(No Model.) 2 Sheets—Sheet 1.

D. SINTON.

Smoke Consuming Furnace.

No. 233,168. Patented Oct. 12, 1880.

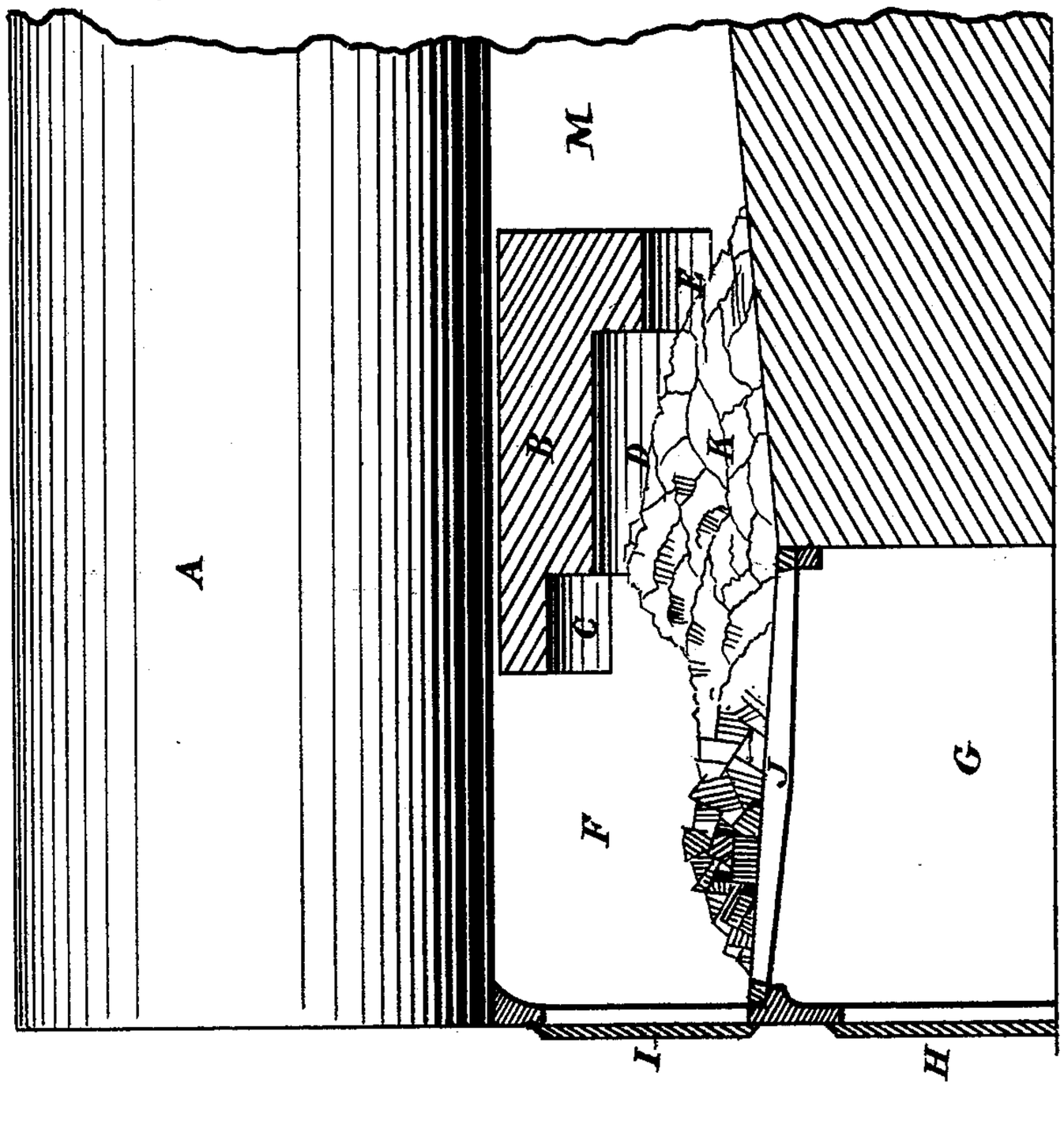

Fig. 1.

