H. M. SMITH.

Furnace.

No. 164,402. Patented June 15, 1875.

Fig. 1.

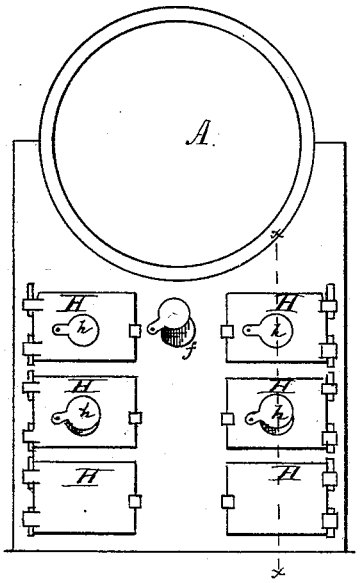
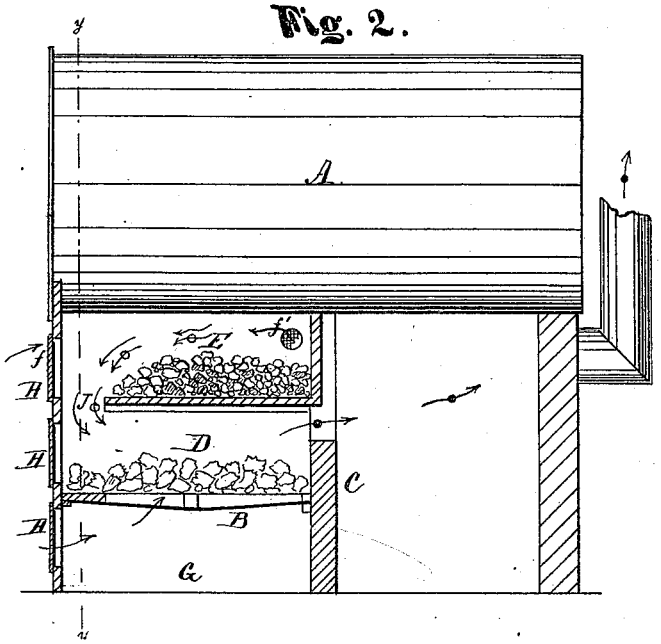


Fig. 2.



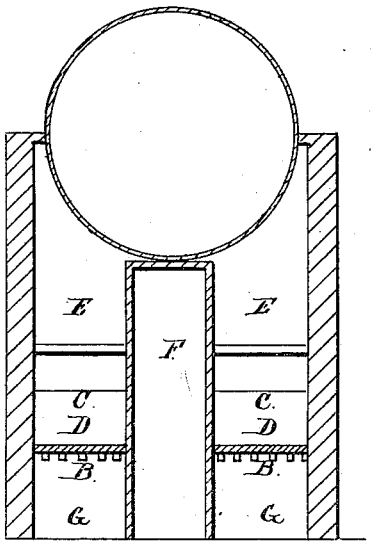


Fig. 3.

Witnesses:

A. Kleininger

Henry L. Smith

Inventor:

Horatio M. Smith

by Munday & Evarts

his Attys.

UNITED STATES PATENT OFFICE.

HORATIO M. SMITH, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS HIS RIGHT TO MOSES W. LESTER AND FRANKLIN LESTER, OF SAME PLACE.

IMPROVEMENT IN FURNACES.

Specification forming part of Letters Patent No. **164,402**, dated June 15, 1875; application filed January 18, 1875.

CASE A.

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 an Improvement in Furnaces for the Combustion of Coal, of which the following is a specification:

This invention relates to an improvement in furnaces for the combustion of coal; the object being the more complete combustion of the fuel, and, consequently, as an incident thereto, the prevention of smoke.

When a charge of coal is placed upon the grate-bars of an ordinary furnace a process of destructive distillation immediately takes place, evolving hydrocarbon gases, and leaving a residue of coke, which remains upon the bars and is thoroughly consumed. There is no difficulty in dealing with this coke, as it will remain upon the bars in a solid state until a final and complete combustion takes place, evolving only a useless product—carbonic acid. The loss and difficulty is met with in dealing with the volatile combustible—the hydrocarbon gases which have been evolved previous to the formation of the coke. These gases require for their production a much less degree of heat than what I should term furnace heat, or that heat at which, if united with their proper proportion of oxygen, they will burn. Hence, a large proportion of this volatile fuel ordinarily passes off unconsumed along with the products of combustion, producing a dense black smoke, whereas the true products of combustion—carbonic acid and steam—should be invisible.

