

F. H. EICHBAUM.
REGENERATOR FURNACE.

No. 177,230.

Patented May 9, 1876.

Fig. 1.

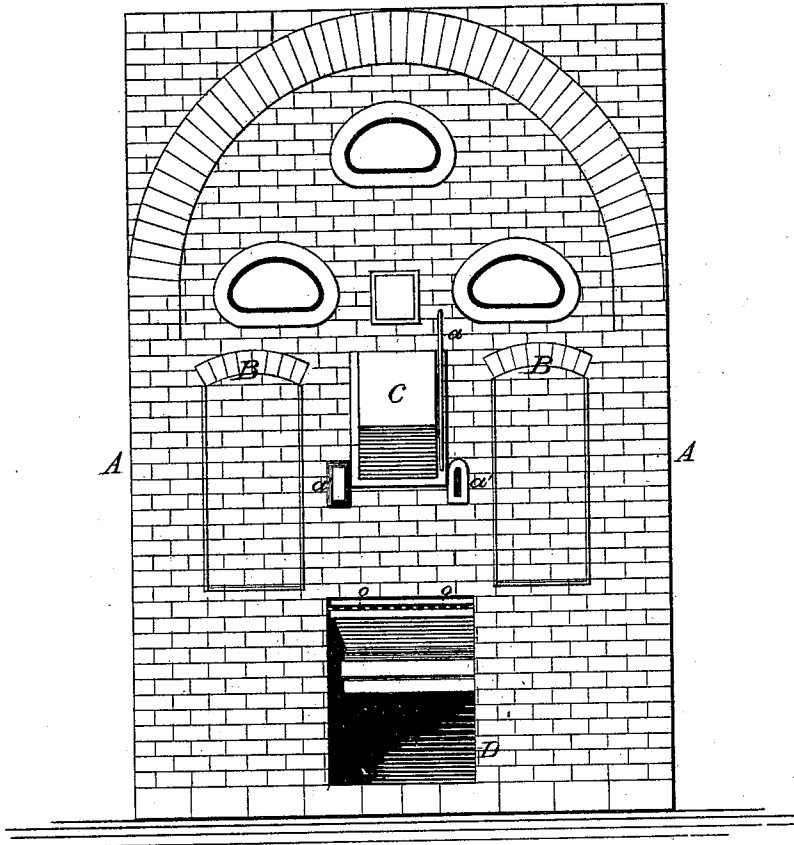
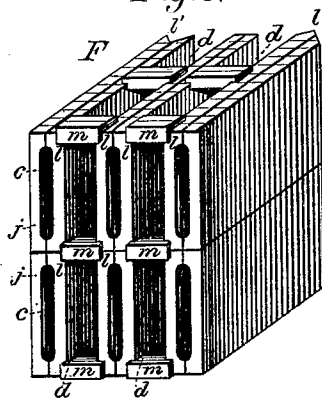


Fig. 5.



