(No Model.) 2 Sheets—Sheet 1.

J. LISTER.

BOILER FURNACE.

No. 511,536. Patented Dec. 26, 1893.

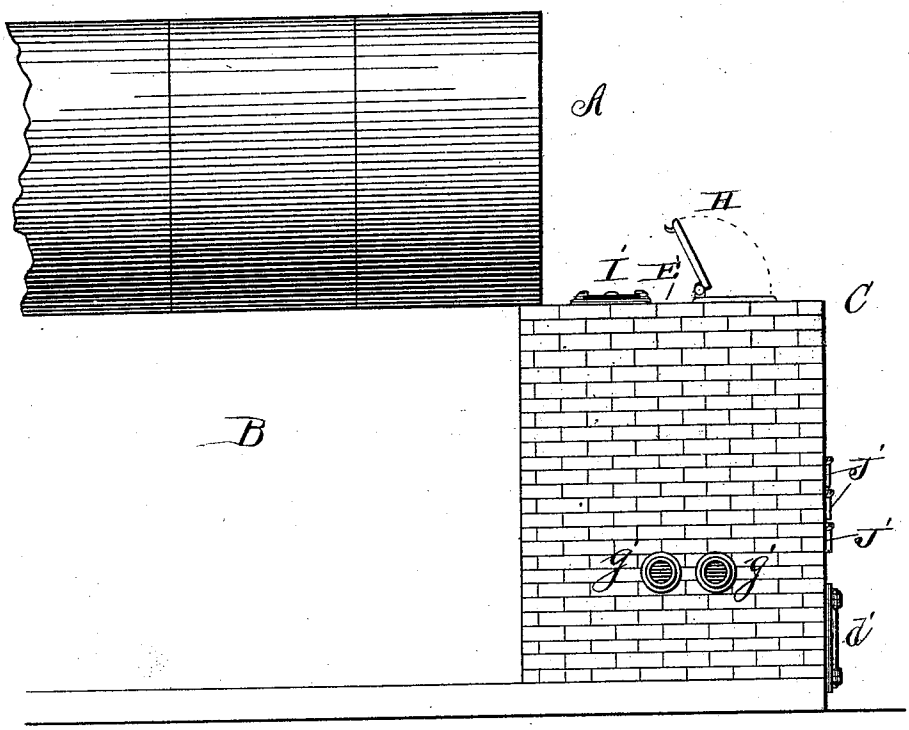

FIG. 1.

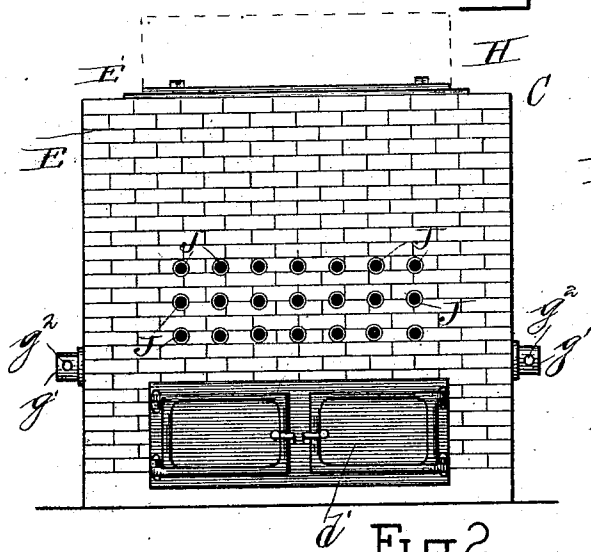

FIG. 2.

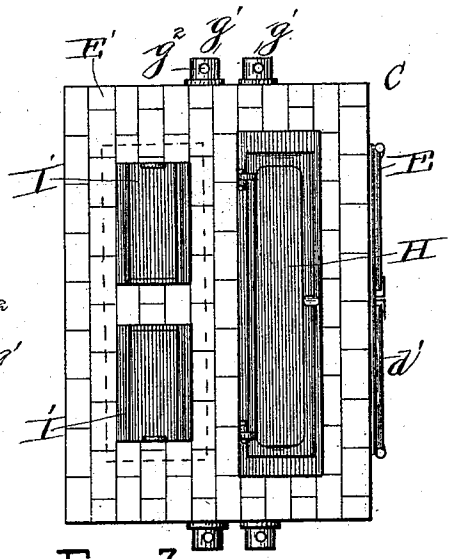

FIG. 3.

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M. B. May

INVENTOR:
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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.)

2 Sheets—Sheet 2.

J. LISTER.

BOILER FURNACE.

