H. M. SMITH.

Furnace.

No. 167,579. Patented Sept. 7, 1875.

Fig. 1.

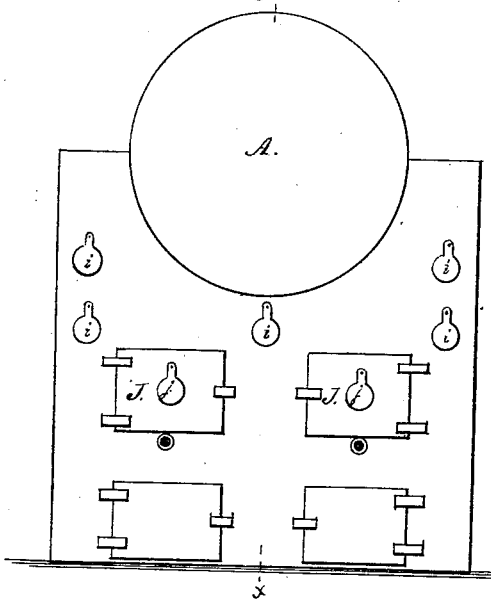


Fig. 2.

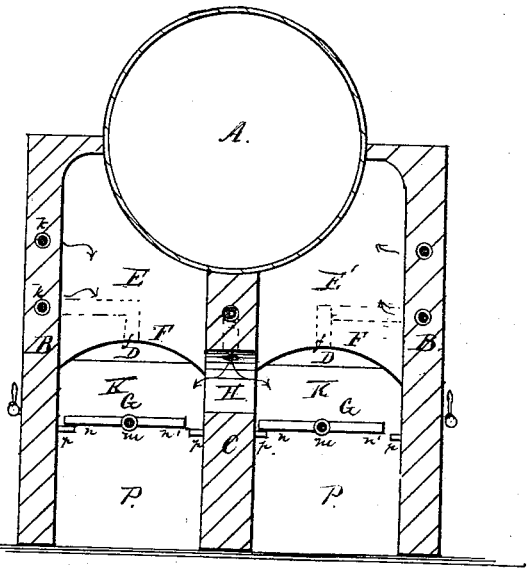
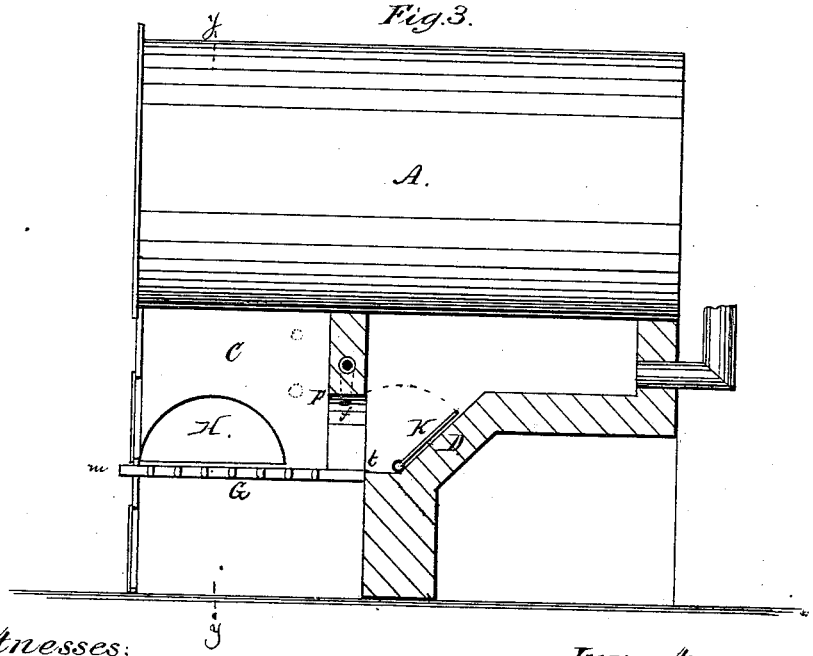


Fig. 3.



Witnesses:
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Ephraim Shattuck

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UNITED STATES PATENT OFFICE.

HORATIO M. SMITH, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN FURNACES.

Specification forming part of Letters Patent No. **167,579**, dated September 7, 1875; application filed July 8, 1875.

CASE D.

To all whom it may concern:

Be it known that I, HORATIO M. SMITH, of Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Furnaces for the combustion of coal; and I hereby declare that the following is a full, clear, and exact description of the same, which, taken in connection with the accompanying drawing, that forms a part of this specification, will be sufficient to enable those skilled in the art to make and use the invention.

The drawing shows at Figure 1 a front exterior view of the furnace; at Fig. 2 a vertical section on *x x* of Fig. 1, and at Fig. 3 a vertical section on the plane *y y*.

Like letters of reference made use of in the several figures indicate like parts wherever used.

It is well known that bituminous coals are rich in combustible matters, which volatilize at a comparatively low temperature, and that in the ordinary modes of combustion these volatile constituents become mostly waste products of combustion, which pass out of the furnace in the form of smoke and invisible carbonic compounds. It is also well understood that sufficient air cannot pass through the grate to produce complete combustion of the necessary quantity of coal resting thereon, and though an accelerated draft intensifies combustion and proportionately elevates the temperature, yet it is equally well known that the fires cannot be urged beyond a certain point except at an expense of fuel greater in proportion than the increase of temperature obtained. Therefore the problem has been to burn these combustible gases after they have been distilled and escaped from the coal upon the grate. Active combustion cannot occur below a certain temperature, and from the moment of liberation these gases begin to lose heat, and the admission of cold air above the grate may, and generally does, cool them below the temperature of ignition.

