H. M. SMITH.

Steam-Boiler Furnace.

No. 164,403. Patented June 15, 1875.

Fig 1.

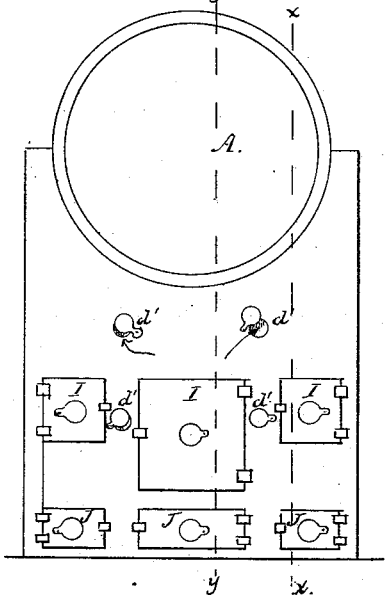


Fig 2.

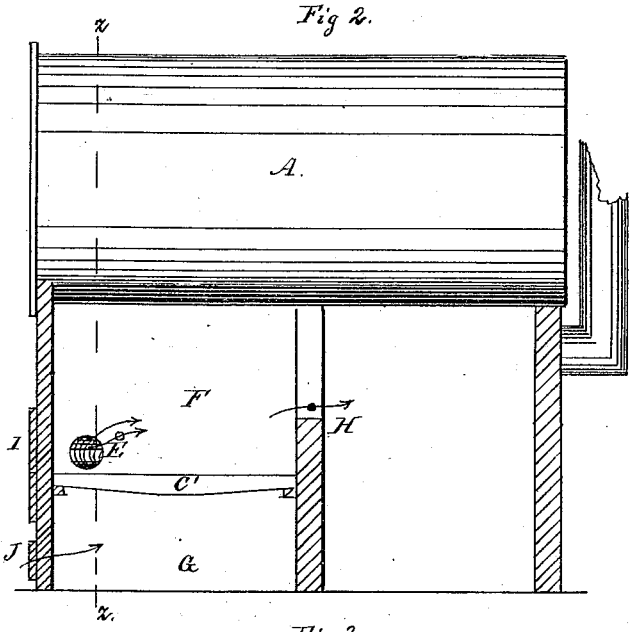


Fig 3.

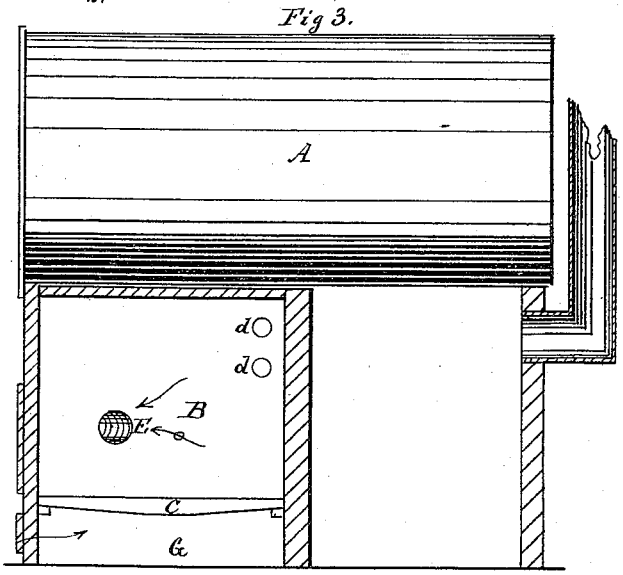
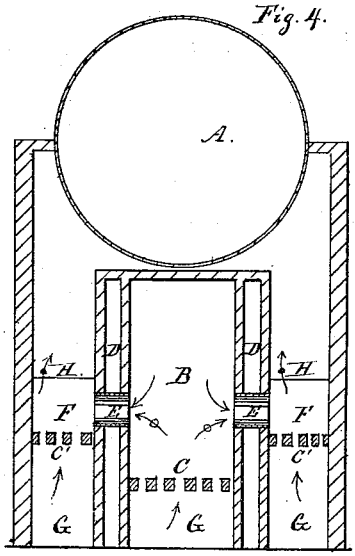


Fig 4.



Witnesses:

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UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN STEAM-BOILER FURNACES.

Specification forming part of Letters Patent No. **161,403**, dated June 15, 1875; application filed January 18, 1875.

CASE B.

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:

In the present invention I aim to separate the combustion of the coal into two stages, carried on in different chambers, to insure a thorough union of air with the volatile portion of the fuel. To this end I employ a close chamber, from which there is no direct draft to the flues. This chamber I provide with a grate, and so arrange it that a rapid coking process of the coal with which it is charged shall take place—a smouldering combustion which shall eliminate the volatile portion of the fuel. The gases so evolved are mingled in proper proportion with fresh air admitted into the primary or central chamber by way of flues, in such manner as to insure a thorough mingling. Near the front of the primary chamber an opening or passage at each side leads the gases and air mingled therewith into two lateral combustion-chambers, provided with grates and bridge-walls after the manner of ordinary fire-boxes, said combustion-chambers being preferably made narrow and deep, so that they may contain a deep bed of coke. Into these lateral chambers the coke formed in the primary chamber is placed and consumed.

