E. L. PEASE.

HEAT INTERCHANGING APPARATUS.

APPLICATION FILED MAR. 1, 1917.

1,291,632.

Patented Jan. 14, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

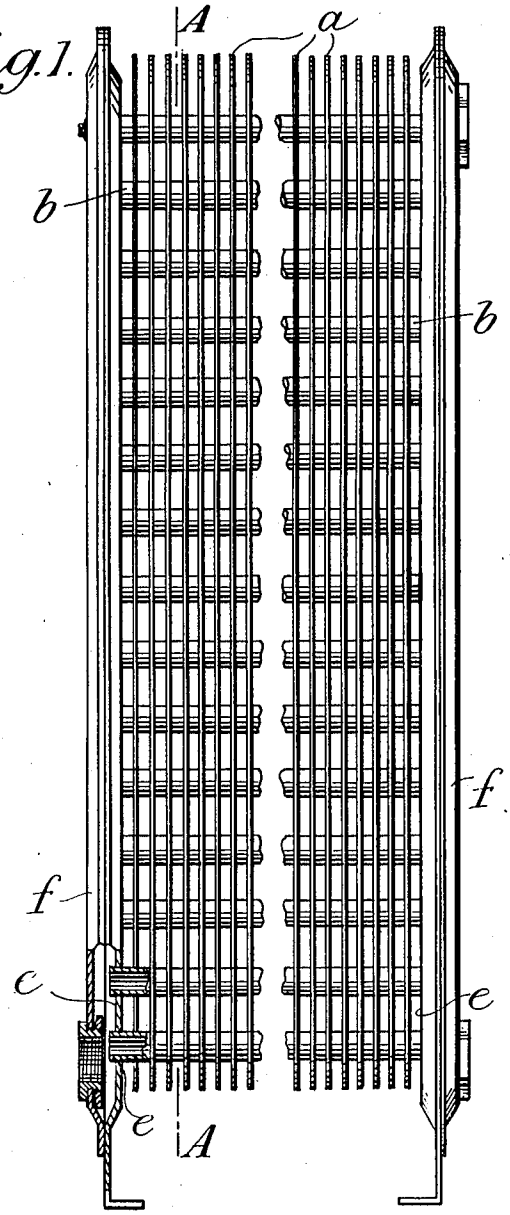
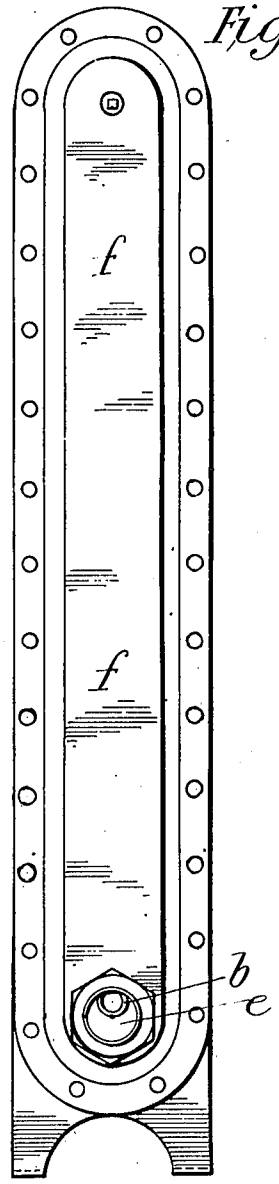


Fig. 2.



Inventor

Edward Lloyd Pease

By Davis & Davis

Attorneys

E. L. PEASE.

HEAT INTERCHANGING APPARATUS.

APPLICATION FILED MAR. 1, 1917.

1,291,632.

Patented Jan. 14, 1919.

2 SHEETS—SHEET 2.

Fig. 3.

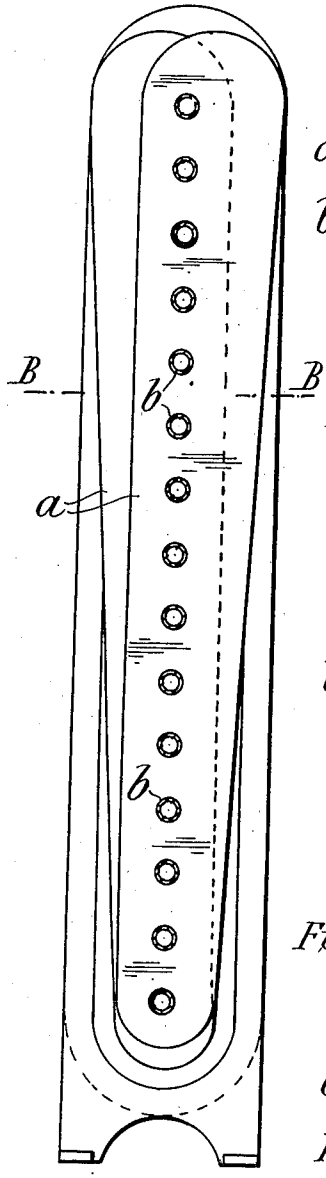


Fig. 6.

