(No Model.) 2 Sheets—Sheet 1.

W. C. FORD.

FURNACE.

No. 303,272. Patented Aug. 12, 1884.

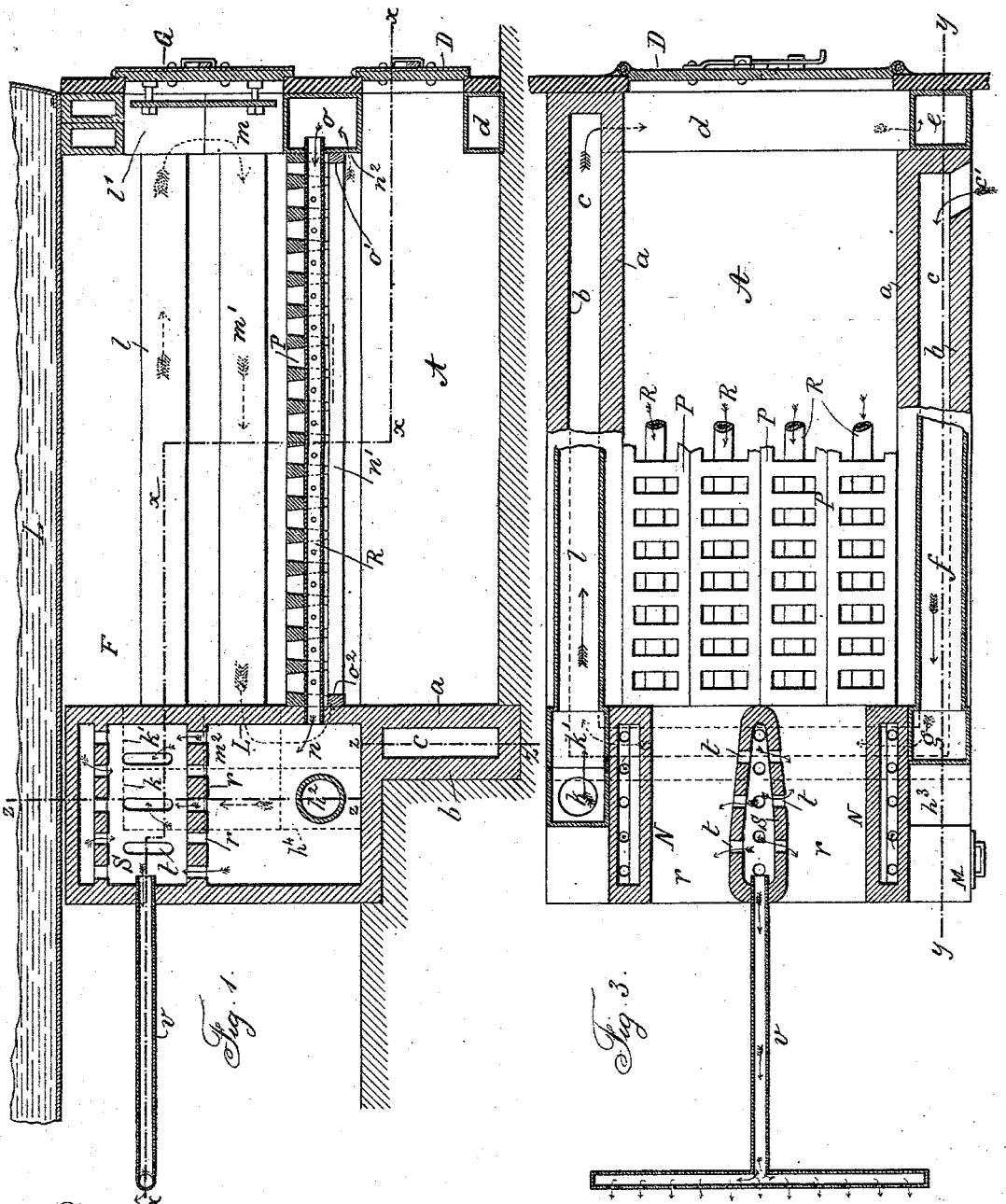

Fig. 1.