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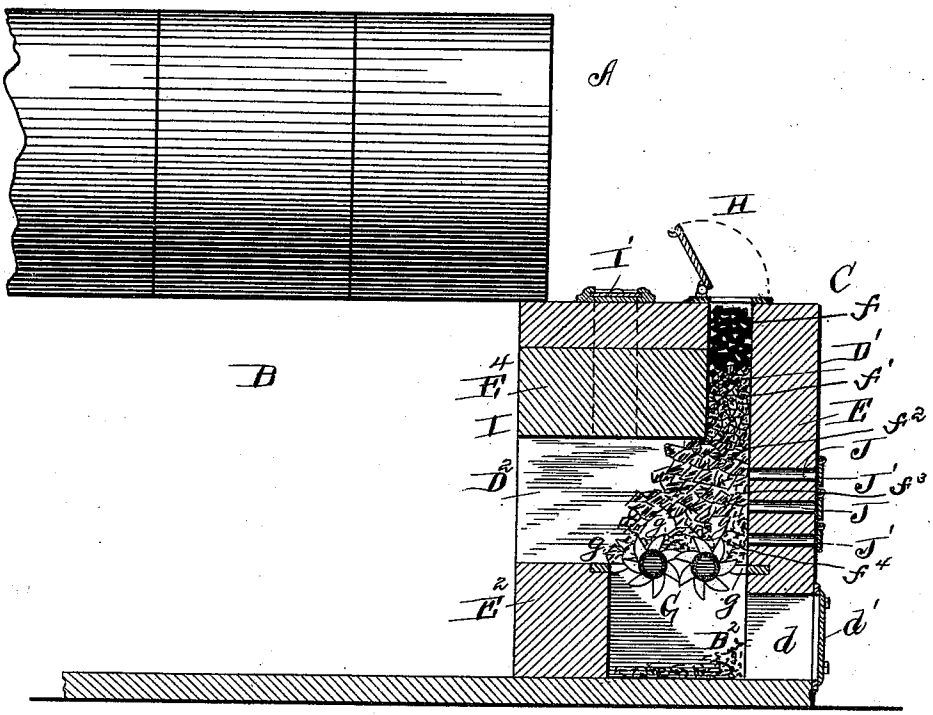

Fig. 4.

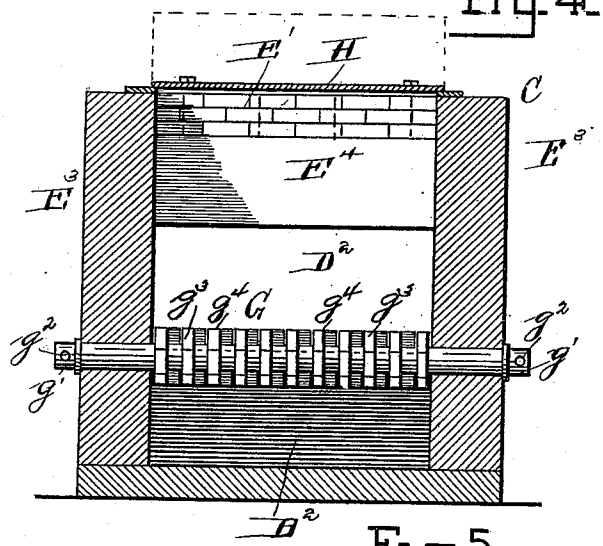

Fig. 5.

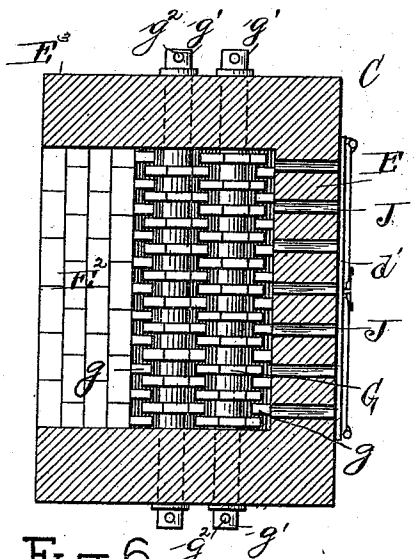

Fig. 6.

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UNITED STATES PATENT OFFICE.

JOSEPH LISTER, OF CHICAGO, ILLINOIS.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 511,536, dated December 26, 1893.

Application filed August 31, 1893. Serial No. 484,465. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH LISTER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Boiler-Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in furnaces, pertaining more particularly to constructions of the sort used in connection with steam boilers and in which soft or bituminous coal is used as fuel.

The invention has several purposes, the main one being to provide a furnace in which there shall be a combustion as complete as possible of all the carbon elements of the fuel and the production or throwing off of as little smoke as possible.

Another important object aimed at is the construction of a furnace in such way that but little or no iron or metallic parts shall be present in proximity to the bed of heated coals or to the chamber where the most powerful combustion is occurring.

There are additional purposes aimed at which will be fully understood from the description and drawings.

Figure 1 is a side elevation of a furnace embodying my improvements, showing also a part of the boiler connected therewith. Fig. 2 is a front view of the furnace. Fig. 3 is a top plan view. Fig. 4 is a vertical, longitudinal section. Fig. 5 is a vertical, transverse section. Fig. 6 is a horizontal section.