In this invention my aim is to so construct and operate the furnace that the hydrocarbons shall be driven from the coal in a compartment of the furnace devoted to this purpose, and at the same time mingled with a proper quantity of air, and led by the draft into another compartment devoted to the combustion of the coke, in which compartment the explosive mixture of hydrocarbons and air meet with the required degree of heat to cause their ignition and combustion.

In the present improved furnace, I place above the grate-bars a coking-chamber, differing from a retort in this respect, that provision is made for admitting the atmosphere into it to mingle with the gases. A fire of coke is built upon the bars below this chamber, and the chamber above is charged with coal, which, when reduced to coke, is raked down upon the bars, and a fresh supply of coal takes its place.

In the accompanying drawing, which forms a part of this specification, Figure 1 is a front view of my improved furnace; Fig. 2, a vertical longitudinal section upon the line *x x* of Fig. 1; Fig. 3, a transverse vertical section of the furnace upon the line *y y* of Fig. 2.

Like letters of reference indicate like parts in all the figures.

In said drawing, A represents a steam-boiler; B, the grate-bars; C, the bridge-wall; D D, the combustion-chambers—in the present instance two in number, because the furnace is made double to insure a more perfect regulation of the temperature and combustion. E E are the coking-chambers, extending above the combustion-chambers from the bridge-wall toward the front, and nearly to the front wall of the furnace. An air-chamber, F, separates the double furnaces and coking-chambers, and receives air through the regulable opening *f* in the front wall of the furnace, and delivers it into the coking-chambers through apertures *f'*. G G are the ash-pits. H H, &c., represent the doors for stoking, regulating, &c., there being one to each coking-chamber, one to each combustion-chamber, and one to each ash-pit. They should be provided (the four upper ones) with regulable apertures *h* for the admission of air, if desired.

The operation of my improved furnace is as follows: Suppose a fire of coke to exist upon the grate-bars, and the coking-chamber to be stoked full of coal. The heat from the combustion-chamber will evolve the gases from the coal in the coking-chamber, which, mingled with air from the aperture *f'*, will pass down through the opening J into the combustion-chamber in a condition to ignite when the proper temperature is reached, which ignition takes place within the combustion-chamber, whereby the combustion of both the coke and the hydrocarbons is insured, and there only escapes

through the smoke-stack the useless products of a perfect combustion. When the coal in the coking-chamber is thoroughly coked, and contains no more gas, it is raked down upon the bars to supply the place of the coke which has been consumed thereon.

In the drawing the air-currents are represented by plain arrows, the currents of hydrocarbon gases by arrows with an open circle upon the shaft, while the currents of products of combustion are indicated by arrows with a black disk upon the shaft.

It will be seen that this construction and arrangement of a combustion-chamber over which is placed an open-mouthed coking-chamber, into which air is admitted at or near the rear, forms a very convenient and perfect furnace for operating this principle. The coal is easily placed in the coking-chamber, and is easily transferred by its gravity into the combustion-chamber through the opening J, while the gases mingled with air pass freely, and without opportunity to cool, directly into the combustion-chamber.

The advantage of placing the air-chamber F between the double furnaces is partly in the fact that the air is thereby warmed by both furnaces before entering the coking-chambers, and partly in the fact that it is extremely inconvenient in most cases, owing to the construction of furnaces generally to introduce the air at another point without interfering with the draft; although it is obvious that the chief result aimed at—namely, the admixture of air with the contents of the coking-chamber—could be accomplished otherwise than by the central air-chamber.

It will be seen that the bottom of the boiler forms the roof of the coking-chambers. This enables me to dispense with a separate covering. It also enables me to utilize the heat rising from the coking-chambers, and at the same time protects the boiler at this point from the intenser heat of combustion-chamber with its combined fire of coke and gas, the heat of which is more gradually diffused to the boiler after passing the bridge-wall.

It is well understood that boilers commonly burn out more rapidly at the front end than elsewhere. This arrangement tends to prevent this unequal effect of the heat.

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

1. The coking chamber or chambers E, constructed with a large in-draft air-supply opening, *f*, located at the upper part of the chamber above the coal, and communicating with the pure external air, and constructed with a downward discharge in the combustion chamber or chambers, in combination with said combustion chamber or chambers located below, as specified.

2. The double furnace, consisting of the combustion-chambers D D, above which are the open-mouthed coking-chambers E E, in combination with the central air-chamber F, which admits air into both coking-chambers at or near the rear thereof, and which air-chamber receives air by a regulable opening, *f*, substantially as specified.

HORATIO M. SMITH.

Witnesses:

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