W. A. GREENE.

Furnace for Steam-Generator.

No. 214,905. Patented April 29, 1879.

Fig. 1.

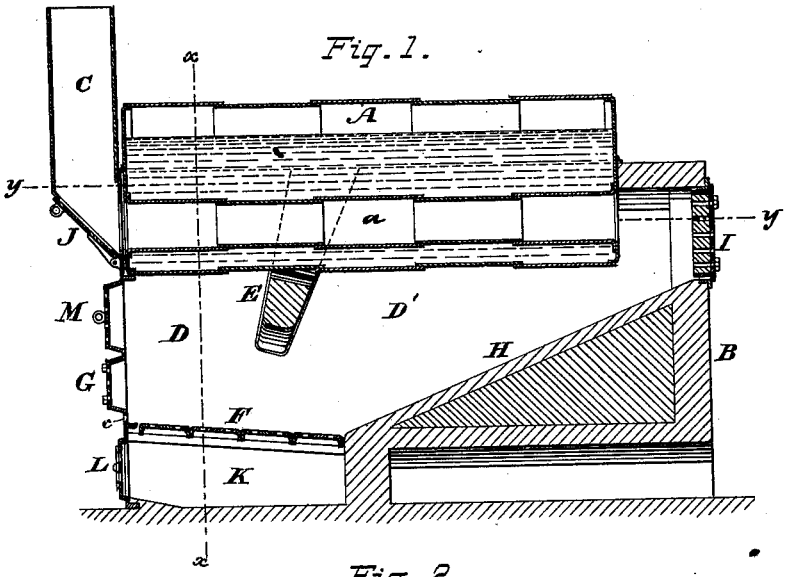


Fig. 2.

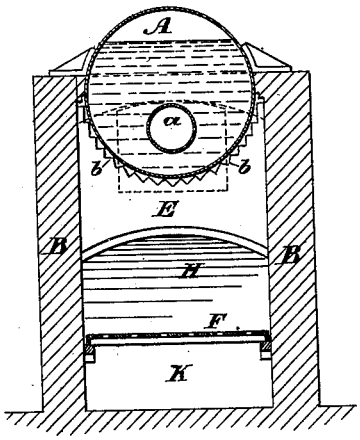
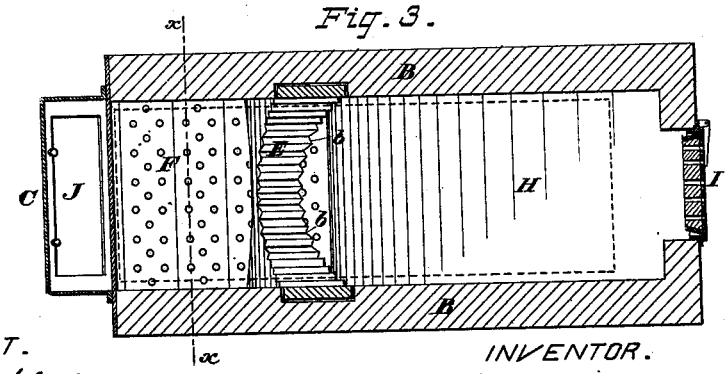


Fig. 3.



ATTEST.

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UNITED STATES PATENT OFFICE.

WILLIAM A. GREENE, OF ELIZABETHPORT, ASSIGNOR OF TWO-THIRDS HIS RIGHT TO EDWIN R. CAHOONE AND ANDREW ALBRIGHT, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN FURNACES FOR STEAM-GENERATORS.

Specification forming part of Letters Patent No. **214,905**, dated April 29, 1879; application filed December 19, 1878.

To all whom it may concern:

Be it known that I, WILLIAM A. GREENE, of Elizabethport, in the county of Union and State of New Jersey, have invented certain Improvements in Furnaces for Steam-Generators, of which the following is a specification.

This invention relates to furnaces adapted especially for burning soft or bituminous coal and fuels rich in hydrocarbons; the object being to consume or combine with the oxygen of the air all of the hydrogen and free carbon, to maintain combustion of the gases generated from the fuel throughout the entire length of the flues, in case of flue-boilers being used.

My invention is shown as applied to an ordinary cylindrical return-flue boiler; but it is equally well adapted to locomotive, marine, or other boilers.

In the drawings, Figure 1 is a longitudinal vertical mid-section of the boiler and furnace. Fig. 2 is a transverse section of the same, taken in the plane of the line *x x*, Fig. 1. Fig. 3 is a plan of the furnace, being a horizontal section taken in the plane of the line *y y*, Fig. 1.

A represents a cylindrical boiler, having a flue or flues, *a*. This boiler is mounted in or on a furnace-wall, B, of brick or other material. C is the breeching, leading to the chimney. D D′ are the front and rear combustion-chambers, they being separated, or partially separated, by a pendent inclined partition, E. This partition is or may be built up of fire-bricks or tiles, with its lower edge slightly arched and inclined toward the front, as shown. Its upper edge conforms to the shape of the boiler, and touches, or nearly touches, the same, being provided with notches or channels *b b*, (see Fig. 2,) extending across its upper edge to form openings for the passage of small jets or currents of air from one combustion-chamber to the other.

F is the fire-bed, which is composed of perforated sections, arranged across the fuel-chamber, as shown. These sections are smooth on their upper sides, and the entire bed slopes back from the fuel or charging door G. From the back edge of the fire-bed, and flush with it, extends a sloping back hearth, H, its rear extremity extending to the back boiler-wall, a short distance below the lower edge of the boiler A. This hearth may be formed of fire-brick or any suitable refractory material.