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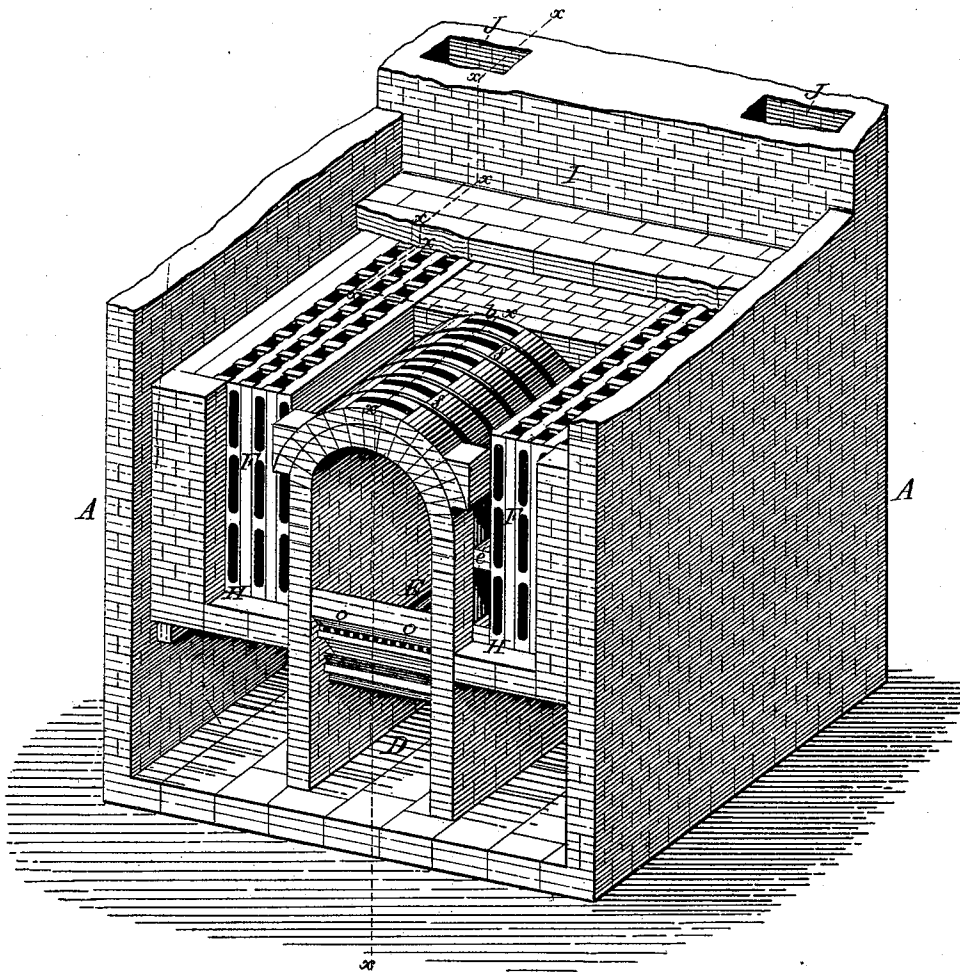
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Fig. 2.



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Fig. 3.

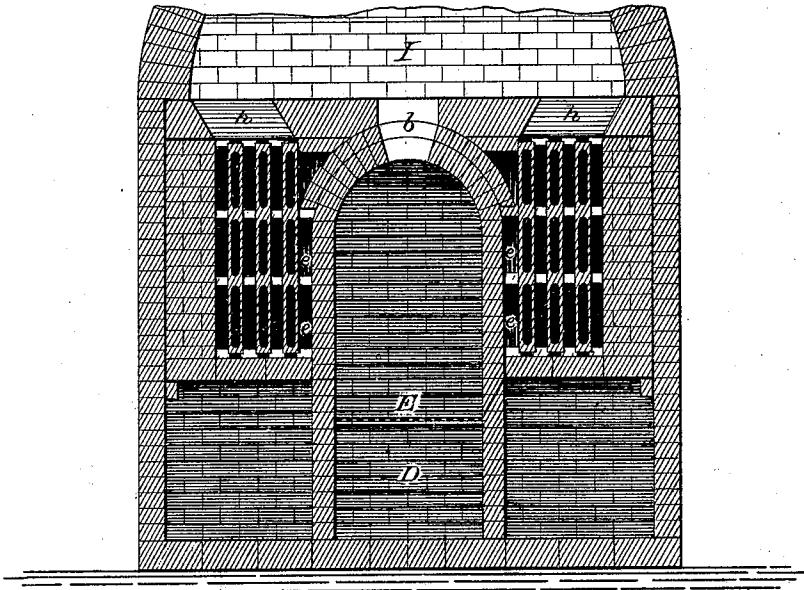
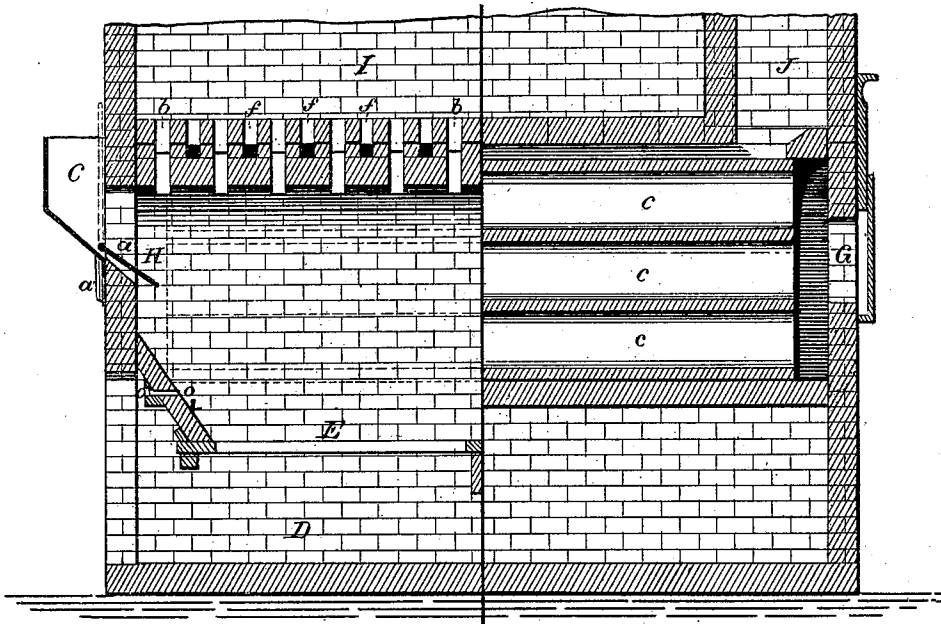


