(No Model.)

C. L. BRAITHWAITE, Jr. & I. BRAITHWAITE.

APPARATUS FOR TRANSFERRING HEAT FROM ONE CURRENT OF AIR TO ANOTHER.

No. 326,839. Patented Sept. 22, 1885.

Fig 1

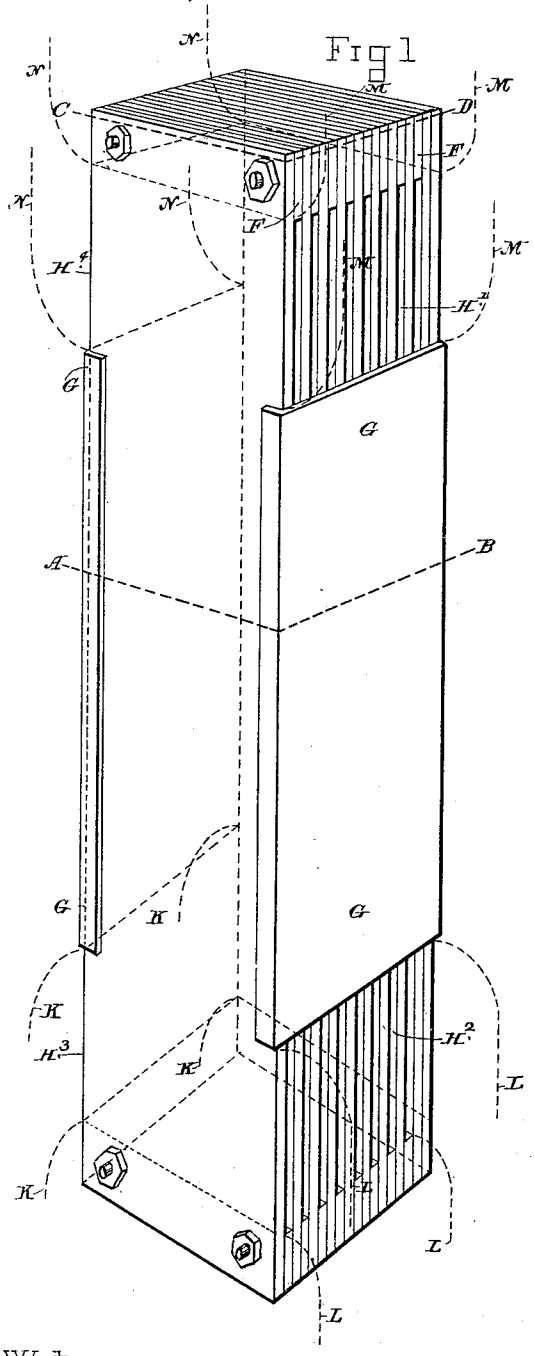


Fig 2

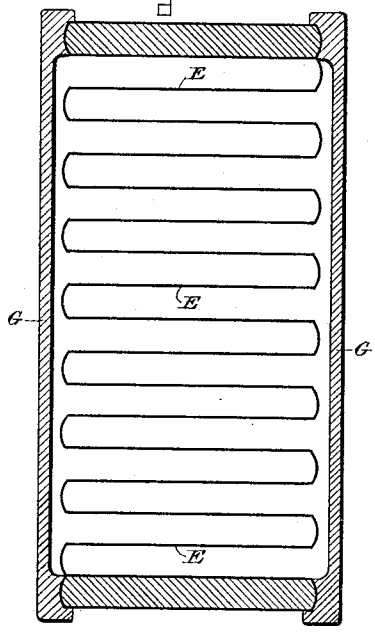
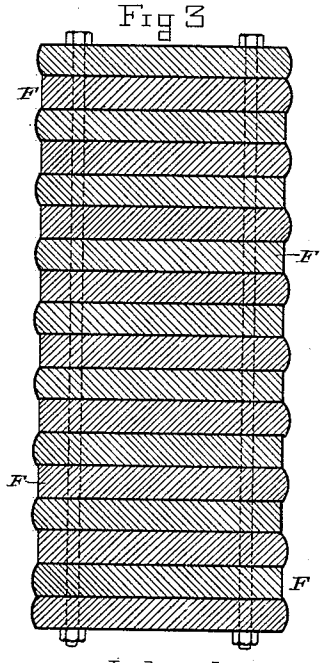


Fig 3



Witnesses:
Jas. L. Dewhurst
Walter D. Dodge

Inventor
Charles L. Braithwaite Jr.
Isaac Braithwaite,
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UNITED STATES PATENT OFFICE.

CHARLES L. BRAITHWAITE, JR., AND ISAAC BRAITHWAITE, OF KENDAL, COUNTY OF WESTMORELAND, ENGLAND.

APPARATUS FOR TRANSFERRING HEAT FROM ONE CURRENT OF AIR TO ANOTHER.

SPECIFICATION forming part of Letters Patent No. 326,839, dated September 22, 1885.

Application filed March 31, 1885. (No model.) Patented in England October 10, 1884, No. 13,441.

To all whom it may concern:

Be it known that we, CHARLES LLOYD BRAITHWAITE, the younger, and ISAAC BRAITHWAITE, subjects of the Queen of Great Britain, residing at Kendal, in the county of Westmoreland, in the Kingdom of England, have invented certain new and useful Improvements in Apparatus for Transferring Heat from One Current of Air or other Fluid to Another, (English Letters Patent dated October 10, 1884, No. 13,441,) of which the following is a specification.

