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HEAT EXCHANGE ELEMENT

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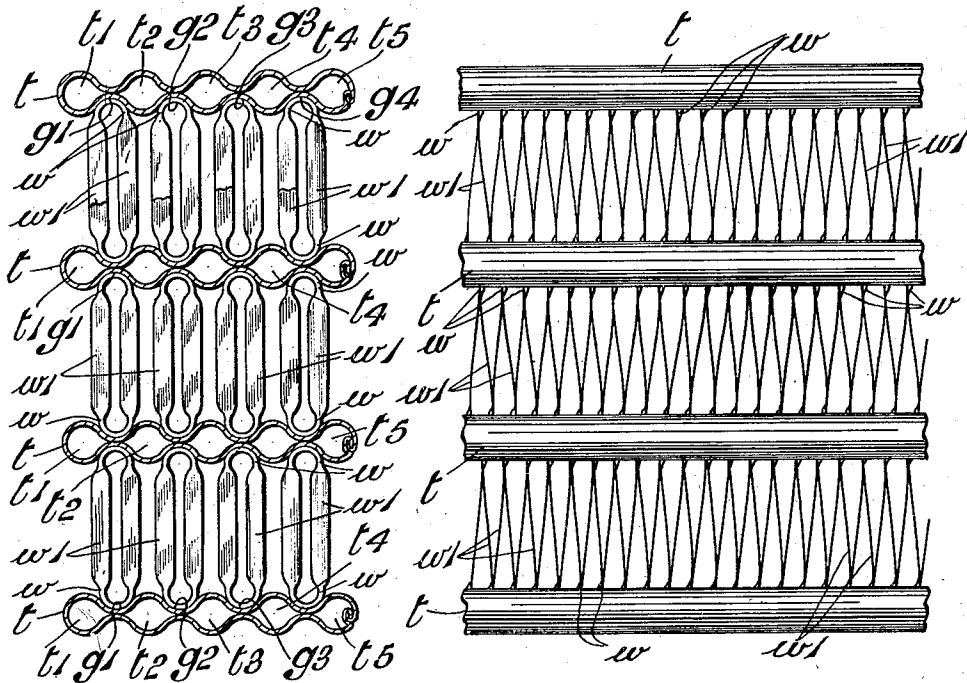


FIG. 1.

FIG. 2.

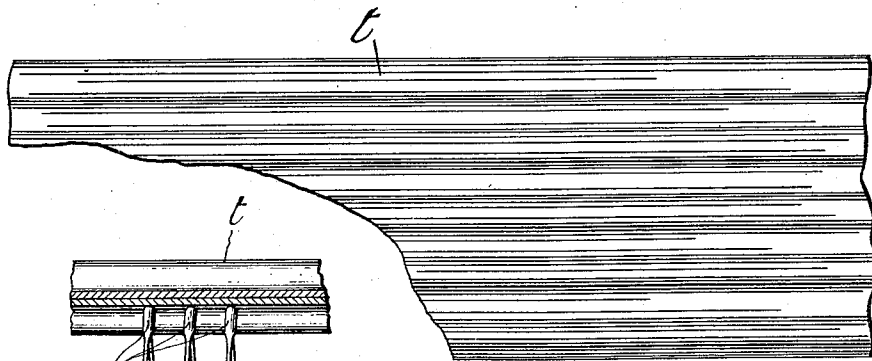


FIG. 4.

FIG. 3.

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UNITED STATES PATENT OFFICE

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HEAT EXCHANGE ELEMENT

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9 Claims. (Cl. 257—263)

This invention relates to a heat exchanger comprising a multiplicity of tubes arranged parallel to each other and through which passes a fluid of which the heat is to be exchanged, and a multiplicity of metal strips extending between and secured to the tubes, and over which passes a second fluid of which the heat is to be exchanged with that of the first fluid. The main object of the invention is to provide a heat exchanger of high efficiency and low cost of production.

The metal strips may be zig zag coils of flattened wire comprising flattened strips of metal bent backwards and forwards in zig zag manner, thus forming flat straight portions connected by round wire portions bent to form the zig zag or they may be formed of flat strips connected by U-shaped portions of round cross section.

In the operation of the device, fluid at a certain temperature flows through the tubes and fluid at another temperature passes over their surface, the said surface including the coils of flattened wire or strip metal which act as fins to extend the surfaces of the tubes. The fins either absorb or give out heat, depending upon the temperatures of the fluids in and around the tubes.

A manner of carrying out the invention is illustrated by the accompanying drawing which illustrates a portion of an interchanger made in accordance with the invention, Figure 1 being a transverse section or end view, Figure 2 a front elevation, Figure 3 a plan, and Figure 4 a view on an enlarged scale of a portion of Figure 2, the ends of each flat portion *w* being connected by a bent portion *w* of round cross section to the adjacent end of the next flat portion *w*, that is each flat portion *w* is continuous with a portion *w* of round cross section, the adjacent flat portions being at an angle to one another. The flattened tubes are shown at *t* and the flattened coils of wire at *w*. These coils of wire are of open pitch so as to appear as a zig zag wire in Figure 2, while in end view they appear as ovals with flattened sides. The coils *w* extend from one flattened tube *t* to another parallel thereto, there being any convenient number of such parallel tubes.

In the example illustrated, each parallel tube *t* has parallel grooves *g*1 to *g*4 arranged longitudinally in its opposite surfaces, and these divide the tube into a number of smaller parallel tubes *t*1 to *t*5 which may be soldered together or connected together in any other suitable manner, and they may be made of thin copper or brass and if desired of tinned surfaces.