Fig. 3.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

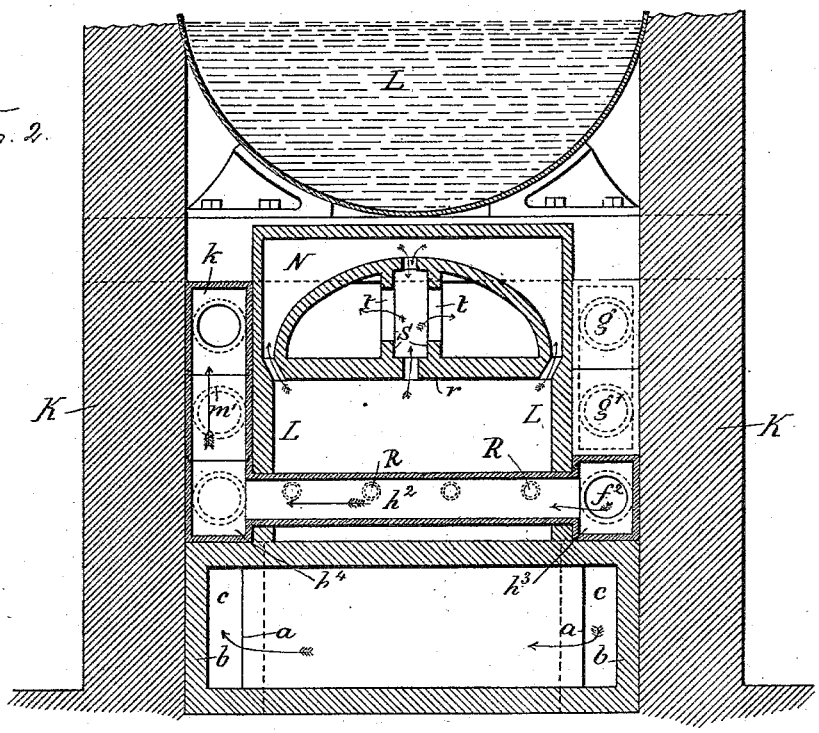
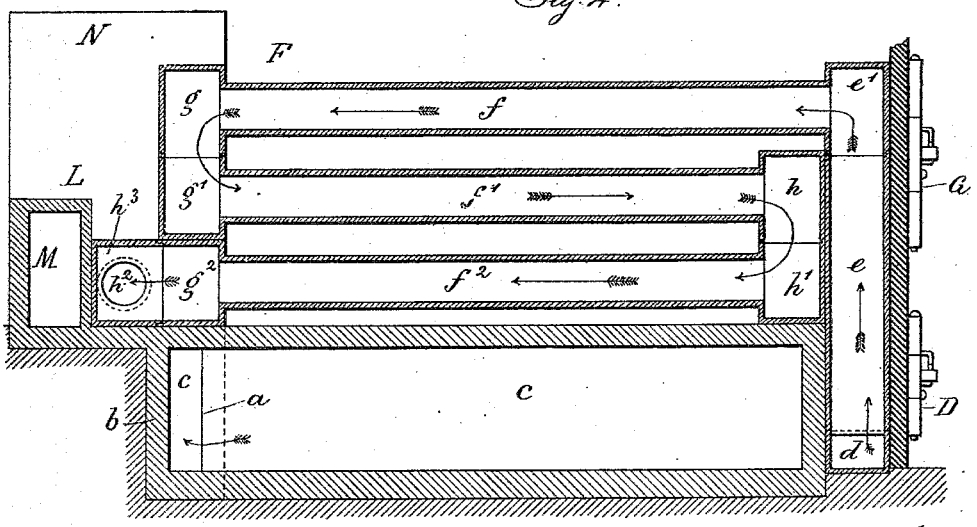


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM C. FORD, OF BROOKLYN, NEW YORK.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 303,272, dated August 12, 1884.

Application filed November 10, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM C. FORD, of Brooklyn, in the county of Kings and State of New York, have invented an Improvement in Furnaces, of which the following is a specification.

This invention is made for supplying into the fire and combustion chamber atmospheric air at a very high temperature, so as to insure a more perfect combustion, and to prevent the loss of heat absorbed or diffused by the walls of the fire-chamber.

This improvement is especially adapted to the furnaces of steam-boilers, but is not limited thereto.

In the drawings, Figure 1 is a vertical longitudinal section. Fig. 2 is a cross-section at the line *z z*, looking forward. Fig. 3 is a sectional plan at the line *x x*; and Fig. 4 is a vertical section at the line *y y*, Fig. 3.

The ash-pit A is surrounded by a double wall, *a b*, forming a flue-space, *c*. The air is admitted at the opening *c'*, or it may be forced in at this opening by a blower. The air-flue *c* traverses three sides of the ash-pit A, and crosses in the trunk *d*, below the ash-pit door D, which door D is to be closed air-tight, or nearly so, except when the ashes are being removed. The air from the trunk *d* ascends in the hollow trunk *e* to the hollow cubical chambers *e'*, thence by the horizontal pipe *f* to the hollow cubical chambers *g g'* at the back end of the fire-chamber F, thence forward through the air-pipe *f'* and by the hollow cubical chambers *h h'* to the pipe f^2 and its rear cubical chambers, g^2. It is to be understood that the edges of the hollow cubical chambers that set together are preferably grooved and ribbed, as shown, to receive cement, and that the parts are bolted together. The tubes *f f' f²* form one side of the fire-chamber F. The fire-door at G is of any suitable character. The chambers at the ends of the respective pipes, being cubical, are easily built into the brick-work, and one range of pipe is made to support another in a firm reliable manner. The connections are easily made at the top, bottom, or sides of such cubical chambers, and the parts are not liable to become separated by changes of temperature and expansion or contraction. The other side of the fire-chamber is made of similar horizontal pipes in a vertical range. The air passes across from the pipe f^2 to the pipe *l'* by means of the pipe h^2, having hollow cubical chambers h^3 h^4, that connect with the hollow cubical chambers g^2 and *k k'* of the respective pipes f^2 and *l*. The pipe h^2 is in the hollow bridge-wall L, more particularly described hereinafter. In this bridge-wall, at one side, is an opening, M, for cleaning purposes. This opening is generally closed by a door. The air now passes along horizontally through the pipe *l*, and by the hollow cubical chambers *l'* and *m* to the pipe *m'*, and thence by the cubical chambers m^2 and *n* to the pipe *n'* and its cubical chamber n^2. These pipes *l m' n'* and their respective cubical chambers form the other side of the fire-chamber F. It is to be understood that these tubes are to be inclosed in brick-work at their outer sides, as shown at K, and that such brick-work extends up sufficiently high to receive the steam-boiler, in any usual manner.