In the drawings A indicates a portion of the steam boiler sufficient to illustrate its relations to the furnace and fire chamber, the furnace being indicated as a whole by C, and the combustion chamber by B. The furnace is constructed of any dimensions desired, and in some respects as to its details can be of any suitable sort. I construct it substantially entirely of refractory material, such as brick work and fire clay. The front wall is indicated by E and the top by E′. E^2 represents the back lower wall or hearth portion. E^3 are the side walls, and E^4 is the arch or that part of the structure which corresponds to the arch, although I do not make it curvilinear in section, but in such way that it has a flat or horizontal surface at the bottom. The purpose of this is to secure uniformity of action above the hearth and in the combustion chamber. Owing to the intensely high heat generated in the furnace, this arch part or E^4 must be constructed with great care and of a material most refractory which is obtainable. I have succeeded in making one from a fire clay, which I find in one locality in the country, others not being sufficiently refractory to resist the heat. The heat is such as to tend to melt many of the more solid or earthy ingredients of the fuel and the result is the formation of hard cinders which accumulate at the bottom of the fuel chamber. To provide for the rapid removal of these I employ peculiarly constructed grate bars as indicated at G G. For ordinary boiler furnaces two of these arranged parallel and transversely of the chamber are sufficient. The journal portions are molded in the side walls E^3 as shown in Fig. 4. Each is formed with a number of arms g^3, preferably having the conformation shown, that is to say, each having an operative edge g^4 which is radial in relation to the axis of the grate bar, and having a curved back edge which is more tangential. The journal parts of these bars project through the south walls, as shown at g' and are provided with sockets or apertures for the application of a wrench to rotate them. Such rotation results in the crushing or grinding of the cinders which drop in reduced masses into the ash pit B^2. From the latter these can be withdrawn through the passages d, the latter being tightly closed by doors d'.

$g\ g$ indicate toothed plates which are seated in the front wall and in the hearth wall, respectively, the teeth being arranged as shown in Figs. 4 and 6, relatively to the projections on the grate bars.

I do not introduce fuel through the front wall, or on horizontal lines in the ordinary manner. I provide a vertical feeding flue D′ which extends down to the front part of the fuel chamber. See Fig. 4. This flue also serves as the duct for the draft.

When the furnace is charged with coal the conditions of the different parts of it vary and the localities of these differing parts are more or less well defined. Thus, at f the coal is in a state substantially similar to that in

which it was when introduced. That at f' somewhat lower down has commenced to be effected by the heat and to have the gaseous elements released and drawn downward into the combustion chamber. The material at f^2 has been reduced to coke. At f^3 the coke portions have reached the highest temperature at the time the last carbon ingredients are being burned. At f^4 the ashes and the cinders accumulate. They act to form a jacket or non-conducting protector for the metal of the grate bars so that the latter are never raised to a dangerously high temperature.

While the bulk of the air draft is being taken through the flue D′, it may be desirable under some circumstances to supplement this by additional air drafts such as can be obtained through the ports at j. These are formed in the front wall in proximity to the mass of red hot fuel and with them an assurance is given that all the carbon ingredients of the fuel shall undergo combustion. The flue D′ and the air draft, which is attainable through it, insure that all of the gaseous productions of combustion, including those which are ordinarily the cause of escaping smoke, shall be passed through and across the mass of red hot coal and through the region of most intense combustion.

If the conditions are such as to demand it, air can be supplied to the combustion chamber at points back of the mass of burning coal.

I′ indicates doors or dampers controlling an air passage extending from the top down to the combustion chamber D^2 on lines back of the fuel flue D′. These parts can be so adjusted as to not only regulate with great accuracy the air which is admitted to the combustion space, but also so as to modify the temperature of the top wall E′ and the arch E^4 and prevent them from being burned in the way to which they are liable if not protected. An enlarged chamber can be formed in these parts E′ and the arch E^4 to hold a body of air for that purpose.

When the parts have been properly adjusted in relation to a given material, the flame region where the final action of combustion occurs will be in the rear part of the chamber D^2 and the forward part of the chamber B beneath the boiler.

It will be seen that the air drafts are not taken up on vertical lines through the grate, that being the common manner of supplying air.

What I claim is—

1. A furnace having the combustion chamber D^2 arranged to deliver the production of combustion horizontally, the normally closed wall E in front of said chamber, the vertical fuel duct or flue D′ in the front end of said chamber behind the wall E, and adapted to maintain a continuous vertical column of fuel and to conduct air downward through the said fuel, the closed ash pit and the vertical flue communicating with the combustion chambers on lines back of the fuel duct, substantially as set forth.

2. In a furnace of the character described, the combination with the horizontally arranged combustion chamber and the vertically arranged fuel flue or duct at the front end of said chamber adapted to support a vertical column of fuel substantially continuous from the grate to the top of the duct, of the revolving grate bars provided with cinder crushing projections and arranged to support a layer of ashes or material heated to a relatively low degree and the closed ash pit below said bars, substantially as described.

3. In a furnace of the character described, the horizontally arranged combustion chamber D^2, the vertically arranged fuel flue or duct at the front end of said chamber which flue normally conducts downward the air for combustion and has a front vertical refractory wall against which the fuel rests in a continuous vertical column, the ports or ducts J in the front wall and horizontally opposite the inflamed fuel, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH LISTER.

Witnesses:
H. H. BLISS,
M. B. MAY.