The gases eliminated in the primary close chamber by the smouldering combustion, mingled with a proper proportion of air, pass into the lateral chambers through the fire of burning coke which raises the mixture instantly to the proper degree of heat required to produce their ignition or explosive combustion, whereby a thorough burning of both the solid and volatile portions of the fuel is obtained—a smokeless combustion. The close chamber, from which there is no outlet except at the apertures mentioned near the front, being provided with grate-bars, forms a peculiar device, operating as a retort in one sense—that is to say, in the sense that a large proportion of the gases are driven from the coal without combustion, and differing from a retort in the essential particulars that it is provided with an open grate below, whereby a smouldering combustion is induced, and also in the particular that a supply of air is admitted above the coal upon the bars, so that there issues from the chamber, instead of gas, an explosive mixture of air and gases, together with a small modicum of products of the smouldering combustion. In other words, the chamber is both a combustion and a coking chamber—it supplies its own heat for coking the fuel, and after eliminating a large proportion of the gases, supplies said gases with a proper proportion of air before they pass beyond the influence of the furnace-heat.

In the accompanying drawing, which forms a part of this specification, Figure 1 is a front view of the furnace. Figure 2 is a section of the same upon the line *x x* of Fig. 1. Fig. 3 is a section of the same upon the line *y y* of Fig. 1. Fig. 4 is a transverse section of the same upon the line *z z* of Fig. 2.

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

A represents a steam-boiler. B is the primary or central coking-chamber, extending from the front of the furnace to the line of the bridge-wall, and entirely inclosed at all sides, being provided with a grate, C. Near the rear of this chamber are located openings *d*, which communicate with the hollow side walls D of said chamber, into which air is admitted through the regulable openings *d'* in the front wall of the furnace. Near the front of said chamber are larger openings or flues E, leading from the chamber B, preferably with an inclination toward the front of the furnace into the lateral combustion-chambers F F at each side. These combustion-chambers are also provided with grates C', which should preferably be upon a higher level than the grate of the coking-chamber. G G G are the several ash-pits, one to each chamber. H H are the bridge-walls at the rear of the combustion-chambers in their usual relation. I I I are the doors to the coking and combustion chambers. J J J are the doors to the ash-pits, all provided preferably with regulable openings for air. The

course of the various currents are represented in the drawing by arrows, those with a plain shaft indicating air-currents, those with an open circle upon the shaft indicating currents of the volatile combustibles or gases, and those with a black disk upon the shaft the course of the products of combustion.

The operation of the invention is as follows: A charge of fresh coal is placed within the central chamber B, and ignited in the usual way upon the grate. A smouldering combustion takes place, regulated by the draft-opening in the central ash-door, which rapidly reduces the contents of the said chamber to coke, a small portion of ashes being produced and evolving a large quantity of gas, which rises within the chamber and mingles with the air introduced through the apertures *d*, and passes out through the openings E into the combustion-chambers F at each side, within which stand fires of incandescent coke, producing within said combustion-chambers an intense heat, being the result of the perfect combustion of the coke within said chambers, and of the explosive mixture drawn therein by the draft from the central chamber. From the combustion-chambers the draft is over the bridge-wall and out at the smoke-stack, in the usual manner.

Although the arrangement of the close coking-chamber in the center between the two lateral combustion-chambers is a very convenient and economical arrangement, and enables me to attain the proper proportion between the two processes with ease, and to govern and regulate more easily the critical part of the whole process, the coking, by its being confined to a single chamber, I do not wish to limit myself to this precise arrangement, as it is obvious that the same result could be produced by having two coking-chambers and one combustion-chamber, or by having several of each.

It will be noticed that the grate-bars of the coking-chamber are much lower than those of the combustion-chambers. The object of this arrangement is to facilitate the discharge of the explosive mixture of air and gas from said coking-chamber. This mixture is taken from above the coal in said central chamber and is delivered nearly upon a level with or among the incandescent coke. This is possible, for the reason that the coke does not cake and clog up the opening, as would be the case with coal not deprived of its bituminous elements.

When the coal is sufficiently coked it is removed from the coking-chamber and placed upon the grates of the combustion-chamber.

The arrangement of the coking-chamber between or contiguous to the combustion-chambers enables me to take advantage of the intense heat of the lateral chambers to assist in the coking process. When a glowing heat is obtained in the lateral chambers it will be imparted through the walls to the central chamber, and will be sufficient often to coke the coal in said central chamber without recourse to the grate in the latter. In such use, if intended, it will be desirable to make the walls of the central chamber solid, and to dispense with the space D, which may then be replaced by small pipes leading from the outer air-openings *d'* to the inner ones *d*.

In case it is desirable to force the fire, it may readily be done by admitting large quantities of air through the grates and air-supply flues of the coking-chamber. This will change the coking-chamber in a measure into an ordinary fire-box.

Having thus fully described my invention, what I claim as new is—

1. In a furnace for burning bituminous coal, a close coking-chamber, provided with grates and with inlets for fresh air and outlets for the mixture of air and gases arising from the coal, substantially as specified.

2. The combination, with a grate-supplied coking-chamber, having inlets for air and outlets for the mixture of air and gas, of one or more combustion-chambers, into which said outlet debouches, substantially as specified.

HORATIO M. SMITH.

Witnesses:

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