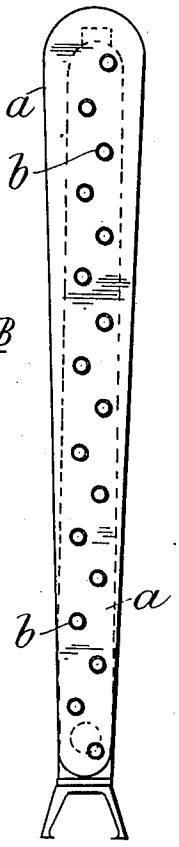


Fig. 7.

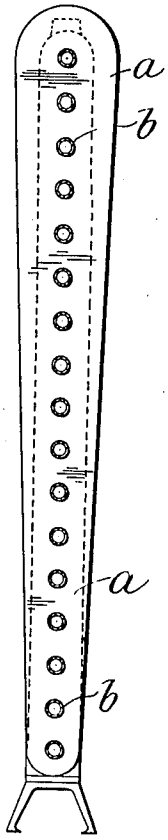


Fig. 8.

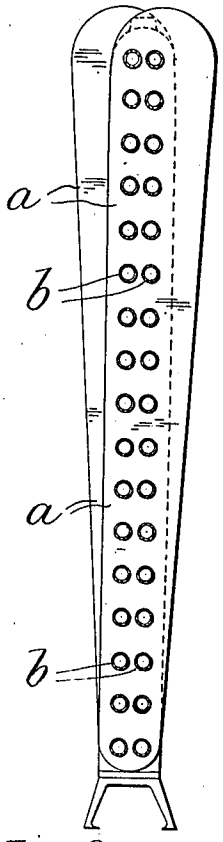


Fig. 4.

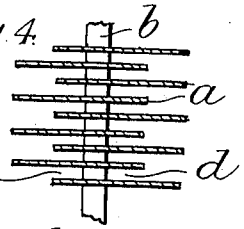


Fig. 5.

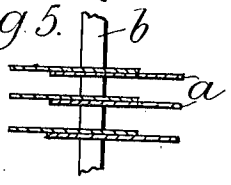
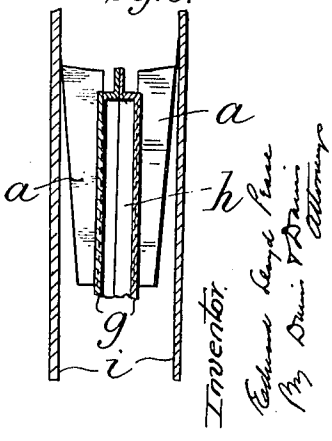


Fig. 9.



Inventor.

Edward Lloyd Pease

By Davis & Davis

Attorneys

UNITED STATES PATENT OFFICE.

EDWARD LLOYD PEASE, OF DARLINGTON, ENGLAND.

HEAT-INTERCHANGING APPARATUS.

1,291,632. Specification of Letters Patent. Patented Jan. 14, 1919.

Application filed March 1, 1917. Serial No. 151,802.

To all whom it may concern:

Be it known that I, EDWARD LLOYD PEASE, a subject of the King of Great Britain and Ireland, residing at Darlington, in the county of Durham, England, have invented Improvements in or Relating to Heat-Interchanging Apparatus, of which the following is a specification.

This invention relates to apparatus of the kind by which there is secured an interchange of heat between two fluids while one flows in streams upwardly between metal strips, plates or gills (hereinafter called gills) constituting part of a structure separating it from the other fluid. Where the stream paths referred to are relatively long and the tendency of the other fluid is to maintain the structure at a uniform temperature, it will be obvious that the heat transference will not be constant throughout but will vary and diminish over the region or regions where the difference between the temperatures of the two fluids being dealt with more nearly approaches equality.

The object of the present invention is to overcome or mitigate this disadvantage and it is achieved by arranging that the width of the gills in the region or regions aforesaid shall be increased to compensate for variation in the temperature of the streams of fluid that flow between the gills, so that the heat transference shall be more effective.

