic drawing of a transverse section of the tube shown in Figure 1, taken on lines 2—2 of this figure.

Fig. 3 is an enlarged section taken on line 3—3 of Figure 4, the strips being shown in plan.

Fig. 4 is a transverse section taken on line 4—4 of Figure 3.

Fig. 5 is a section taken on line 5—5 of Figure 4.

Fig. 6 is a section of the strip taken on lines 6—6 of Figure 3.

As thus illustrated, the tube is designated by reference numeral 10 and the strip in its entirety is designated by reference character A. Tube 10 is flattened as illustrated in the various figures, the edges being curved as shown in Figure 4.

Member A comprises a strip 11 formed preferably from copper or brass having its edges hemmed or flanged as at 12—12 in order to strengthen the body of the strip. Strip 11 is cut in spaced relation as at 13, the cuts extending from line 14 to a line 15 where the strip ends are cut free so these strips, which are desig-

nated by numerals 16 and 17 may be bent in opposite directions at an angle to the strip as clearly illustrated in Figure 6.

The free ends of the strips are slightly curved as at 18 and the ends being slightly wider apart than the inside width of the tube so when the strip is pulled into the tube, as shown in the figures, these ends will lie substantially flat against the sides of the tubes (see Figure 5).

In some strips, it has been found necessary to allow the width of a strip through its center as at 19; thus to increase the strength of the strip but these omitted portions as indicated, are alternately positioned so there is no straight through passageway through the tube for the width of a strip.

Before the strips are pulled into the tubes, the interior surface of the tube is preferably tinned and under some circumstances, the strip itself is tinned so that when it is in position in the tube, heat may be applied to the exterior of the tube sufficient to bond the ends of the wings to the walls of the tube; thus to make a better heat exchange contact between the strips and the tubes.

In experimental tests, it has been found that the device works more efficiently if the fluid passes through the tubes in the direction indicated by arrow in the figures so the fluid is caused to impinge the walls of the tubes adjacent the ends of the wings.

The straight passageways left at the edges of the tubes as at 20 are so near the wings and the area of these surfaces so small that the oil being diverted at such short intervals by the adjacent wings will be caused to flow out into this open space and thus cause the oil in this space to impinge the wall of the tube at frequent intervals.

Clearly wings of the type shown would not be efficient if very wide; however they are narrow and closely spaced longitudinally thus to secure the greatest heat exchange between the fluid and tubes.

By scrutinizing the figures, it will be seen that I have provided a very efficient easily manufactured at low cost strip for flattened tubes; that the ends of the wings may be bonded to the flat sides of the tubes and that after the strips are in position and bonded, they will be permanently held into position and the area of fluid contact for heat exchange is greatly increased and the strength of the sides of the tubes greatly increased. With my improved strip, the heat exchange capacity of the fluid in the tube may be stated as approximately equal to the heat ex-

change capacity between the exterior fins and blast of air in contact therewith.

Having thus shown and described my invention, I claim:

1. A device of the character described, comprising a uniformly flattened tube for its length, a metal strip within said tube having substantially the length and inside width thereof, said metal strip having two rows of longitudinally spaced portions cut free on three sides from the strip and in the same direction, and being arranged so the portions are in transverse alignment but zig-zagged longitudinally, said portions being cut transversely into a number of narrow strips and being extended at an obtuse angle alternately on opposite sides of the metal strip.

2. A device of the character described, comprising a uniformly flattened tube, a metal strip within said tube having substantially the length and inside width thereof, a number of groups of longitudinally spaced, transversely arranged, groups of narrow strips, cut free on three sides

5 from the metal strip and in the same direction without removing material, alternate strips transversely being bent at an obtuse angle on opposite sides of the metal strip, whereby their ends yieldingly contact the side walls of the tube, the narrow strips on the same side of the metal strip being zig-zagged longitudinally.

3. A device of the character described, comprising a flattened tube, a metal strip within said tube having substantially the length and inside width thereof, a number of longitudinally spaced, transversely arranged, groups of narrow strips, cut free in the same direction from the metal strip without removing material, alternate strips transversely, being bent at an obtuse angle on opposite sides of the metal strip, whereby their ends yieldingly contact the side walls of the tube, the narrow strips on the same side of the metal strip being zig-zagged longitudinally and the ends 10 of said narrow strips being bonded to the side walls of the tube.

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