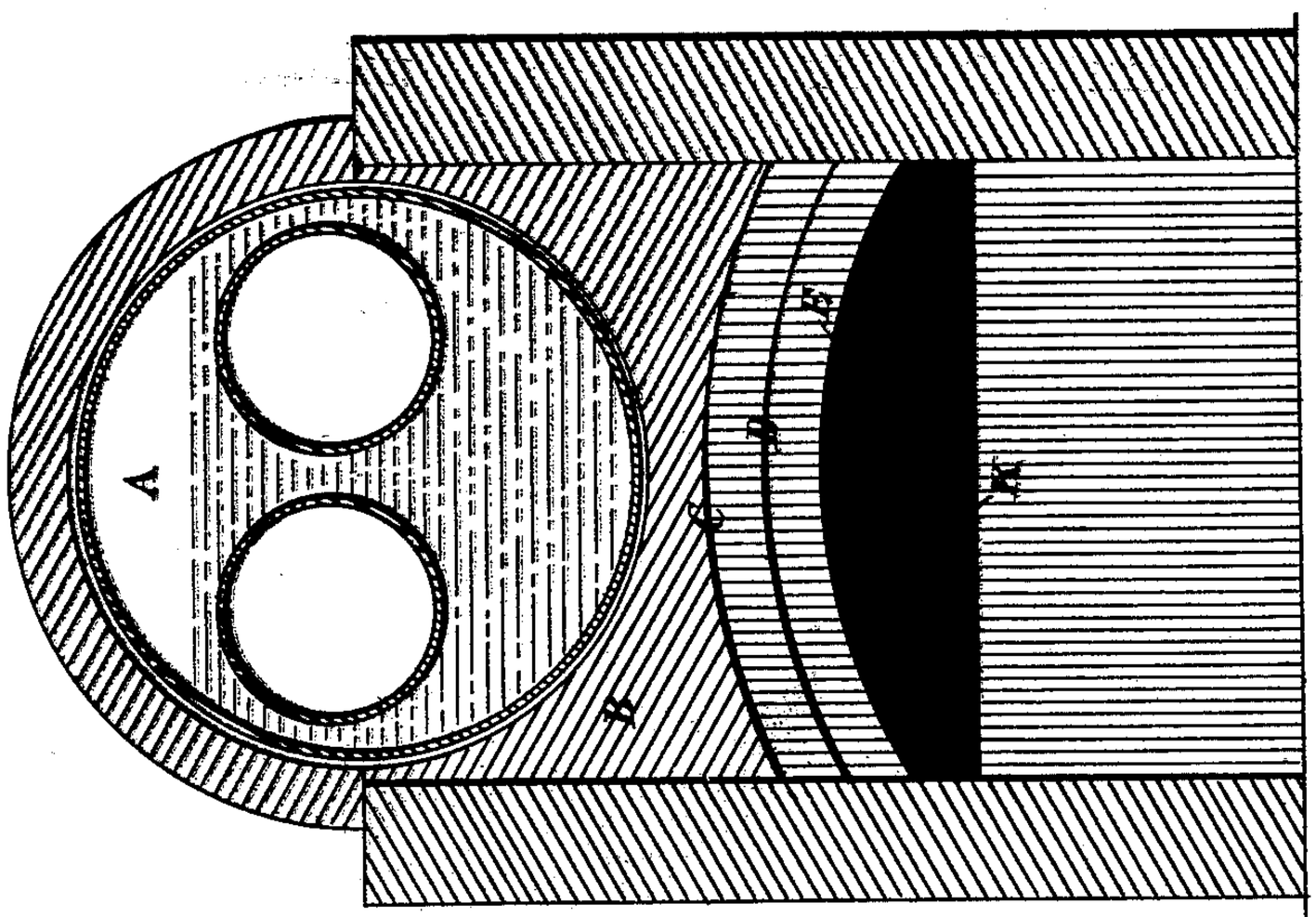

Fig. 2.

Attest:
Jeremiah F. Twohig
James D. Crawley

Inventor:
David Sinton

(No Model.) 2 Sheets—Sheet 2.

