2 Sheets--Sheet 1.

H. FRANK.

Regenerators for Metallurgic Furnaces.

No. 134,373. Patented Dec. 31, 1872.

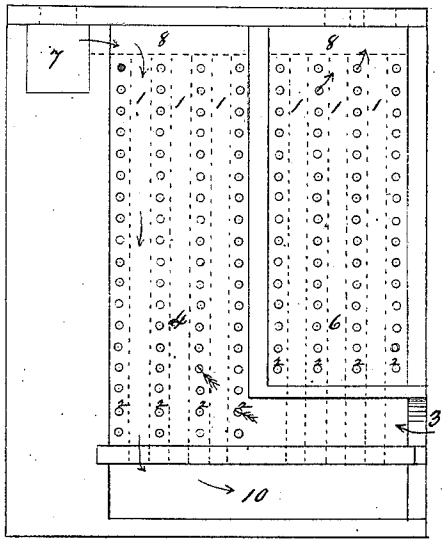

Fig. 1.

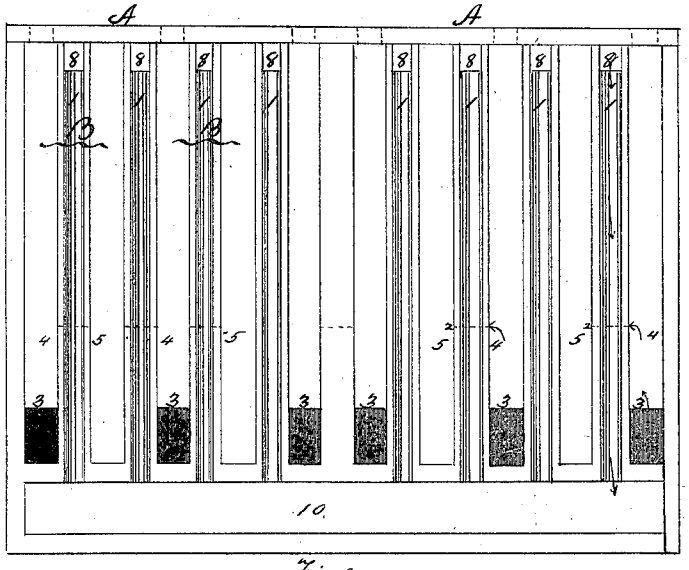

Fig. 2.

WITNESSES

James I. Kay.

E. C. Fitler

INVENTOR

Hiram Frank

by Baxewell Christy & Kerr

His Attorneys

2 Sheets--Sheet 2.

H. FRANK.

Regenerators for Metallurgic Furnaces.

No. 134,373. Patented Dec. 31, 1872.

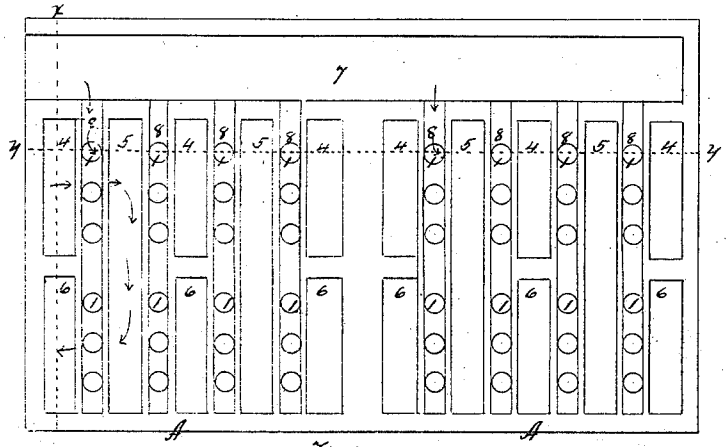

Fig. 3.

Witnesses

James L. Kay.
E. C. Fisher

Inventor

Hiram Frank
by Bakewell Christy & Kerr
His Attorneys

UNITED STATES PATENT OFFICE.

HIMAN FRANK, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN REGENERATORS FOR METALLURGIC FURNACES.

Specification forming part of Letters Patent No. **134,373**, dated December 31, 1872.

To all whom it may concern:

Be it known that I, HIMAN FRANK, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Construction of Regenerators for Metallurgic and other Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing forming a part of this specification, in which—

Figure 1 is a vertical cross-section of my improved regenerator through the line *x x* in Fig. 3. Fig. 2 is a vertical longitudinal section through *y y*, Fig. 3; and Fig. 3 is a plan view of the same.

