

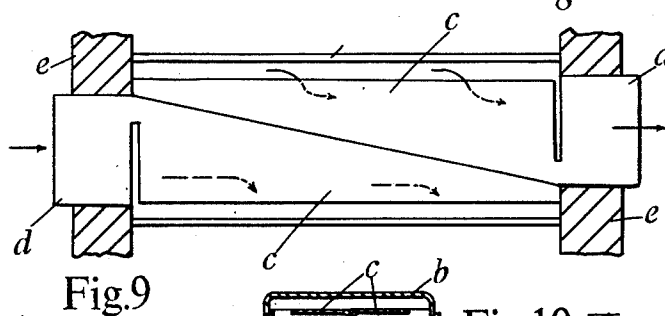
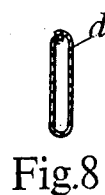
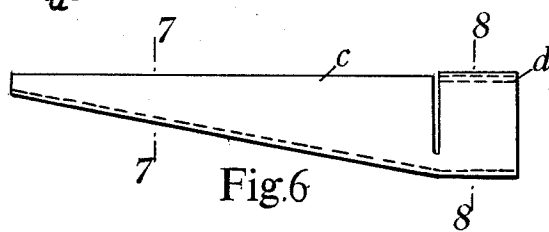
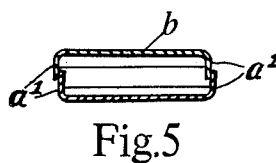
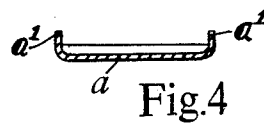
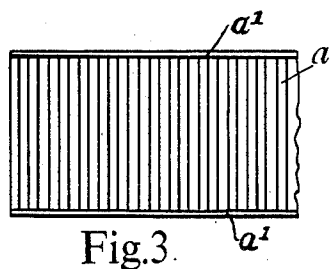
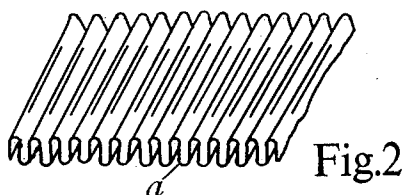
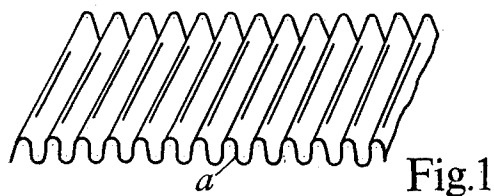
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HEAT INTERCHANGE APPARATUS

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HEAT INTERCHANGE APPARATUS

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1 Claim. (Cl. 138—38)

1

This invention relates to apparatus for effecting interchange of heat between two fluids, and more particularly for use with internal combustion engines, the apparatus being of the type comprising an assembly of tubes such that one of the fluids can flow through the tubes and the other between the tubes. The object of the invention is to provide an improved tube construction.

In the accompanying drawings:

Figure 1 is a perspective view showing in a preliminary state a portion of a transversely corrugated thin metal strip used in the construction of a tube made in accordance with the invention.

Figure 2 is a similar view to Figure 1, showing the condition of the strip, after the endwise compression for narrowing the corrugations.

Figure 3 is a plan of a portion of one half of a tube made from the strip shown in Figure 2, and Figure 4 is a cross section of the same.

Figure 5 is a cross section of the completed tube.

Figure 6 is a plan of one of a pair of similar core pieces to be placed in the tube, and Figures 7 and 8 are respectively cross sections on the lines 7—7, 8—8, Figure 6.

Figure 9 is a sectional plan and Figure 10 a cross section of a tube with the core pieces in position.

In the embodiment of the invention illustrated by the drawings, each tube is made from a pair of transversely corrugated thin metal strips as *a*. In one example the thickness of the strip is about 0.1 mm. Across each strip are formed narrow corrugations. In the first stage of manufacture the corrugations are relatively coarse as shown in Figure 1. The strip is then subjected to endwise compression for narrowing the corrugations as shown in Figure 2. In this condition the corrugations are about 1 mm. pitch and about 2 mm. deep. The strip may be of any desired width and length, a convenient width and length being about 25 mm., and 80 mm., respectively. Each strip is then flattened and flanged at *a'* along its edges as shown in Figures 3 and 4, and two such strips are then united at the flanges by copper welding, soldering or otherwise to form a flat-sided tube *b* as shown in Figure 5.

Within the tube is secured a hollow two-part core which is made from thin sheet metal and is adapted to extend beyond both ends of the tube to form fluid inlet and outlet connections. Each core part *c* is shaped to the form shown in Figures 6, 7 and 8. At one end it has the form of a flat tube *d* adapted to extend beyond one end

2

of the corrugated tube. Along the portion of its length which extends as nearly as possible along the whole length of the corrugated tube the said part is of tapered form, the oblique and closed edge of this part coinciding with a diagonal line of the corrugated tube, and the other edge being open as shown in Figure 7. When in position as shown in Figures 9 and 10 the closed edges of the two core parts are contiguous or closely adjacent, and the open edges respectively lie immediately adjacent to the longitudinal edges of the corrugated tube.

The arrangement is such that the fluid entering, say, the left hand end of one part of the core as shown in Figure 9, emerges at the open edge and thence flows in thin parallel streams from one edge of the enclosing tube to the other by way of the passages formed by the corrugations. On reaching the opposite edge the streams unite and enter the open edge of the other core part and then pass along this part to outlet at the right hand end.

The required heat interchange apparatus is built up from a number of the abovedescribed tubes which are arranged parallel with and closely adjacent to each other so that the external surfaces of the corrugations form passages for the other fluid, the tubular ends of the cores being carried by plates *e* forming parts of headers or ducts for the fluid flowing through the tubes.

When the two fluids to be dealt with are both gases, one of them is air and this flows through the tubes, and hot gas, which may be the combustion products from an engine, being caused to flow through the passages between the tubes. The tube assembly may be exposed to the atmosphere or it may be mounted in an air duct. In this form, the apparatus may be used for preheating the air to be supplied to the combustion chamber of a prime mover.

The invention is not, however, restricted to the example above described, as the mode of construction may be modified to suit different requirements. Thus, instead of making each tube from a pair of corrugated strips it may be made in part from a single corrugated strip forming one side of the tube, the core being adapted to form the other side of the tube.

Further the invention is capable of being applied to apparatus for a variety of purposes, such as the cooling of engine jacket water, for cooling or warming lubricating oil, or for any other use in which heat interchange is required between two fluids either or both of which may be a gas or a liquid.

3

An essential condition of the invention is that the cross section of the transverse corrugated passages through which the fluids are required to flow in parallel shall be such as will ensure as nearly as possible laminar or stream line flow in the passages, thus enabling high efficiency to be obtained in an apparatus of compact form.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

A heat interchange tube having at least one of its sides transversely corrugated over the whole of its length and having a core comprising a pair of similar hollow tapered parts which lie in contact with the corrugations in said tube, and which at opposite ends respectively form a fluid inlet at one end of said tube and a fluid outlet at the other end of said tube, said hollow parts having a pair of closed and inclined longitudinal edges in closely adjacent relationship, and

4

having opposite longitudinal edges open to the interior of said tube and in communication with opposite ends of the passages formed by said corrugations, so that fluid entering said inlet and flowing through the open edge of the corresponding hollow part is caused to flow in parallel streams through said passages before passing into the other hollow part through the open edge thereof, and thence to said outlet.

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