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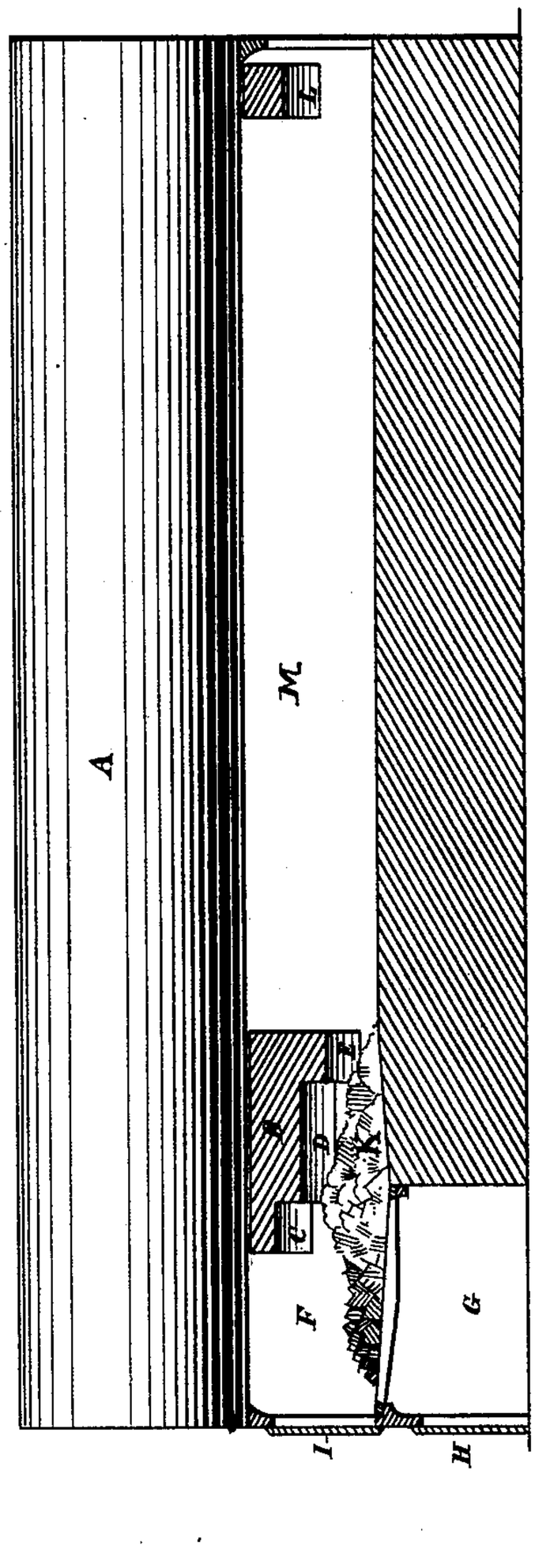

Fig. 3.

Attest:

Jeremiah F. Twohig.

James L. Crawley.

Inventor:

David Sinton

UNITED STATES PATENT OFFICE.

DAVID SINTON, OF CINCINNATI, OHIO.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 233,168, dated October 12, 1880.

Application filed April 19, 1880. (No model.)

To all whom it may concern:

Be it known that I, DAVID SINTON, of Cincinnati, Hamilton county, Ohio, have invented an Improvement in Smoke-Consuming Furnaces, of which the following is a specification.

My invention consists of an improvement in boilers or other furnaces of such a nature that the change transforms the ordinary furnace into one that will make such a complete combustion of the fuel as to prevent the emission of smoke.

In order to accomplish the above result it is, in my opinion, necessary, first, to remove the gases of the burning fuel from contact with the boiler for such a distance and in such a manner that they will have their temperature elevated to a very high degree; second, to introduce into these gases atmospheric air in such heated condition and in such quantities and diffusion as will produce a perfect chemical combination and combustion.

To produce these results I have constructed the following invention:

In my furnace, at or near the rear end of the fire-chamber, I construct a tunnel the arch of which reaches the boiler and descends in steps from front to rear, as shown in the drawings herewith. The soffit of the arch may have any number of descending steps, or it may be smooth and inclined; but I prefer the stepped arch, as herein stated. The upper portion of the arch must encircle the boiler on both sides until it reaches its semi-horizontal diameter or closure. The grate-bars of the fire-chamber may descend slightly from front to rear, or they may be level, and they should be shorter than those ordinarily used, and with no dead-plate in front. From the end of the grate-bars the base of the tunnel is built solid, either gradually ascending or level, while its arch descends by steps from front to rear, and thus the exit of the tunnel can be more or less contracted, according as the requirements of each furnace may demand. Atmospheric air is admitted through the fire-doors by merely opening and closing them from time to time, and to such an extent as may be necessary. The fire-chamber under the boiler should be large, with sufficient dimensions to provide for the proper expansion of the heat and gases evolved from the tunnel, and to prevent any injurious concentration of heat on the boiler a bridge-wall is dispensed with. In case the flues in the boiler fail to properly arrest the too rapid transit of heat, an arch should be constructed at the rear end of the boiler, leaving underneath only such space as is necessary for this purpose and consistent with the sufficient draft of the furnace; but such arch is always beneficial under a cylinder-boiler.

Having described generally the construction of the invention, I shall now proceed to describe more particularly the drawings herewith, in which—

Figure 1 is a longitudinal section of the furnace and one-half of the boiler, and Fig. 2 is a cross-section of the furnace and boiler; and Fig. 3, a section showing the rear arch.

A is the section of the boiler here shown, being a double flue of twenty feet in length and forty inches in diameter.

While it is preferred to give the base of the tunnel or hearth a slight upward inclination from the grate, as shown in the drawings, on account of the more perfect action thereby secured, the base may be made level and good results secured thereby.