The object of this invention is to effect the complete combustion of these gases by subjecting them to the intense heat of a blast without accelerating the draft through the grate. It is evident this effect should be produced as near to the grate as possible.

My invention, therefore, relates to that class of furnaces called smoke-consuming; and it consists, first, in a narrow throat at the rear end of the grate, through which these waste gases, mixed with fresh air, may be compelled to pass at an accelerated velocity, and in contact with a mass of intensely-burning fuel, whereby the temperature is so raised that combustion is made complete; second, in a dead-plate continuation of the grate-surface to hold the coke or coal which is used to block up said archway; third, in a splayed or inclined bridge-wall behind said arch and dead-plate to permit the flame to be partly diffused before impinging upon the boiler.

I am aware that many furnaces have been constructed wherein the waste gases and smoke have been compelled to pass the flame of a second fire; but in this furnace one part of the same fire is maintained at a much higher temperature than the remainder, and the waste gases are compelled to pass said hot part before they have lost temperature or formed incombustible oxides.

In the said drawing, A represents a steam-boiler of ordinary style. B B are the exterior walls of the furnace. C is a central vertical division-wall extending from the ground up to the boiler, and from the front back to the inclined bridge-wall. D is the inclined bridge-wall, made in this form so that the draft of flame will not be caused to impinge too abruptly upon the boiler, to avoid the danger of burning the boiler out at a certain point. Within each of the two chambers E E′, formed by the exterior walls, the boiler, and the central wall, are placed partition-arches F, at a point just over, or very near to, the rear end of the grate G, and in front of the inclined bridge-wall D. These arches descend nearly to the grate G, so near that a narrow throat is formed, which may be readily blocked up with the fuel, and which will be so narrow that no gases can pass through without being heated to the required degree to insure combustion if a sufficient quantity of air should be present. An air-vent, *f*, is placed at this arch, debouching either downward at the crown of the arch, as shown, or to the side or front over the arch, to insure a proper supply

of air. I call the parts F arches, because they are such in the furnace illustrated, and I prefer that they should be arches in form; but it is not essential that they should have this form, as will be readily understood. Nor is it essential that they should be placed in the precise position shown, as it may often be advisable to put them farther back, even beyond the back of the grate. In front of the arches F, and above the grate, being nearly upon a level therewith, is the archway or passage H, forming a communication between the chambers E and E′. The doors J are provided with regulable draft-openings *j*, and similar openings *i* furnish an air-supply by suitable conduits *k*, which deliver it into the chambers E E′ at or near the rear, and also into the arched passage H from above, as shown.

It is not desirable that the coal or coke pushed under the arch F, to block up the same, should rest against the bridge-wall D, because the draft would thereby be detrimentally obstructed; and I therefore extend the dead-plate *t* backward on a level with the grate sufficiently far to form a base for the pile of fuel which chokes said arch, and from the rear end of said dead-plate the bridge-wall D rises with an inclination backward, which permits the flame to become somewhat diffused before impinging upon the boiler, and therefore there is no danger of burning the latter in the vicinity of the bridge-wall.

In working this improved furnace I first charge both chambers with coal, and dam up the fuel at the arches F, so that it shall become coked; or, if preferred, coke-fires may be built in each chamber, or a coke-fire may be built upon one side and a coal-fire upon the other. When fairly started in the latter case, I dam up the coal under the arch F by pushing it back, so that there shall be very little or no draft out over the bridge-wall. Sometimes it may be found desirable to close this outlet by the damper K. The draft is thus brought around through the passage H into the other chamber containing a coke-fire. Air from the apertures at the rear and at the passage H mingles with the gases evolved from the coal, both at the time of their generation and as they pass through the passage H, and the said gases should, therefore, be in a condition to burn upon entering the chamber containing the coke-fire. The flame is carried, by the draft in the latter chamber, up over the bridge-wall in the usual manner.

The two chambers are alike, as will be noticed, and when the coal in the closed chamber has become reduced to coke, a charge of coal is placed in the outer chamber in like manner and dammed up at the throat under the arch F, making it in turn a coking-chamber, and the draft is reversed into the other chamber; or, if desired, the coke may be dumped by the grate and transferred from one chamber to the other, via the ash-pit.

The top of both chambers is formed by the boiler, so that all of the heat generated within the chambers is felt upon the boiler.

A single chamber provided with the closely-descending arch F may be successfully, and with good effect, used; but I prefer two, as described, for the reasons indicated.

In cases where furnaces have but one door the central vertical division-wall C may be brought to the front or to within a short distance of it, so that the gases may pass from the coking to the combustion chamber around the front edge of the wall C.

In many instances where the draft is good, and the grate and steam-heating surfaces are plenty, it will not be necessary to bank the coke under the throat on either side, as the small space left between the arch F and the grate-surface, through which the mingled smoke and air must pass, will force them so near the incandescent coke or coals as to insure combustion in the chamber where the gases are generated.

What I claim as new is—

1. In a furnace, the combination, with the rear grate-surface and its supporting-wall, a descending partition arranged to form a throat or chamber at the juncture of the grate and wall, the same adapted to be partially banked up with fuel, as set forth.

2. In a furnace, the combination, with the rear grate-surface and its supporting-wall, a descending partition arranged to form a throat or chamber at the juncture of the grate and wall, and air-supply pipes or openings debouching at the crown, or in front of said arch, as set forth.

3. The grate G, partition F, and dead-plate *t* combined with the bridge-wall D, for the purpose described.

HORATIO M. SMITH.

Witnesses:
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