W. A. GREENE.
Boiler-Furnace.

No. 221,808. Patented Nov. 18, 1879.

Fig. 1.

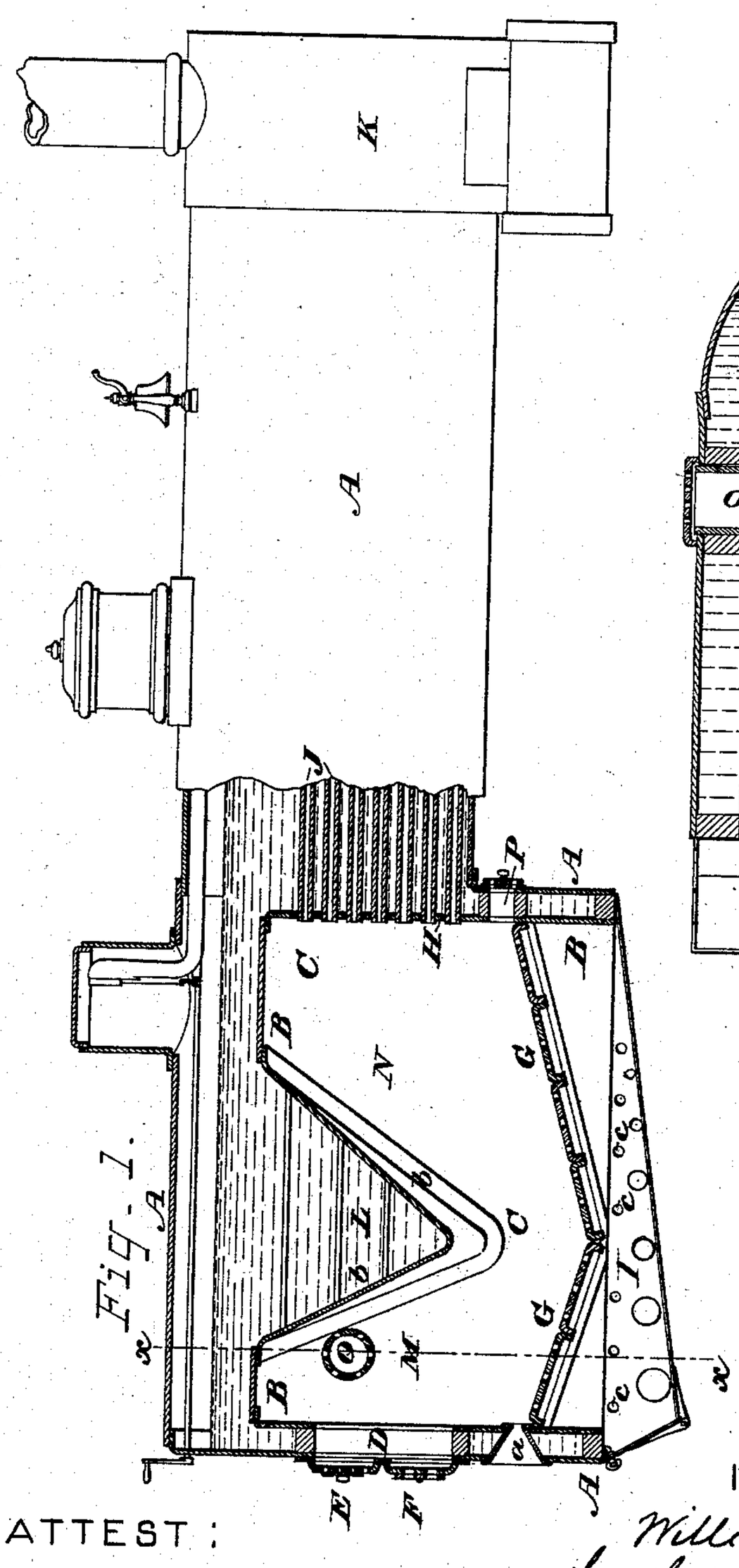
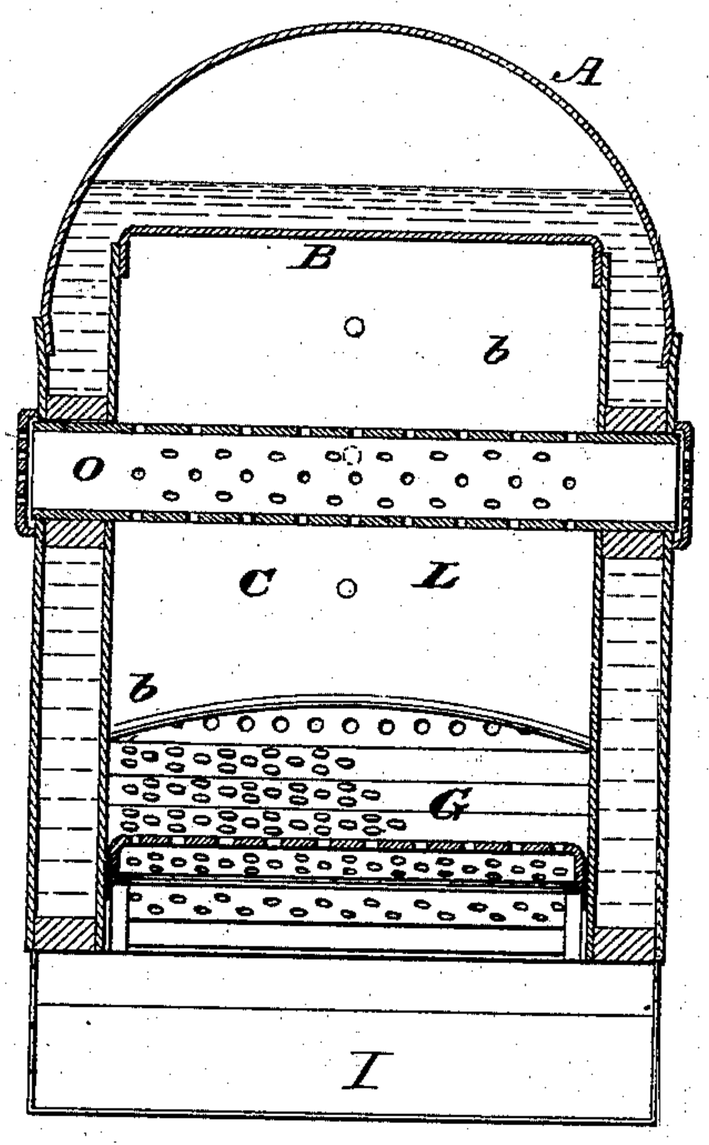