One form of apparatus to which the invention is particularly applicable is described in the specification of my application for Letters Patent Serial No. 55,814 filed 14th October, 1915.

Thus, in the specific case of the heat interchanging apparatus or radiator described in the application just referred to, it will be understood that since the heating agent flows in parallel through the various horizontal tubes of the vertical set thereof and consequently heats all the tubes practically to the same degree, the air ascending between the gills, each of which is traversed by all the tubes, will become increased in temperature as the upper part of the apparatus is approached. Consequently, the heat from the upper tubes will not be so readily dissipated as from the lower ones.

According to the present invention however the gills in lieu of being of constant width, are made wider at the top than at the bottom, it being convenient to make the gills with a gradual taper from the bottom to the top. Such gills may be bi-laterally symmetrical with regard to the vertical plane containing the axes of the set of heating tubes, or the increase of width of the gills may be located more to one side of the said vertical plane than the other. The diameter of the tubes may advantageously be as small as possible in relation to the width of the gills having regard to the heating agent used and the heat required to be supplied to the gills so as to leave a large proportion of the space between the gills as unrestricted vertical air passages that are freely open at all parts for passage of air and radiant heat.

The invention in addition to being applicable to tubular heat interchanging apparatus of the kind described in my said former specification can also be applied to other constructions of heat interchanging apparatus as for instance one comprising a vertical chamber through which a heating agent is caused to flow and provided with external gills between which air is caused to flow.

Furthermore, in cases where there may be a substantial difference in temperature between various parts of the apparatus to which the gills are applied, such gills as a whole may be diminished to secure a more uniform heat transference.

In the accompanying drawings, Figures 1 and 2 are elevations at right angles to one another and Fig. 3 a vertical transverse section on the line A A of Fig. 1 showing a heat radiator of the type described in my said former specification but provided with gills according to the present invention. Fig. 4 is a horizontal section on the line B B of Fig. 3. Fig. 5 is a similar view to Fig. 4 showing a modification. Figs. 6, 7 and 8 are similar views to Fig. 3 showing modified arrangements. Fig. 9 is a vertical transverse section of another type of heat interchanging apparatus having gills according to the invention applied thereto.

As will be seen from Figs. 6 and 7, the metal gills *a* that are fixed upon the heating tubes *b* connected to the end headers of the heat radiator, instead of being made of constant width as before, are made wider at the top than at the bottom, it being convenient to make them with a gradual taper from the

bottom to the top for the purpose hereinbefore set forth. Such gills may be bi-laterally symmetrical with regard to the vertical plane containing the axes of the vertical set of heating tubes *b* as shown in Fig. 7, or the increase of width of the gills may be located more to one side of the said vertical plane than the other, as shown in Fig. 3, where one edge of each gill is parallel to the vertical set of tubes. In the latter figure also, adjacent gills *a* are arranged to overlap one another alternately to right and left so that the width of the vertical air passages *c* and *d* (Fig. 4) between adjacent gills are constant at the lowermost heating tube *b* but are of two dimensions proceeding upwardly, the length of the passages *c*, measured horizontally from the tubes, being equal at all parts of their height and that of the others, viz. *d*, becoming greater from bottom to top.

The gills may be individually separated to equal extents as shown in Figs. 1 and 4, or they may be arranged in contacting pairs as shown in Fig. 5. The latter arrangement is equivalent to employing gill material of varying thickness in cross section which may be adopted to obtain increased contact area with the heating tubes.

In Fig. 6 the heating tubes *b* are arranged with their axes in two vertical planes but with no two axes in the same horizontal plane so that air has free access to the tubes all around them. In this example, the gills *a* of gradually increasing width from bottom to top are each shown as arranged symmetrically with reference to the tubes. The tubes may be similarly arranged in two vertical sets when the gills are arranged to overlap one another sidewise as in Fig. 3, if desired and as shown in Fig. 8. In this example pairs of tubes are shown arranged in the same horizontal plane.

In Figs. 1 and 2, the heating tubes *b* are expanded into a plate *e* at each end, such plates *j* forming parts of pressed steel headers of which the parts *f* constitute covers which are bolted to the plates *e*. With such a construction the plates *e* of two adjacent radiator sections can be bolted together in contact with one another, after removing their covers *f*, to form a longer radiator.