This invention relates to that class of furnaces in which the waste heat which passes from the combustion-chamber is utilized for the purpose of heating the air or air and gas which is admitted into the furnace to aid in combustion; and its direct object is an improvement in the method of constructing the "regenerators," such being the term applied to the chambers through which the waste products of combustion are caused to pass on their way from the combustion-chamber to the "stack." These "regenerators" operate to take up from the waste products of combustion the heat they may still retain, and to transmit or impart the same to the inflowing air, or air and gas, in their passage to the combustion-chamber. This is accomplished in various ways; as, first, by alternately exposing the "regenerators," which are built of a refractory material and with numerous passages or flues for the passage of the currents of air and gas to the influence of the heated spent gases or products of combustion from the combustion-chamber, and to the currents of air and gas entering or flowing to the combustion-chamber. By this method the heat acquired from the heated products of combustion by the regenerators will be taken up by the inflowing air and gas. This method is objectionable, since it produces variations of temperature in the inflowing air, which is very highly heated when it first passes through the regenerator, but, as the latter cools, is reduced in temperature.

Another method is to build the regenerators with vertical and transverse flues, and to cause the waste products of combustion to descend through one series of flues, and while the inflowing air and gas pass upward through another series of flues, so that the heat will be transmitted through the bricks or tile, of which the regenerator is built, from the outflowing current to the inflowing currents of gas and air.

Among the various methods of building the regenerators is that of constructing them of alternate solid and hollow bricks, the solid bricks being placed vertically and laterally and the hollow bricks transversely relatively to each other, so as to form the desired flues or passage. The hollow bricks have openings passings through them longitudinally, and all the bricks used in this regenerator are necessarily very small.

One great objection to this last method is that the bricks being very small, there are, consequently, very many joints to the regenerator, which are liable to leak and permit the air and gas to mingle with the waste products of combustion. In no case have the regenerators been constructed with walls having both vertical and transverse passages running through them.

My invention consists in constructing the regenerators A A of bricks or tile having vertical openings, passages, or flues 1 1 and transverse openings or flues 2 2. In each regenerator A there are one, two, or more series of chambers and flues, B B, each series having an entrance-flue, 3, for the admittance of the air or gas; a chamber, 4, into which it passes from the flue 3; an intermediate chamber, 5, which it enters by the openings 2, and from which it passes by the openings 2 into the chamber 6, which completes the series of ascending passages. The ascending current passes directly from the chamber 6 into the flue leading to the combustion-chamber. The descending flues or passages to accommodate the heated waste products of combustion consist of the drop-flue 7 which leads from the combustion-chamber, the distributing-flue 8, and the vertical passages or flues 1 1 which lead down into the flue 10 running directly to the stack.

In connection with the furnace to which I have applied my improvement, I make use of two regenerators, A A, one for the gas and

the other for the air, to be used in the combustion-chamber. The admission of these into the regenerators is regulated by suitable valves and passages, which, not forming any part of the subject-matter of this application, I will not further mention.

The operation is as follows: The air or gas, being admitted into the flues 3 3, passes into the chamber 4, and from thence, by means of the openings 2, through the wall, into the chamber 5, whence it passes, by means of the passages 2, into the chamber 6 on either side, and from thence upward into the flue leading to the combustion-chamber or bed of the furnace. The spent gases or waste products of combustion passing out of the neck of the furnace enter the drop-flue 7, and from thence pass into and through the distributing-flues 8 into the passages 1, down which they pass, imparting their heat to the surrounding walls, and from thence into the flue 10 which leads to the stack. The heat taken up by the walls is transmitted through them and imparted to the inflowing currents of air and gas, which are thereby raised in temperature as they ascend.

The great advantages of this construction of the regenerator A A are its great simplicity and cheapness. By this construction I am enabled to subject the inflowing air and gas to a steady, invariable heat, and secure a regenerator with very few joints.

The bricks of which the regenerators are constructed form the subject-matter of another application, and are made, in the usual way, of a refractory material. They are made of any desired size, and with any number of passages 1 and 2. Each wall may be made in one piece, or may be composed of two, three, or more bricks, if desired; the less the better, as it reduces the number of joints.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The regenerators A A constructed of bricks having vertical flues or openings 1 and transverse openings 2 2, substantially as described.

2. The vertical flues running through the center of the walls of the regenerator, through which the products of combustion pass to the stack, in combination with the chambers and transverse openings in the walls, through which the air and gas pass to the combustion-chamber, substantially as and for the purposes described.

In testimony whereof I, the said HIMAN FRANK, have hereunto set my hand.

HIMAN FRANK.

Witnesses:
A. S. NICHOLSON,
THOS. B. KERR.