Fig. 2.



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

IMPROVEMENT IN BOILER-FURNACES.

Specification forming part of Letters Patent No. **221,808**, dated November 18, 1879; application filed July 24, 1879.

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 new and useful Improvements in Boiler-Furnaces, of which the following is a specification.

My invention relates to the class of boilers most commonly used in locomotives, but which are also adapted to other uses and purposes, being constructed with a series of horizontal tubes, or with a flue or flues for the passage of the products of combustion from the furnace proper to the uptake or smoke-stack.

My improved furnace is designed for burning bituminous coal, or other fuels rich in hydrocarbons—as peat, for instance—and is a development of and improvement on the furnace for return-flue stationary boilers patented by me April 29, 1879, No. 214,905.

In the drawings, Figure 1 is a vertical longitudinal mid-section, partly in side elevation, of a locomotive boiler and furnace constructed according to my invention; and Fig. 2 is a vertical cross-section of the same on a somewhat larger scale, taken in the plane of the line *x x*.

Let A represent the outer shell of the boiler, and B the inner shell of the same, forming the walls of the furnace proper or fire-box C. Between the shells A and B is formed the usual water-jacket surrounding the furnace, and through it, at the back of the furnace, is formed an aperture or opening, D, in which are arranged a perforated plate or door, E, and a charging-door, F. These are preferably hung in an open frame, which is hinged to the shell A, so that the frame may be swung open when it is desired to have access to the furnace for cleaning or repairs, thus making the entire opening D available for that purpose.

a a are one or more poke-holes, preferably three, through which to pass a poker or slicing-bar to manipulate the fuel. Owing to the thickness between the shells A and B and the necessity for vibrating the poker laterally upon an incline after insertion, I prefer to make the bushing for the holes in the form of a conical tube, as shown, its mouth being turned toward the outside. From the lower edges of the holes *a a*, inside the furnace, the grate or fire-bed G extends or slopes down to a point about one-third of the way toward the rear tube-sheet, H, and from the said point the grate rises on a gentle incline until said tube-sheet is reached. The purpose of this conformation is hereinafter explained.

I is an ash pit or pan of the usual kind, and J J are the usual tubes for conveying the products of combustion from the furnace C to the uptake K, leading to the smoke-stack. Instead of tubes J J, a flue or flues may be employed.

The furnace C is partially divided into two parts by a pendent water partition or limb, L, which extends down from the roof of the furnace about two-thirds of the distance toward the lowest part of the grate, and passes from one side of the furnace to the other. It is preferably wedge-shaped, or of V shape in cross-section, as seen in Fig. 1, and is formed of a sheet or sheets, *b*, of boiler-plate, fastened at the top to the roof plate or shell B of the furnace, and extending downward in a direct line and at a suitable inclination to a rounded side or edge at the bottom, the end edges of the sheet or sheets being flanged and fastened to the side shell, B. This water-partition L provides a channel for free circulation of the water across from one side to the other of the water-jacket surrounding the furnace, and also acts as an important aid in generating steam, inasmuch as it depends into the very heart of the furnace, where the heat is extreme. It also affords means for bracing the boiler transversely in a much stronger manner than has heretofore been possible.