Fig. 9 shows gills of tapered shape applied in apparatus constructed according to the invention described in my former specification No. 684 of 1916 and designed for use as a water cooler, such apparatus comprising two plates *g* arranged to form between them a passage way *h* for one of the fluids, say a heated fluid is caused to flow, and provided on their outer sides with gills *a* of tapered shape. In this example the apparatus may be used as a water cooler, the heated water to be cooled being caused to flow through the passageway *h* and air for cooling purposes being caused to flow through a casing *i* and thereby constrained to flow between the gills *a*.

As will be obvious, tapered gills as and for the purpose hereinbefore described, can advantageously be used in heat exchanging apparatus of various kinds where air is caused to flow between the gills to carry off heat therefrom and each gill is heated along its length to substantially the same or to an increasing temperature through its attachment to the tubes, chamber or equivalent carrying it and containing the heating agent.

What I claim is:—

1. Heat interchanging apparatus comprising a hollow structure through which a heated fluid can pass and elongated metal strips attached to and heated by said structure and between which the fluid to be heated is capable of flowing lengthwise of the strips, the part of the structure to which each strip is attached being designed to be heated to substantially the same temperature and each strip increasing in width along its length in the direction of flow of the fluid to be heated, and terminating substantially at its widest part.

2. Heat interchanging apparatus comprising a hollow structure comprising adjacent tubular sections through which a heated fluid can pass and elongated metal strips attached transversely to and heated by said tubular sections along their length and between which the fluid to be heated is capable of flowing lengthwise of the strips, said strips being made of increased width along their length from the portions thereof with which the fluid to be heated first comes in contact.

3. Heat interchanging apparatus comprising a hollow vertically arranged structure through which a heated fluid can flow horizontally in one direction only and vertically arranged elongated metal strips attached to and heated by said structure along their length and between which the fluid to be heated is capable of flowing lengthwise of the strips, said strips being made of tapering width with their smaller width at the lower part of the apparatus where the fluid to be heated first enters between them and terminating substantially at their widest upper ends.

4. Heat interchanging apparatus comprising horizontal tubes, vertical side headers connected to opposite ends of said tubes, one of said headers constituting an inlet header and the other an outlet header and vertical elongated metal strips each secured to all the tubes, said strips being of greater width at their upper ends than at their lower ends.

5. Heat interchanging apparatus comprising horizontal tubes, vertical side head-

ers connected to opposite ends of said tubes, one of said headers being an inlet header common to all the tubes and the other an outlet header common to all the tubes and elongated vertical metal strips each secured on all the tubes and made of gradually increasing width in an upward direction.

6. Heat interchanging apparatus comprising horizontal tubes, vertical side headers connected to the opposite ends of said tubes, and each in communication along its height with said tubes, and elongated vertical metal strips each secured on all the tubes, one of said headers having an aperture at its lower end and the other having an aperture at its upper end for passage of heated fluid, one of said headers having a removable cover in which one of said apertures is formed.

7. Heat interchanging apparatus comprising horizontal tubes, vertical side headers connected to the opposite ends of said tubes, and each in communication along its height with said tubes, and elongated vertical metal strips each secured on all the tubes, one of said headers having an aperture at its lower end and the other having an aperture at its upper end for passage of heated fluid, each of said headers having a removable cover in which one of said apertures is formed.

8. Heat interchanging apparatus comprising horizontal tubes, vertical side headers connected to said tubes, and vertical metal strips each secured on all the tubes and made of gradually increasing width in an upward direction, adjacent strips being arranged to overlap one another sidewise.

9. Heat interchanging apparatus comprising horizontal tubes, vertical side headers connected to said tubes, and vertical metal strips each secured on all the tubes and made of gradually increasing width in an upward direction, the tubes adjacent to one edge of each strip being equally distant from such edge.

10. Heat interchanging apparatus comprising a vertical series of horizontal tubes, side headers connected to the ends of said tubes and vertical metal strips secured on all the tubes and made of tapering width in an upward direction, one edge of each strip being vertical and parallel to the vertical set of tubes.

11. Heat interchanging apparatus comprising a vertical series of horizontal tubes, side headers connected to the ends of said tubes and vertical metal strips on all the tubes and made of tapering width in an upward direction, adjacent strips being arranged to overlap one another sidewise.

12. Heat interchanging apparatus comprising a vertical series of horizontal tubes, side headers connected to the ends of said tubes and vertical metal strips secured on all the tubes and made of tapering width in an upward direction, said strips being spaced apart on said tubes, some of said strips being arranged to extend laterally from said tubes to a greater extent than others.

Signed at London, England, this 8th day of February, 1917.

EDWARD LLOYD PEASE.

Witnesses:
WILLIAM CROSS,
CHARLES ERNEST BROUGHAM.