The arch B, with three descending steps, C, D, and E, forms the top of the tunnel, and is constructed partly over the fire-chamber F and the remainder over the solid base of the tunnel, so that the front end of step D is immediately over the rear end of the fire-chamber grate, and the remainder of the arch B is over the solid base of the tunnel.

G is the ash-pit; H, the ash-pit doors; I, the fire-doors; J, the grate, and K the tunnel.

After the first, and immediately preceding each subsequent firing, the incandescent coals on the grate should be pushed back into the tunnel until it is nearly filled.

To facilitate the removal of clinkers the solid base of the tunnel should be kept covered with ashes.

L is the arch at rear of the boiler.

By these arrangements a constant supply of incandescent coals is maintained, the diffusion and heat of the air and gases amply provided for, and the draft of the furnace so improved that the strength of its current under the boiler is sufficient to overcome all the checks and hinderances of the stepped arch,

the incandescent coals in the tunnel, the enlargement of the flue-chamber under the boiler beyond the tunnel, and the further impediment of an arch under the rear end of the boiler, as before stated, thus causing that slowness of current which is essential to such chemical combinations of the air and gases as will produce perfect combustion and economize fuel. The result of this is, that under all ordinary circumstances of subsequent firings, including the opening of the fire-doors, no smoke is emitted from the furnace.

In operating the furnace the fire is built on the grate-bars, and after it is fairly burning the incandescent coals are pushed back under the arch, as shown at K, and fresh fuel placed on the grate. The partial combustion which takes place in the chamber A produces hydrogen gas and carbonic-oxide gas. Hydrogen gas is very light, and rises to the top of the chamber, while the carbonic oxide is very heavy and remains in the bottom of the chamber.

By the admission of the atmospheric air, which is heavier than the hydrogen and lighter than the carbonic oxide, through the door I, it is caused to mingle with them both, thus producing a compound of the three, which passes under the broken or inclined arch and through the incandescent coals K. By the arch the compound is caused to roll or curl upon itself, and the constituent elements are thereby thoroughly mixed.

The heat here produced rises from about 300° Fahrenheit to 1400° or 1500°, and causes a complete combustion of all the combustible gases, which takes place under the rear end of the arch and in the long flue or chamber beneath the boiler. This combustion is facilitated by the absence of the usual bridge-wall.

The arch at the rear end of the chamber or flue is designed to control the flow of the gases or vapors through the chamber.

For the combustion of the smoke and gases a heat of from 1400° to 1600° is required. The space on the boiler which is covered by the arch must therefore be sufficiently long for the compound of gases passing through the incandescent coal to attain the temperature named. The hearth or bottom of the tunnel must be solid, so that no air can enter the bottom. The entire bottom of the furnace, including the forward portion of the tunnel or chamber—or, in other words, the hearth—must be level, or substantially so, in order that the coals may be pushed back readily from the grate. The gases, after passing down through the incandescent coal, must find an exit or an explosion will occur. The passage or throat under the rear end of the arch is large enough for this purpose, and the gases pass into the flue or passage under the boiler at a very high degree of temperature, and in said flue the final combustion takes place.

I am aware that a descending arch located beneath the boiler in the fire-chamber is old; also, that boiler-furnaces have been constructed without bridge-walls; also, that air has been admitted to a furnace above the grate-bars; but I believe myself to be the first to combine and arrange the features named in such manner as to produce a practical smoke-consuming furnace.

I claim—

1. In a boiler-furnace, the combination of a substantially horizontal grate, a smooth ascending hearth or tunnel-bottom extending upward from the rear line of the grate, as shown, and a downwardly-extending arch located immediately beneath the boiler, partly above the rear end of the grate and partly over the forward end of the hearth or bottom, as described and shown.

2. In a smoke-consuming boiler-furnace, the combination of a substantially horizontal grate, a backwardly-extending tunnel having its bottom or hearth flush with the rear end of the grate, a downwardly-extending arch located beneath the boiler above the rear end of the grate and the forward end of the tunnel-bottom or hearth, and means, substantially such as described, for admitting air above the grate at the front of the furnace.

3. The combination of the boiler, chamber F, inclined arch, located as described, grate J, space G, and the flue M, extended backward beneath the boiler without having a bridge-wall therein, as described and shown.

4. The combination of the boiler, the downwardly-inclined arch immediately beneath the boiler, the grate, the tunnel having the smooth bottom in line with the grate, the passage M, the arch N at the rear end of the passage, and means, substantially such as shown, for admitting air in graduated amounts above the grate, said features being combined and arranged relatively to each other as described and shown.

DAVID SINTON.

Witnesses:
JOHN R. DE CAMP,
JEREMIAH F. TWOHIG.