# H. M. SMITH.

## BOILER-FURNACE.

No. 181,991. Patented Sept. 5, 1876.

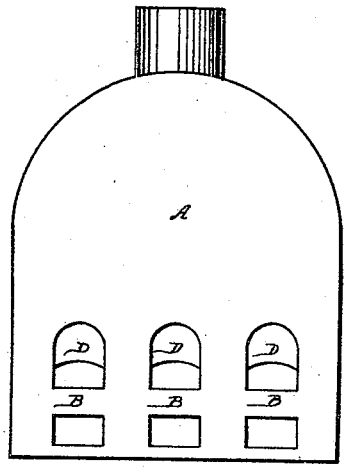


FIG. 1.

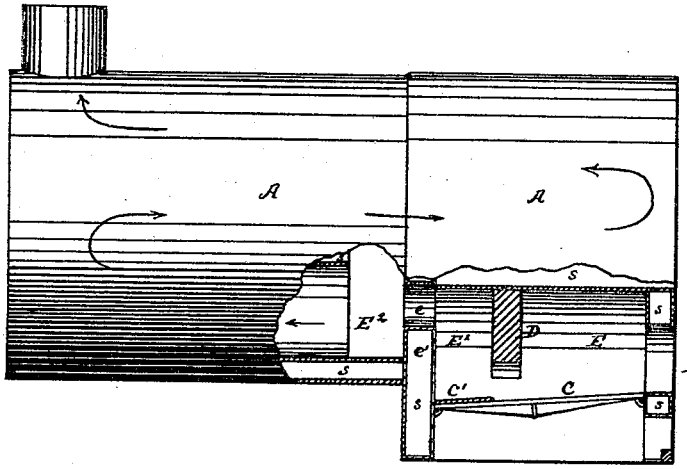


FIG. 2.

WITNESSES:
Jos. R. Smith
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INVENTOR:
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his attys

# UNITED STATES PATENT OFFICE.

HORATIO M. SMITH, OF CHICAGO, ILLINOIS.

## IMPROVEMENT IN BOILER-FURNACES.

Specification forming part of Letters Patent No. **181,991**, dated September 5, 1876; application filed February 17, 1876.

*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 Boiler-Furnaces, of which the following is a specification:

The nature of my invention will be fully understood from the hereunder written description and the accompanying drawing, forming a part of this specification, in which drawing—

Figure 1 is a view of the front of my improved boiler-furnace; and Fig. 2 is a vertical longitudinal section of one of the furnaces and of a portion of the boiler.

Like letters of reference made use of indicate like parts in both figures.

In said drawing, A indicates the boiler, which, in this instance, is of the kind known as "marine boilers," provided with three furnaces, B B B, alike in all material respects, and having the usual fuel-doors and ash-pit openings in front. The interior arrangement and construction of these furnaces B are clearly shown by the vertical section thereof in Fig. 2. The grate C is given a slight declension toward the back, as shown, though this is not essential. Over the rear ends of the grate-bars is a plate, C′, designed to deaden the draft at that point from between the bars, and to hinder access of air to the fire through that portion of the bars covered by it, thus affording a deadened surface for the fire to rest upon, to which may be appropriately given the name of "dead-plate." Just over the front of this dead-plate, and depending from the top of the furnace B, is a descending partition, D, terminating in an arch, which comes down near enough to the rear grate-surface to form a throat so narrow that it may be readily banked or choked with fuel, the downward incline given to the bars facilitating this operation somewhat. This arched partition in effect divides the furnace into two chambers, and I have designated them as E and $E^1$, the former being the front and the latter the rear chamber, the only communication between the two being under the arch D, and the rear chamber being closed to the draft by the dead-plate C. This rear chamber debouches through opening *e* in the wall *e′* into a chamber, $E^2$, still farther in the rear, and from which opens the flue system of the boiler, the general course of which flue system is indicated in Fig. 2 by the arrows. All three of the furnaces are provided in the same manner with the dead-plate and descending partition, and each of the rear chambers so formed debouches in like manner through similar openings *e* into said chamber $E^2$, which thus becomes the common receptacle of the flame and products of combustion from the three fires.

The operation of my furnace, thus constructed, is substantially as follows: The fire being started, enough of the live fuel is pushed back to partly fill or choke up the throat under the descending arch. As the throat is the only means of egress from the chamber E, the flow from said chamber must of necessity pass through said narrowed throat, whereby a perfect combustion ensues; and hence there issues into chamber $E^1$ only the flame and the volatile products of combustion. These volatile products of combustion expand or diffuse themselves, of course, the moment they are liberated from the narrow throat through which they have just passed, but are compelled to contract or combine again before entering the opening *e*. The diffusion or expansion is repeated when the chamber $E^2$ is reached.

I have found that this arrangement of chambers, whereby the gases are alternately caused to diffuse or expand, and to combine or contract, is an advantage in works where large boilers, heated by several fires, are used.

After the fire is well started, the fresh fuel may be thrown into the throat, or even beyond it, without loss of any of the evolved gases, as the strong blast which always exists in that part of the furnace insures their combustion.

The arrangements I have described enable me to accomplish the burning of the smoke in a manner similar to that described in my previous patents; but my present invention has an advantage over the way there shown, in that it affords a more simple mode of applying the method to existing furnaces.

It will be observed that in my improved form of furnace, the flame issuing from under the descending partition will become some-

what diffused before impinging against the boiler surface by reason of the distance, and for the further reason that the draft will tend to deflect it into the opening *e*. Thus danger of burning out the boiler at that point is avoided.

In the drawing, the parts marked *s* surrounding the furnace are water-spaces. Instead of the dead-plate C′, the same result may be had by placing under that portion of the grate described as deadened by said plate a wall of brick, or a suspended plate or pan, which would effectually or sufficiently prevent the passage of air through that part of the grates.

The descending partition, terminating in an arch, should be of refractory material; or it may be a water-space, in which latter event it would afford a good steam-making surface. It should be so placed as to form a throat between itself and the juncture of the active and deadened grate surfaces.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The combination of the furnace divided into two chambers, E and $E^1$, with the chamber $E^2$ in front of the flue system, and connected to chamber $E^1$ by the opening *e*, substantially as specified.

HORATIO M. SMITH.

Witnesses:
EDW. S. EVARTS,
FORD R. SMITH.