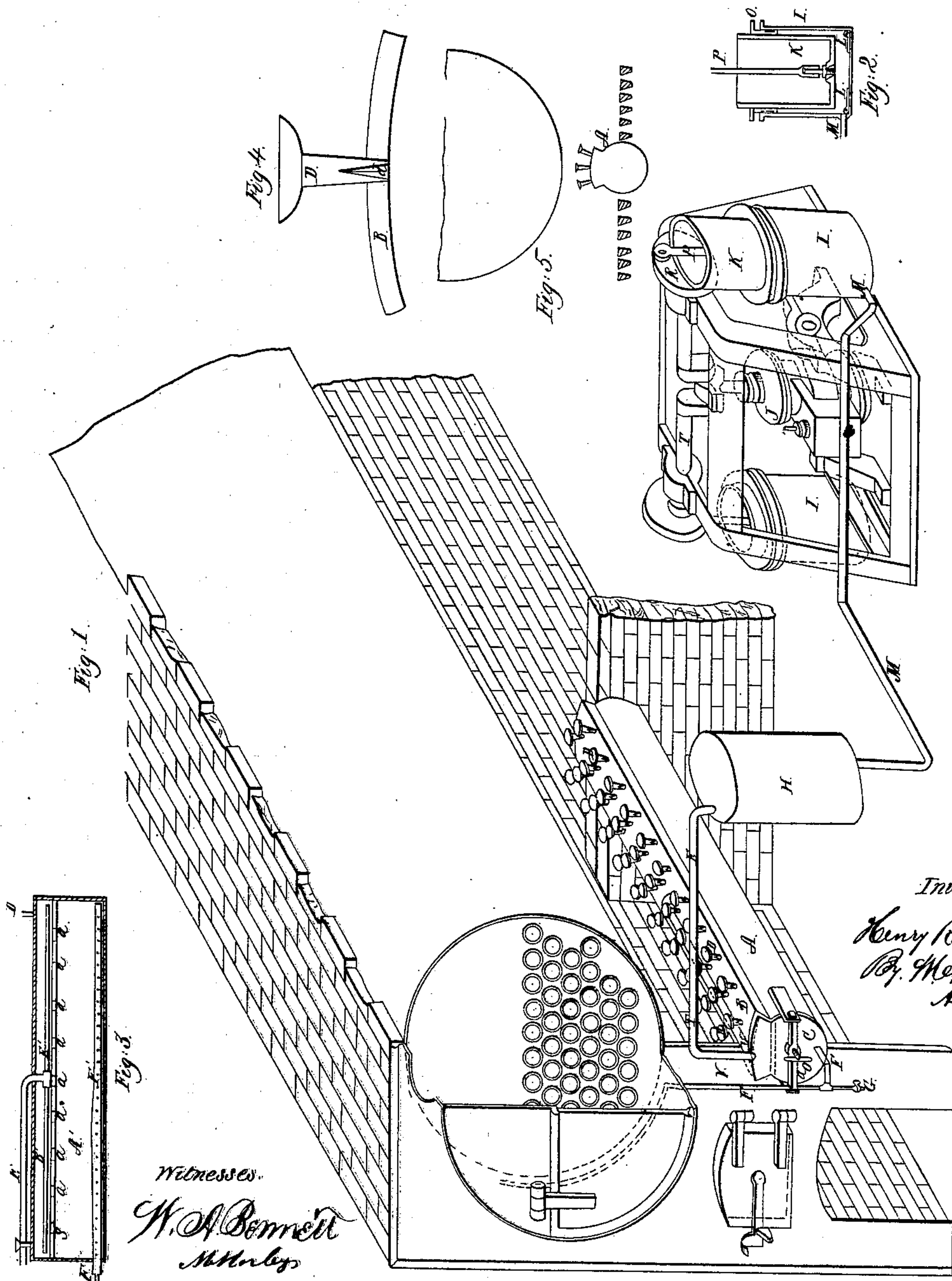


H. R. Foote,
Burning Hydrocarbon.
N^o 69,790. *Patented Oct. 15, 1867.*



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HENRY R. FOOTE, OF OIL CITY, PENNSYLVANIA.

Letters Patent No. 69,790, dated October 15, 1867.

IMPROVEMENT IN FURNACES FOR STEAM-BOILERS, &c.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, HENRY R. FOOTE, of Oil City, in the county of Venango, and State of Pennsylvania, have invented certain new and useful Improvements in Utilizing Fuel and Generating Heat in Furnaces; and I do hereby declare that the following is a clear, full, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, and to the letters of reference thereon marked.

My invention consists in arranging a retort of novel construction in the furnace, where it will be heated by the combustion of the fuel of the ordinary grate, and supplying said retort with steam to be decomposed by being passed through a mass of carbonaceous matter, highly heated, to produce certain gases, to be therein mingled with air supplied by a pump or similar means, and then burned as they escape from the retort into the furnace, thereby producing an intense heat, and at the same time assisting to consume the gases evolved by the combustion of the fuel on the grate.

Figure 1 is a perspective view of a furnace with my improvement applied.

Figures 2, 3, 4, and 5 are views of portions, shown more in detail, as will be hereinafter described.

Similar letters represent corresponding parts in different figures.