In drying goods by means of heat, either the atmosphere surrounding the article heated is more or less confined, in which case the moisture evaporating from the goods is confined with it, injuring the drying effect of the heat, or the hot atmosphere, charged with vapor, is allowed to escape in a constant current to the great loss of heating power.

Now, our invention is designed to allow of a constant circulation and escape of moisture-laden air without any material sacrifice of heat, as while allowing the moist air to escape we abstract its heat and give it to the incoming current of air.

Our invention is not merely applicable in the case of drying, but also for ventilation likewise, and in all cases where heated air, gas, vapor, or even liquid is allowed to escape, and an incoming current of air, gas, vapor, or even liquid is required in the warm state, the heat of the effluent fluid being transferred in all these cases to fresh inflowing one. It is also applicable to heating air, gas, vapor, or liquid by means of steam or the gaseous products of combustion or hot water.

The invention is best described by the accompanying drawings, which show (in the original drawings filed) full-sized views of an apparatus made by us. In these Figure 1 is an elevation; Fig. 2, a transverse section through A B, Fig. 1; and Fig. 3, a section through C D.

In these E is a sheet of thin metal foil, preferably copper; but in some cases another metal may be used, where circumstances or the chemical nature of one or both of the currents make it desirable. We use metal foil, as being of greater conductivity than other material. This sheet is folded backward and forward alternately, (the folds being preferably across the length of the sheet,) leaving narrow spaces between the folds for the passage of the two currents of air, vapor, or liquid proceeding along the alternate openings, preferably in opposite directions. The object of making them pass in contrary directions is to obtain the greatest interchange of heat, since each current, as it becomes cooler or hotter, respectively, comes opposite cooler and cooler or hotter and hotter parts, respectively, of the other current, and so continue to extract or give out heat to the very last. This secures a transference of heat from the hotter of the two currents to the cooler. The folds are filled up or closed at the ends by small blocks F, of metal, wood, cement, or other material, or by plunging the ends of the folds into a shallow trough containing melted metal or other material of a lower melting-heat, and allowing the whole to cool together; and they are also guarded along the central portions of their length on each side by sheets or blocks G of any suitable material, preventing lateral escape of the current from between the folds.

The spaces H' H^2 H^3 H^4 left on each side between the end blocks, F, and the central sheets or blocks, G, provide for the entrance and exit of the currents, so that the one current will enter at the one end of one side, say at H', and leave the apparatus by the other end of the same side, say at H^2, while the other current enters and leaves by the openings H^3 and H^4, respectively, on the opposite side, (proceeding along the folds preferably in the reverse direction to that taken by the other current.)

In this apparatus a very complete transference of heat within a small space is obtained by the use of thin divisions between the currents and by the subdivision of the currents in the large number of narrow alternate passages, so that within a comparatively small apparatus a very large amount of heating-surface is obtained, and the form of the apparatus is convenient for allowing the currents to pass through it in opposite directions, by which the maximum effect is secured.

In case of transference of heat from gaseous currents to water or liquid, (or vice versa,) or from steam to air, or where the volume of one current is largely in excess of the other, it is desirable to fold the foil so that one set of passages should be wider than the other set.

Although we have hitherto spoken of foil only, and with gaseous or atmospheric currents not under different pressures foil is best, yet where a considerable difference of pressure exists between the two currents it will be necessary to use much stronger material, and perhaps to put supporting-stays at intervals to prevent collapse. If stronger and thicker material be used, however, the other dimensions must be increased to correspond. For ventilating purposes the apparatus should be placed vertically, with a tube, K, from one of the two openings in the lower end leading to the outside, and a tube, L, from the other lower opening leading to the chimney or other point of exit. This latter draws the air from near the ceiling by means of a tube, M, connected with the opening in the upper end of the apparatus, and the fresh air from outside is preferably delivered near the floor by means of a tube, N, from the other upper opening. If the apparatus be near the ceiling or near the floor, one of these tubes M or N can be dispensed with, and in like manner so can tube K where circustances admit of it.

It will be obvious that in place of the guard G being placed for a part of the way only on both sides, and the blocks F filling the entire ends, one side, say that which is shown open at H′ H^2, could be closed entirely, and the passages now opening at H′ H^3 could open at the ends, the blocks F only closing every alternate passage—namely, those opening at H^3 H^4.

We claim as our invention—

1. In combination with the angular box closed at its ends and open on two opposite faces at each end, the flat metallic plate bent to form parallel passages open alternately at opposite edges.

2. In combination with the angular body or box constructed substantially as herein described and shown, and provided with suitable inlets and outlets, the metallic-foil plate E, extending from top to bottom, and bent to form a series of parallel passages open alternately at opposite edges.

3. The combination, with a box or body constructed substantially as shown, of the metallic-foil plate E, bent to form a series of parallel passages open alternately at opposite edges, blocks F, between the folds of the plate at opposite ends, and bolts passing through the plate and block, as shown.

4. A heater composed of a box or body closed at its ends and open on opposite faces at each end, and a flat metallic plate, E, dividing said box into a series of parallel passages open alternately at opposite sides and closed at their ends.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CHAS. L. BRAITHWAITE, JR.
ISAAC BRAITHWAITE.

Witnesses.
JNO. JAS. MOFFET,
JAMES WM. PRESTON.