In the rear wall, opposite the end of the boiler, is a perforated door, I, arranged to admit air in fine jets to the heated gases as they pass from the chamber D′ to the flues of the boiler, and ignite them or maintain their ignition. This door also serves a useful purpose in enabling the flues of the boiler to be readily inspected, as by throwing open said door and the door J in the breeching a clear view through the flues may be had. The door I also serves to give access to the chamber D′ for cleaning purposes, and the arrangement of the hearth H to slope from the said door down to a point flush with the rear edge of the fire-bed F greatly facilitates this operation.

K is the ash-pit, and L represents doors opening into the same, and provided with registers for the regulated admission of air under the fire-bed.

M is a perforated plate or door for the admission of air to the combustion-chamber D, and to provide, by its removal, for the more ready access to the said chamber. The charging door or doors G may also be perforated, as represented, and both it and the plate M may be provided with registers. The fire is kindled under the pendent partition E, and soft or bituminous coal fed in at the charging-door G. The fuel takes fire and burns from the back, and as the temperature increases it becomes charred or coked, losing its hydrogen and free carbon. When sufficiently coked it is pushed back wholly or partially under the partition E into the chamber D′ by means of a poker inserted through holes *c c* beneath the charging-door and just above the level of the first bed.

As soft coals cake and compact in coking, and these masses must be broken up or sliced, the operator inserts the poker, as above stated, under the mass, and, utilizing the walls of the holes *c c* as a fulcrum, pries it up. The sloping smooth-surfaced fire-bed greatly facilitates this operation, as well as that of pushing back the coked fuel.

In the chamber D′ the coal combines with

the constantly-incoming current of oxygen from the air entering in jets through the perforations of the fire-bed, and becomes incandescent, its fixed carbon combining with the oxygen so completely as to prevent almost entirely the formation of smoke. In the meantime green or uncoked fuel is fed in at the charging-door, as needed, to supply the place of the coked fuel pushed forward.

By reason of the partition E the draft is invariably downward from the charging-door and plate M, so that the carbon set free in the chamber D and the gases eliminated from the fuel in coking mix intimately with the air in passing through the contracted opening beneath the partition, and they must also pass through the incandescent mass in the chamber D′, back of the partition, before they can escape. Consequently the combination and evolution of heat must be nearly perfect.

Such gases, however, and free carbon as may be generated in the chamber D′, and be enabled to combine with oxygen entering at other points, will be supplied with air from the perforations in the door I, and thus very little, if any, smoke or soot be permitted to reach the flues or breeching.

The partition E should not touch the boiler-shell all around, as it would be likely to interfere with the even heating of the same and cause injury by unequal expansion; and this would be the more likely to result from the fact that in such an arrangement the heat would be more intense in the chamber D′ than in D. To avoid this I permit the partition to touch, or nearly touch, the shell of the boiler, and then form channels *b b*, before mentioned, across its upper edge, to permit the heated gases and products to pass back and forth to a limited extent, and thus equalize the temperature of the boiler-shell throughout its length.

The points between the channels *b b* may be allowed to touch the boiler without serious detriment, as the contact is small.

By this construction of a furnace for steam-generators, I am enabled to greatly reduce the extent of fire-bed per horse-power, as the heat is more intense, and the fuel is more perfectly consumed. The fire-bed and back hearth, H, being perfectly smooth and flush with each other at their junction, no obstacles are offered in cleaning out ashes and clinkers; and this necessary operation is also greatly facilitated by the arrangement of the doors G and I at opposite ends, as shown. The sections of the fire-bed are arranged across the fuel-chamber, instead of lengthwise, as in ordinary furnaces, and they may be readily removed when burned out and be replaced by new ones.

The arrangement of the partition E to slope toward the front gives the chamber D somewhat of a hopper form to receive the green fuel, and gives a free clearance for the fuel and gases in the rear chamber.

The hearth H serves as a bed for some portion of the incandescent mass of fuel pushed under the partition E, beyond the limit of the fire-bed; but before reaching this point the hydrocarbons and free carbon will have been substantially eliminated. This arrangement serves to fully utilize at the rear of the boiler the heat emanating from the incandescent mass, which is, in ordinary furnaces, concentrated near the front end.

I claim—

1. In a furnace for steam-boilers, adapted for burning soft coal, the combination of the pendent partition E, arranged inclined to the front, as shown, and about midway of the length of the fire-bed, and having an air-passage left for a reduced circulation between it and the boiler-shell, with the inclined perforated fire-bed F and the back hearth, H, substantially as set forth.

2. In a furnace for steam-generators, adapted for burning soft coal, the inclined fire-bed F, the back hearth, H, arranged flush with the bed at their junction, and sloping up to the door I, the said door I arranged to admit air to the flues, and the pendent partition E, all combined and arranged substantially as set forth.

3. In a boiler-furnace, the perforated door I, arranged in the back wall opposite the rear end of the boiler, the hearth H, arranged to slope down from the said door to the rear edge of the fire-bed, the fire-bed F, constructed of perforated sections, and the door G, all arranged and combined substantially as specified.

4. In a furnace for return-flue boilers, the arrangement of the furnace or fire-grate F under the forward end of the boiler, the pendent partition E, arranged to partially divide the fire-box, and the perforated door I, to admit air to the furnace at the point where the products of combustion turn into the flues, substantially as set forth.

5. In a furnace for steam-generators, adapted to burning soft coal, the fire-front provided with the perforated plate or door M, the charging door or doors G, the holes *c c*, and door L, in combination with the fire-bed F, the sloping hearth H, the door I, and the partition E, all arranged substantially as and for the purposes set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM A. GREENE.

Witnesses:

HENRY CONNETT,

WALTER W. SCOTT.