In fig. 1, I have represented an ordinary steam-boiler and furnace, with the side of the furnace broken away for the purpose of showing the retort A placed in position, as intended to be used. I construct a retort, A, of iron, fire-clay, or any suitable material, of the form preferably as represented in fig. 1, and as long as the grate-bars of the furnace in which it is to be used. This retort is composed of a shell, having a lower compartment, A', and an upper chamber or compartment, B', separated by a longitudinal plate, S, perforated with openings *a*, as shown in section in fig. 3. The rear end of the retort is permanently closed, while its front end is provided with a removable door, C, which is secured by a cross-bar, *n*, and set-screw *o*, as shown in fig. 1, or by any similar means for rendering it gas-tight. A pipe, F', is placed in the chamber A' of the retort, resting on the bottom, and having along each of its sides a series of minute perforations, as represented in fig. 3. In the upper compartment B' is placed a similar perforated pipe, E', which is located directly above the openings *a* in the plate S. The upper surface of the retort is perforated with a series of holes, in which is inserted a series of burners, D, which consist of a stem to fit the hole, and having a circular spreading disk at its upper end, as shown in figs. 1 and 4, there being two or more V-shaped grooves in the sides of the stems, as shown in fig. 4, to permit the gases to escape thereat. The retort being thus constructed is placed in the furnace, as shown in fig. 1, there being several of them used in a large furnace, while in a small furnace a single retort may be used, it being placed at the centre of the grate, as represented in fig. 5. When thus arranged the pipe F', in the lower chamber of the retort, is connected by a pipe, E, with the steam-boiler, preferably at the dome if it have one. The pipe E', in the upper chamber B', is also connected by a pipe, E, with a reservoir, H, filled with compressed air by means of the air-pumps I through the pipe M, or any similar means; the pipes E and F both being provided with stop-cocks and check-valves, as usual in such devices; a cock, G, being provided at the lower end of pipe F, also, to permit the escape of water formed by the condensation of steam therein. In this case I have represented the reservoir H as being supplied with air by means of two air-pumps I, connected at opposite ends of a crank-shaft, T, which is operated by an oscillating steam-cylinder, J, arranged to operate independent of the main engine. Fig. 2 represents a vertical section of one of these air-pumps, I being the cylinder, K the piston or plunger, O the gland, and L the inlet-valves. It is, however, obvious that any other suitable means may be substituted for the air-pumps, such, for instance, as a fan or blower, and that the same may be operated by connection with the main engine direct, without the use of a separate cylinder or engine for that purpose. The retort being thus arranged, and connected by pipe F' with the boiler, and by pipe E' with the air-reservoir H, is then charged by filling its lower compartment A with anthracite or bituminous coal, charcoal, coke, or other carbonaceous matter, which may be done by means of its removable end piece C. This being done, and the retort then closed, the fire is lighted on the grate in the usual manner. As soon as steam is generated in the boiler it is admitted through pipe F' into the lower chamber of the retort, which by that time will have become highly heated with its contents. The steam escaping through the orifices in the sides of the pipe F' will be brought into immediate contact with the incandescent carbon, and thereby decomposed, forming hydrogen gas and carbonic oxide gas, which will pass thence up through the openings *a* in partition S, into the

chamber B' above. Air is admitted through pipe E, from the reservoir H, into the chamber B' at the same time, which not only forces the gases out through the grooves *d*, in the sides of the burners D, but also supplies a fresh quantity of oxygen. The gases and oxygen thus mingled, and forced out through the grooves, impinge against the under side of the caps of the burners, which latter being heated very hot instantly ignite them, causing an intense heat directly under the boiler; and these burners D being raised several inches above the surface of the fuel on the grate, and the gases burning with a strong blast and intense heat, serve also to ignite and consume the gases evolved from the fuel on the grate, and which would otherwise pass off with the smoke unconsumed. By this means I not only utilize the fuel to a much greater extent than usual, but also prevent the formation and escape of smoke to a very great extent, if not entirely. When bituminous coal is used in the retort the volatile product is first driven off and consumed as it escapes, and when the mass is reduced to coke the operation of decomposing the steam is commenced, and continued as long as the carbonaceous matter remains in the retort. In all cases the retort is to be re-filled as often as necessary, that is, whenever the carbonaceous matter is consumed. If a very intense heat is required the reservoir H may be partially filled with benzole or any of the volatile hydrocarbons; and as the air passes over or through it, a sufficient quantity will be taken up and carried along to add great intensity to the flame; or the hydrocarbon may be placed in the retort itself.

Having thus described my invention, what I claim, is—

1. The combination, with a furnace, of the retort A, constructed substantially as described, when arranged to be used in connection therewith for the purposes set forth.
2. The combination and arrangement, substantially as described, of the retort A within a furnace, and connected to the boiler by the pipe F, and with the reservoir H, as described.
3. I claim the admixture of air, by means of an air-pump or its equivalent, with the gases obtained from the decomposition of steam, by means of the heated carbon in the retort, before ignition, when used in combination with an ordinary furnace, substantially as described.
4. I claim the admixture of the vapor of hydrocarbon, in the manner described, with gases obtained from the decomposition of water or steam, in the manner described, for the purpose of generating heat in connection with the furnace of steam-boilers, substantially as herein described.

HENRY R. FOOTE.

Witnesses:

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