The parallel grooves in one flattened tube *t* are arranged opposite to those in the next parallel

tube *t*. The coiled wire at the opposite bent portions of each coil extends into the opposite grooves of the series *g*1 to *g*4, and these ends are left as round wire *w* while the sides of the ovals are flattened to form vanes *w*1 placed with their flat surfaces at right angles to the tubes *t*. The round portions *w* are preferably soldered in the grooves *g*1 to *g*4.

It will thus be seen that the flattened wire of the coils of open pitch offer the least possible resistance to the air or fluid flowing over them and greatly increase the heat transfer surface of the tubes.

It will thus be seen that the invention comprises broadly a heat interchanger for transferring heat from one fluid to another comprising tubes to which are attached a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, the flat surfaces of the wires of each coil being held between adjacent tubes, parallel to the flow of fluid and perpendicular to the tubes through which the other fluid passes.

The open pitch referred to means that the coils of wire are not closely wound, but that the convolutions are spaced apart to form oppositely disposed angular openings for the passage of one of the fluids.

In the operation of the device, a fluid at one temperature is circulated in the multitude of channels extending at right angles to the tubular members, this fluid, in its course, circulating about all portions of the helices or coils and contacting with a surface of the tube forming member. A second fluid at a different temperature is circulated through the plurality of tubes or channels of the tube members through which a constant circulation of a fluid at a different temperature is maintained. The heat in one of the tube members will thus be rapidly conducted by the metal of the two elements to the other fluid which, by reason of its being circulated, will remove the heat thus transferred.

The construction of the device is such as to conduct heat to or from the helices constituting the fins from or to two adjacent tubular elements, thus permitting a more effective transfer of heat with a reduced volume of the fluid circulated through the tubes.

By a device embodying the invention, there is a constant circulation of the entire volume of the two fluids which will minimize likelihood of that fouling of either of the elements which might interfere with the conduction of heat from one

element to the other by reason of accumulated sediment in the tubes.

The helices themselves may be made of non-corrosive material or be coated with such material in a manner to avoid the accumulation of a surface coating upon the fins which would also interfere with the absorption of heat from the fluid being circulated about said fins. The manner of combining the two elements and the form of each is such as to permit the convenient production of each element, and the assembly of the two elements in a manner to provide a permanent contact area between the two elements sufficient to ensure a rapid transfer of the heat from one element to the other, and therethrough from one circulating fluid to the other.

The particular manner of forming and combining the two elements is immaterial to the invention. The flattened wire forming the fins may be conveniently and rapidly produced. By positioning the flat edge of each fin in the manner shown and described, and by using a helix of considerable pitch, there will be very little resistance to flow of fluid over all portions of the flat surface of the fins.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawing, nor to the manufacturing methods employed, it being obvious that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. A heat interchanger for transferring heat from one fluid to another comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, the flat surfaces of the convolutions being held parallel to the flow of the fluid between the oppositely disposed broad sides of a multiplicity of pairs of flattened tubes through which the other fluid passes.

2. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, a multiplicity of oppositely disposed parallel pairs of flat sided tubes grooved longitudinally and through which tubes the other fluid passes, the flat surfaces of the convolutions being held parallel to the flow of the fluid in the oppositely disposed grooves.

3. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, a multiplicity of oppositely disposed parallel pairs of tubes each tube having oppositely grooved sides which when placed together form on the inside a number of smaller parallel tubes through which the other fluid passes, and on the outside a number of parallel grooves in which the coils are secured so that the flat surfaces of the convolutions are held parallel to the flow of the fluid between the oppositely disposed sides of the pairs of tubes.

4. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, the flat surfaces of the convolutions being held

parallel to the flow of the fluid between the oppositely disposed broad sides of a multiplicity of pairs of flattened tubes through which the other fluid passes, the portions of each convolution of each coil positioned between the flattened tubes being flattened so as to provide enlarged surface areas extending transversely of said tubes and narrow edges presented in the direction of the flow of the fluid, the portion of each convolution engaging the tube not being flattened.

5. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, a multiplicity of oppositely disposed parallel pairs of tubes each tube having oppositely grooved sides which when placed together form on the inside a number of smaller parallel tubes through which the other fluid passes, and on the outside a number of parallel grooves by which the flat surfaces of the convolutions are held parallel to the flow of the fluid between the oppositely disposed sides of the pairs of tubes, the portions of each convolution of each coil positioned between the flattened tubes being flattened so as to provide enlarged surface areas extending transversely of said tubes and narrow edges presented in the direction of the flow of the fluid, the portion of each convolution engaging the tube not being flattened.

6. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, the flat surfaces of the convolutions being held parallel to the flow of the fluid by solder between the oppositely disposed broad sides of a multiplicity of pairs of flattened tubes through which the other fluid passes.

7. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, a multiplicity of oppositely disposed parallel pairs of tubes each tube having oppositely grooved sides which when placed together and connected by solder form on the inside a number of smaller parallel tubes through which the other fluid passes, and on the outside a number of parallel grooves by which the flat surfaces of the convolutions are held parallel to the flow of the fluid between the oppositely disposed sides of the pairs of tubes.

8. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, the flat surfaces of the convolutions being held parallel to the flow of the fluid between the oppositely disposed broad sides of a multiplicity of pairs of flattened tubes of tinned sheet metal through which the other fluid passes.

9. A heat interchanger for transferring heat from one fluid to another, comprising a multiplicity of coils of flattened wire of open pitch over which one of the heat interchanging fluids passes, the flat surfaces of the convolutions being held parallel to the flow of the fluid between oppositely disposed lateral series of adjacent tubes through which the other fluid passes.

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