

Oct. 6, 1931.

H. V. DALGLIESH
HEAT EXCHANGE ELEMENT
Filed Sept. 23, 1930

1,826,344

2 Sheets-Sheet 1

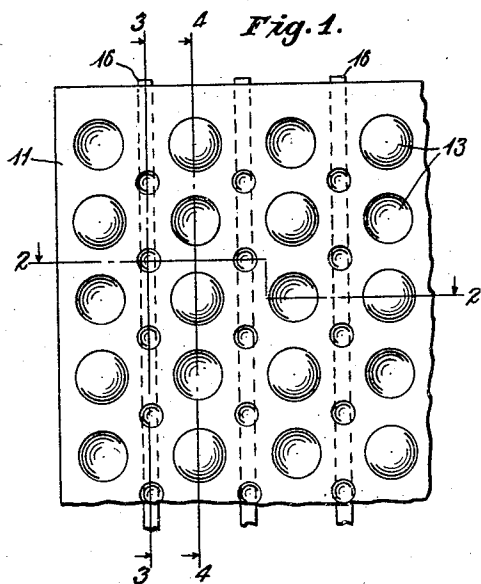


Fig. 3.

Fig. 4.

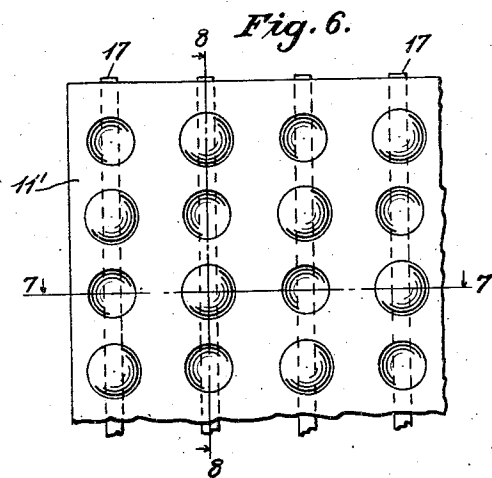
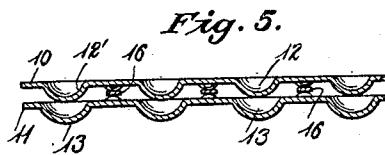
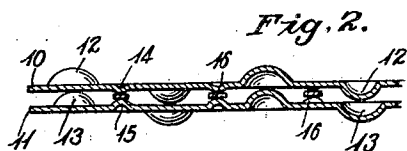
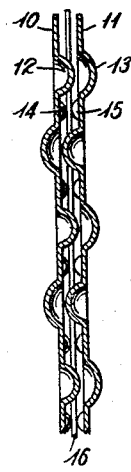
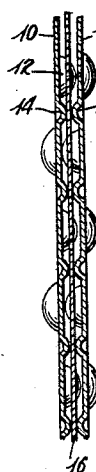
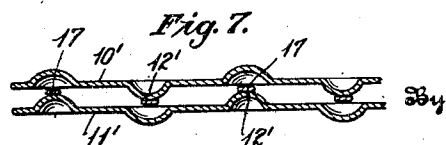
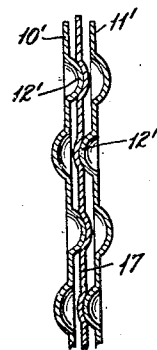


Fig. 8.



Inventor
Herbert V. Dalgliesh

Brown & Peck

Attorneys

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Fig. 9.

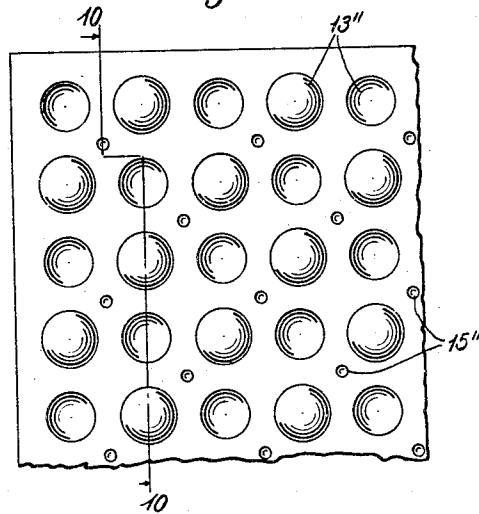


Fig. 10.

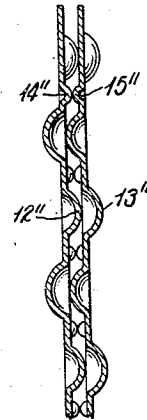


Fig. 11.