The partition or water-limb L divides the furnace C into two portions—a primary combustion-chamber, M, back of it, and a secondary combustion-chamber, N, in front of it, the latter being much the larger, to give a space for the reverberation of the gases before they pass into the tubes J J.

Near the upper part of the chamber M a tube, O, is arranged, extending horizontally from one side of the furnace to the other, and passing to the outside of the shell A, that its ends may be open to the outer air. It is provided with perforations throughout its entire length in the furnace, and its purpose is to take air at its ends from outside the furnace,

to draw it inward, and to discharge it through the perforations in a series of jets into the furnace.

At the junction of the grate G with the tube-sheet I arrange through said sheet and the shell A an opening, P, which is normally closed by a perforated door. This admits a second supply of air to the furnace, which mingles with the gases in the chamber N just before they pass into the boiler-tubes J J.

By opening the perforated door a bar may be inserted at the opening P, to rake off and clear the forward rising surface of the grate.

Fuel is fed through the door F into the chamber M, where it is ignited, and as the temperature rises it becomes charred or coked, giving off its hydrogen and free carbon in the form of gas or smoke, which is drawn down by the draft, and which passes under the partition L into the chamber N. As the coal in the primary chamber becomes coked, it is pushed forward into the secondary chamber by means of a poker inserted at one of the holes *a a*. In the secondary chamber the combustion of the solid portions of the fuel is completed, the greater portion of its gaseous constituents having been driven off in the chamber M.

Air is admitted under the grate through a series of perforations, *c c*, in the ash-pan I, and air is also taken into the chamber M through the duct-tube O at the top and through the perforated plate E at the back. The door F may also be perforated or provided with a register for the further admission of air.

The air entering the chamber M mingles with the gases from the fuel, passes down through the fuel under the partition L, and rises into the chamber N, where it reverberates in the clear space forward of the partition, being constantly exposed to the intense heat from the incandescent fuel on the rising surface of the grate in this chamber, and mingling with the products of combustion rising therefrom, and with the second supply of air entering through the opening P and through as much of the forward part of the grate as is not covered with fuel. The commingled gases then pass into and through the tubes J J, their combination being completed therein, and they escape at the smoke-stack almost entirely devoid of combustible constituents.

The contour of the fuel in the furnace is shown by the irregular dotted line in Fig. 1. It will be observed that the greatest thickness of fuel is in the primary chamber, it being there heaped close to and touching, or almost touching, the rear side of the partition L. In the secondary chamber it is spread out in a nearly uniform line, its thickness gradually decreasing as it approaches the front. This form of the fuel is essential to the best operation of the furnace, and is directly due to the formation of the fire-bed or grate-surface. If the fire-bed were flat and level, the fuel would soon spread itself out in a uniform layer over the same, and a considerable space would be left between its surface and the bottom of the partition; or if the fire-bed sloped continuously downward toward the front, the greater portion of the fuel would be transferred into the secondary chamber, and all advantage of a divided fire-box would be lost. In a locomotive, for which my furnace is specially intended, the jarring and uneven motion in running would make these effects more marked. I therefore so arrange my fire-bed as to cause the fuel to assume of itself the desired form and position. This arrangement consists, chiefly, in sloping the fire-bed from the front downward to a point directly under the partition, and also, by preference, in extending it from that point with an upward inclination to the back wall of the furnace. With this construction, even if the upper surface of the fuel were to become entirely level, the space between the grate and the bottom of the partition would still be very nearly filled, and by continually charging the fuel into the primary chamber it is kept heaped against the rear side of the partition in the desired form.

I am aware that sloping fire-beds have been before employed in connection with a transverse water-partition; but in such the grate has always sloped uniformly downward to the farther end of the secondary chamber, or has sloped downward from the charging-door to directly under the partition, and has from that point been continued on a level through the secondary chamber.

I claim—

1. The combination of the pendent wedge-shaped water-partition L, extending transversely across the fire-box and partially dividing the same into a primary combustion-chamber, M, and a secondary combustion-chamber, N, with a fire-bed, G, having an uninterrupted surface, and sloping downward from its front edge to a point under the lower edge of the partition L, substantially as and for the purposes set forth.

2. The divided furnace C, having primary and secondary combustion-chambers M and N, uninterrupted grate G, transverse perforated air-tube O, perforated air-inlet plate E, charging-door F, and poke-holes *a a*, combined and arranged to operate substantially as set forth.

3. The furnace C, divided into two parts by a pendent water-partition, L, and provided with the uninterrupted grate G and poke-holes *a a*, and with the perforated air-inlet plate E and charging-door F at the rear, and the air-inlet opening P at the front, combined and arranged to operate substantially as set forth.

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

WILLIAM A. GREENE.

Witnesses:

ARTHUR C. FRASER,

HENRY CONNETT.