There is a hollow cross-bearer, *o*, below the fire-door, and this has a ledge, *o'*, on its inner face, upon which rest the ends of the grate-bars P, and there is a similar ledge, o^2, at the face of the hollow bridge-wall, upon which the grate-bars rest at their inner ends. These grate-bars are of any desired size or shape; but I prefer bars with cross-pieces between the longitudinal portions, as shown.

Beneath the grate-bars there is a range of tubes, R, passing at their front ends into the hollow bearer *o* and at their rear ends into the hollow bridge-wall. These tubes are perforated; hence a portion of the atmosphere which has become highly heated by traversing the respective pipes at the sides of the fire issues from these perforations and passes up through the bed of incandescent fuel on the grate-bars. The remainder of the highly-heated atmosphere passes into the hollow bridge-wall.

The bridge-wall L will usually be built of fire-bricks with the internal air-space sufficiently large for the passage of the pipe h^2 and for the tubes R to open into such air-space. There is a slab, *r*, covering the air-space of the bridge-wall and forming the top of such bridge-wall, and through this slab are holes

that open into the hollow bridge-wall arch N, with its central hollow partition S. This hollow arch and partition are preferably made of fire-clay molded and baked, or of iron, and in either separate pieces or joined together. The atmosphere in its highly-heated condition ascends from the hollow bridge-wall into the hollow arch and partition, and escapes through openings at *t t* into the products of combustion as they pass over the bridge-wall, and in so doing any unconsumed carbonaceous matters are burned and the most perfect combustion insured.

If desired, there may be a pipe, *v*, extending backwardly from the hollow partition, and terminating in the perforated T-head to more fully distribute the highly-heated air among the escaping products of combustion.

There may be a steam-pipe introduced into the tubular cross-beam *o*, with nozzles opening into the tubes R, so that the atmosphere may be drawn through the heating-tubes and driven by the steam-jets into the perforated tubes and the hollow bridge-wall, instead of using a blower to force the atmosphere into the hollow wall of the ash-pit, or there may be pipes and steam-jets introduced into one or more of the air-tubes, so as to promote a rapid circulation of the air through the heating-pipes and the delivery of such air into the combustion-chamber.

I claim as my invention—

1. The combination, with the grate-bars and inclosure forming the fire-chamber, of tubes passing along at the sides of the fire, and the hollow cubical chambers opening into each other, and the hollow walls around the ash-pit, and the cross-flue below the door of the ash-pit, connecting the hollow walls with the cubical chambers, substantially as set forth.

2. The hollow walls for the ash-pit, through which the atmosphere is caused to circulate, in combination with the ranges of tubes at the sides of the fire-chamber, and the hollow cubical chambers and the flue *d*, crossing below the ash-door, and the pipe h^2, crossing through the bridge-wall, substantially as set forth.

3. In combination with the fire-chamber and hollow bridge-wall, the ranges of air-tubes at the sides of the furnace, the cubical chambers at the ends of such tubes, connecting one tube with the next, and the tube h^2 within the hollow bridge-wall, and passing across from one range of side tubes to the other, substantially as set forth.

4. The hollow bridge-wall and the tubular cross-bearer at the fire-door, in combination with the grate-bars supported upon ledges, and the perforated air-pipes extending from the tubular cross-bearer to the hollow bridge-wall, and the ranges of air-pipes at the sides of the fire-chamber connecting with the hollow bearer, substantially as set forth.

5. The hollow bridge-wall, in combination with the hollow arch and hollow partition resting upon the bridge-wall, and having connecting openings with the air-space in the bridge-wall, and openings for the heated air to pass into the escaping products of combustion, substantially as set forth.

Signed by me this 3d day of November, A. D. 1883.

WM. C. FORD.

Witnesses:
GEO. T. PINCKNEY,
WILLIAM G. MOTT.