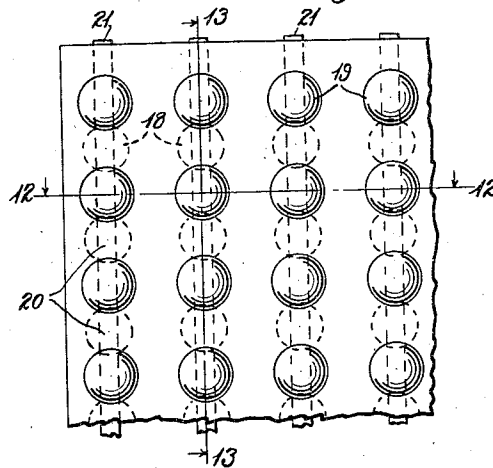


Fig. 13. Fig. 14.

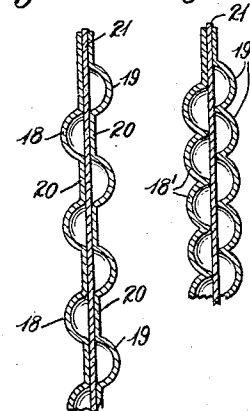
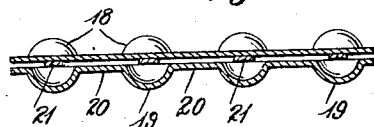


Fig. 12.



Inventor
Herbert V. Dalgliesh

By

Brown & Phelps

Attorneys

UNITED STATES PATENT OFFICE

HERBERT V. DALGLIESH, OF ATLANTA, GEORGIA, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO RESEARCH & DEVELOPMENT CORPORATION, OF ATLANTA, GEORGIA, A CORPORATION OF GEORGIA

HEAT EXCHANGE ELEMENT

Application filed September 23, 1930. Serial No. 493,943.

The invention relates to heat exchange devices and has as an object the provision of an element for use in such devices to provide for effective heat exchange between media in contact with the outside of the element.

It is a further object of the invention to provide a heat exchange element which shall be extremely strong to resist internal pressures and which may be cheaply produced.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawings showing illustrative embodiments of the invention, and wherein:

Fig. 1 is an elevation;

Fig. 2 is a horizontal section on line 2—2 of Fig. 1;

Figs. 3 and 4 are vertical sections respectively on lines 3—3 and 4—4 of Fig. 1;

Fig. 5 is a horizontal section of the device similar to Fig. 1 but illustrating a modification thereof;

Fig. 6 is an elevation of a further modification;

Figs. 7 and 8 are horizontal and vertical sections respectively on line 7—7 and 8—8 of Fig. 6;

Fig. 9 is an elevation of a further modification;

Fig. 10 is a vertical section on line 10—10 of Fig. 9;

Fig. 11 is an elevation of a still further modified form;

Figs. 12 and 13 are horizontal and vertical sections respectively on lines 12—12 and 13—13 of Fig. 11;

Fig. 14 is a section similar to Fig. 13 of a modified form of the device of Fig. 11.

As shown in Figs. 1 to 4 inclusive, the device comprises a pair of plates 10, 11 provided with cupped depressions 12, 13 arranged upon the two plates to be in nesting registry whereby to provide a tortuous path for a medium to be subjected to heat exchange with a medium in contact with the outer surfaces of the plates 10 and 11.

The projection of the depressions from the plates is shown in this modification as alternating both vertically and horizontally

from opposite sides of the assembled element.

The modification of Fig. 5 is similar to the embodiment of Figs. 1 to 4 inclusive with the exception that the depressions all project in the same direction from the plates, those upon one plate presenting concavities to the space between the plates and those on the other side presenting convexities to the space between the plates, the convexities standing opposite the concavities.

To preserve the spacing of the plates in this form of the invention and to secure the plates together at a plurality of points, there are shown a plurality of inwardly projecting portions 14, 15 struck from the metal of the plates, all of said projections extending toward the space between the plates and of much smaller area than the portions 12, 13. Extending between the projections 14, 15, are a plurality of strips 16 which are contacted upon opposite sides by the projections 14, 15 and span the spaces between the same, being thereby spaced from the bodies of the plates 10, 11, as clearly illustrated in Figs. 3 and 4.

The same spacing arrangement is shown in the modification of Fig. 5.