Fig. 4.



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UNITED STATES PATENT OFFICE

FREDERICK H. EICHBAUM, OF DETROIT, MICHIGAN.

IMPROVEMENT IN REGENERATOR-FURNACES.

Specification forming part of Letters Patent No. **177,230**, dated May 9, 1876; application filed February 29, 1876.

To all whom it may concern:

Be it known that I, FREDERICK H. EICHBAUM, of Detroit, in the county of Wayne and State of Michigan, have invented a new and useful Improvement in Furnaces; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The object of my improvement is an apparatus for utilizing in a more effective and economical manner fuel used for heating furnaces adapted for the treatment of metals, or for gas or other retorts or crucibles, by introducing large volumes of highly-heated air to aid in combustion; and my invention therein consists in the peculiar construction of the passages or ducts through which the heated air passes in its transit to the heating or combustion chamber, and through which the products of combustion pass in their transit to the exit, and also in the various combinations of the several operative parts, all as more fully hereinafter explained.

In order that those skilled in the art may be enabled to make and use my furnace, I proceed to describe the same, having reference to the drawings, in which—

Figure 1 is a front elevation of my furnace, showing a bench of three gas-retorts in position; Fig. 2, a front perspective of the same with the top broken away and the front wall removed, so as to exhibit the flue systems; Fig. 3, a vertical central section from side to side of the furnace, with the top broken away; Fig. 4, a vertical longitudinal section upon the line *xx* of Fig. 2, and Fig. 5 a separate view of a group of the bricks or tiles which form the passages or flues for the heated air and the products of combustion.

Similar letters denote corresponding parts in each figure.

In the drawings, A represents the shell or setting of the furnace, made in the ordinary way; B, the usual arches, adapted to be taken down for giving access to the flues; C, the feeding chute, where fuel is introduced; *a*, the lever for working the cut-off which prevents the escape of the gases of combustion, and *a'* the usual poke-holes; D, the ash-pit opening, having proper doors and adjustable open-

ings for the admission of air. Above the ash-pit is a suitable grate, E, above which is the fire-box, both of which are preferably centrally arranged in the front of the furnace, extending usually about one-half of the distance to the rear end of the same. Above the grate is a series of openings, *o*, through which bars may be introduced to pass through the mass of fuel in the fire-box. In the top of the fire-box are a series of openings, *b*, through which the products of combustion may have exit. Upon each side of the fire-box is placed a group of passages, ducts, or flues, F, preferably about as high as the fire-box, and extending to the rear of the furnace. In this group of passages, ducts, or flues are air passages or ducts *c* for heated air, and flues *d* for the products of combustion. These above-named ducts *c* extend from suitable openings G in the rear wall of the furnace, which openings have proper adjustable valves or doors to a chamber, H, in front of said ducts, by means of which currents of air drawn in at the rear of the furnace pass through the ducts *c* to the chamber H, whence such currents, turning to the rear, pass into the openings *e*, and in such passage find their way into the ducts *f* above the fire-box, and out through the openings *g* into the heating-chamber I. On the other hand the products of combustion pass up through the openings *b* into the heating-chamber I, which, it will be observed, is also a secondary combustion-chamber, and there uniting with the heated air in such chamber. At the point of union a combustion of the gases takes place. The products of this last-named combustion, after the chamber I is filled, pass out of such chamber through the openings *h* into the flues *d*; thence along said flues to the rear into the chimneys or exits J.