By the structure described, a medium as a liquid flowing between the plates will be restricted in its flow between the plain surfaces of the bodies of plates 10 and 11 and will thereby flow more rapidly between said plain surfaces where the strips 16 are not present and the liquid standing about the strips 16 will be dragged along by said flow to cause turbulence of the liquid, which turbulence will also be increased by the tortuous path of the liquid passing into and out of the space between the depressions 12, 13. The liquid contacting with all sides of the strips 16 and being circulated thereabout as described will give heat to or extract heat from the strips 16 which being in physical contact with the portions 14, 15 will conduct heat to or from the bodies of the plates 12 and thus from the medium in contact with the outer surfaces of the plates 10, 11.

In the assembly of the device the points of contact between the strips 16 and the portions 14, 15 will be secured as by solder, brazing, or electric welding, preferably the latter.

In the modification of Figs. 6, 7, and 8, the plates 10', 11' are similar to the plates 10, 11 but the strips 17 in this form of the device are shown as passing into contact with the inwardly projecting portions 12'. As shown in said figures the strips 17 are provided with deformed portions in the nature of corrugations to conform to the surface of portions 12' with which they come in contact and in the assembly of the device are secured thereto in the manner already described in connection with strips 16. The heat conductivity of the strips 17 has an action similar to that described in connection with strips 16.

In the form of the device illustrated in Fig. 9 the depressions 12'', 13'' are similar to and arranged similar to the depressions 12, 13, already described. For purposes of spacing the plate in this form of the invention the projections 14'', 15'' are brought into direct contact where they may be secured together to preserve the spacing of the plates and to act against internal pressure within the element and said depressions projecting into the space between the plates will be surrounded by liquid flowing therebetween to act as additional heat conducting portions for heat transfer.

In the form of the invention of Figs. 11 to 14 inclusive, the cupped depressions 18, 19 of the plates are all outwardly projecting, those in Figs. 11 to 13 inclusive being in staggered relation between the two plates as clearly illustrated in Figs. 12 and 13, and the depressions upon the plates are spaced apart substantially equal to the diameter of the depressions 18, 19 thereby presenting plain surfaces 20 to the space between the plates opposite the depression of the opposed plate.

The form of Fig. 14 differs from that of Figs. 11 to 13 inclusive by the fact that the bases of depressions 18', 19' are substantially tangential so as to provide a tortuous path vertically between the plates substantially equal in width to the spacing between the plates themselves plus the depth of the depressions.

To space the plates of this form of the invention apart, strips 21 pass vertically between the plates and in the line of the opposed depressions therein whereby the strips are surrounded by the medium flowing downwardly into and out of the depressions 18, 19, or 18', 19' to secure the heat conductive action described in connection with Figs. 1 to 8 inclusive.

While the depressions have been shown as portions of spherical forms, it is obvious that other forms, rectangular, polygonal, or elliptical in cross section could be used.

Further minor changes may be made in the physical embodiment of the invention within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A heat exchange element comprising, in combination spaced plates having projections from their surfaces provided by cupped deformed portions of the plates, certain of said projections extending outwardly and others thereof extending inwardly of the space between the plates, spacing and heat conducting strips between said plates in contact with and secured to certain of said inwardly extending projections, the bodies of said strips between said points of contact standing clear of said plates whereby to be immersed in a medium flowing between said plates.

2. A heat exchange element comprising, in combination spaced plates having cupped depressions in registry, the registering pairs of said depressions projecting in the same direction from the plates, heat conducting spacing strips in contact with the domes of depressions presenting a convexity to the space between the plates and secured thereto, and being otherwise out of contact with the plates.

3. A heat exchange element comprising, in combination spaced plates having cupped depressions extending away from the space between the plates, the said depressions on each plate alternating with those on the remaining plate, and spacing strips between the plates spanning said depressions and in contact with and secured to the surfaces of the plates alternately at points opposite said depressions.

4. A heat exchange element comprising, in combination spaced plates having vertically aligned cupped depressions, the corresponding depressions on the plates in nesting relation with the inwardly directed domes on one plate spaced from the inwardly directed concavities of the remaining plate, rows of inwardly directed registering projections on each of the plates out of alignment with said depressions, said pairs of projections secured together at their apices.

5. A heat exchange element comprising, in combination, spaced plates having vertically aligned cupped depressions, the corresponding depressions on the plates in nesting relation with the inwardly directed domes on one plate spaced from the inwardly directed concavities of the remaining plate, rows of inwardly directed registering projections on each of the plates out of alignment with said depressions and spacing strips extending between the apices of said projections and secured thereto.

HERBERT V. DALGLIESH.