The group of passages, ducts, or flues F is constructed in the following manner: A brick or tile, *j*, is made of suitable refractory material, hollowed out upon one side, as at *k*, and having a portion of one corner cut away or recessed, as shown at *l*. One of the bricks is made convex and the other concave at the ends, so that when two are placed together the end will present a wedge form, or else a recessed form, as shown at *l'*. Two of these bricks or tiles are put together, with the hol-

lowed sides facing each other, by which means the duct *c* is formed.

These bricks or tiles, placed on their ends one above the other, the beveled ends fitting into the recessed ends, and vice versa, form a series of ducts, *c*. Other suitable bricks or tiles *m*, fitting into the cut-away corners *l*, separate the bricks or tiles making the series of ducts *c* from one another, leaving spaces which are flues *d*, before spoken of. These bricks or tiles and the flues between them are so adjusted as to their respective sizes that they are built closely into the space prepared for them, and fill the same, so as to require no other means to secure them in place.

It will be observed that the chamber I is to be constructed for the particular purpose for which it is intended, its form depending, of course, upon the use for which it is to be adapted, whether for heating, reheating, smelting, or puddling metals, and for the placing in position of gas or other retorts or crucibles.

The preferable mode of operation of this furnace is as follows: A fire being kindled in the usual way upon the hearth of the chamber I, the products of combustion pass off through the proper flues, as described, into the chimneys. After a little these flues become heated; then a fire should be kindled on the grate, and the fire-box should be filled about two-thirds full through the feed-chute, or about even with the stoking-holes, with any kind of inferior grades of coal, coal-dust, or screenings. The fire in the hearth may then be raked off or suffered to burn out. The fire on the grate should be allowed to burn until it is thoroughly kindled and the fuel begins to give off freely carbonic oxide, carburated hydrogen, and vaporized hydrocarbons. Then air is allowed to enter the rear end of the furnace through the openings described, which air passes through the ducts *c*, the chamber H, the openings *e*, and ducts *f*, being highly heated in its transit into the chamber I, where it mingles and unites with the before-named products of combustion, and an intense heat is produced from the combustion of the gases before named and the heated air within the chamber I. This heat increases in intensity as the flues become heated by the outgoing products of combustion, and the incoming air becomes more and more highly heated, for the same reason.

When it is necessary to replenish the fire, more fuel should be added, and when the grate becomes clogged and choked with debris, by inserting rods or bars in the holes *o* the mass of fuel above is retained in position, while the debris below such rods or bars may be dropped into the ash-pit. This fire thus made and replenished may be kept up as long as required, the operation of the furnace in this respect being continuous.

The advantages of my furnace consist, chiefly, in the simplicity of its various parts, the readiness with which the flues and ducts can be replaced, repaired, or cleaned out, and in its capacity to use a cheap or almost worthless fuel to great advantage.

Having thus described my furnace, what I claim as new therein is—

1. The brick or tile *j*, hollowed out on one side, and having a corner cut away, substantially as and for the purposes set forth.

2. The group of passages, ducts, or flues *F*, composed of the bricks or tiles *j*, each hollowed out upon one side, and cut away at one corner, with concave and convex ends, and the intermediate bricks *m*, constructed and arranged substantially as and for the purposes set forth.

3. In a furnace, the combination, with the chamber I, of the ducts *c* and the fire-box E, the flues *d*, the chamber H, the openings *e*, the ducts *f*, and the opening *b*, constructed and arranged substantially as and for the purposes set forth.

4. In a furnace, the combination, with a fire-box, of a secondary combustion and heating chamber above it, with a suitable communication between both, and flues adapted to carry away the products of combustion to the exit placed between ducts, for leading air from the rear to said secondary combustion and heating chamber, and heating the air in its transit, the several parts constructed and arranged substantially as and for the purposes set forth.

This specification signed and witnessed this 28th day of February, 1876.

FREDERICK H. EICHBAUM.

Witnesses:

CHARLES THURMAN,
R. N. DYER.