(No Model.)

2 Sheets—Sheet 1.

F. HARRIS.

FURNACE.

No. 396,869. Patented Jan. 29, 1889.

Fig. 1.

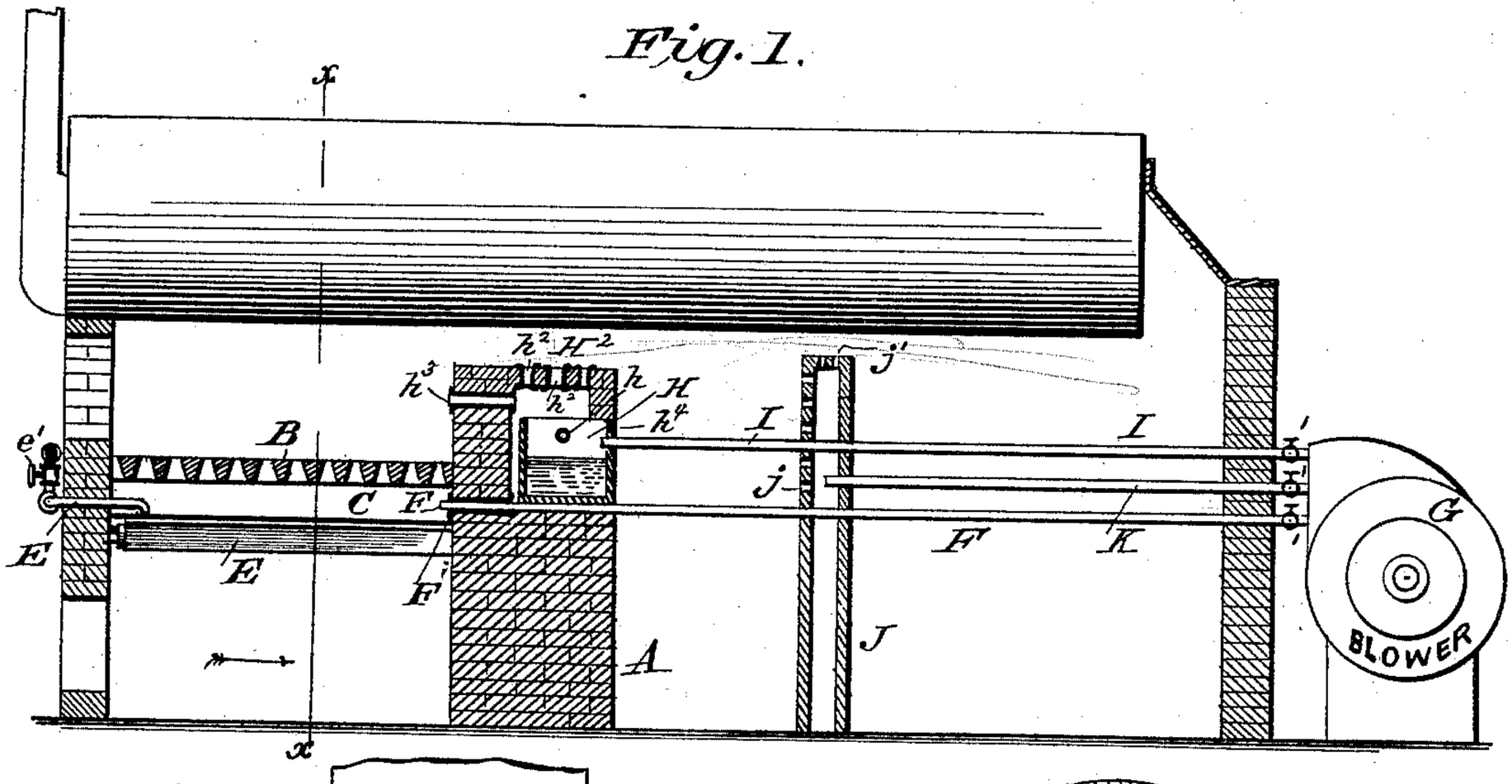


Fig. 2.

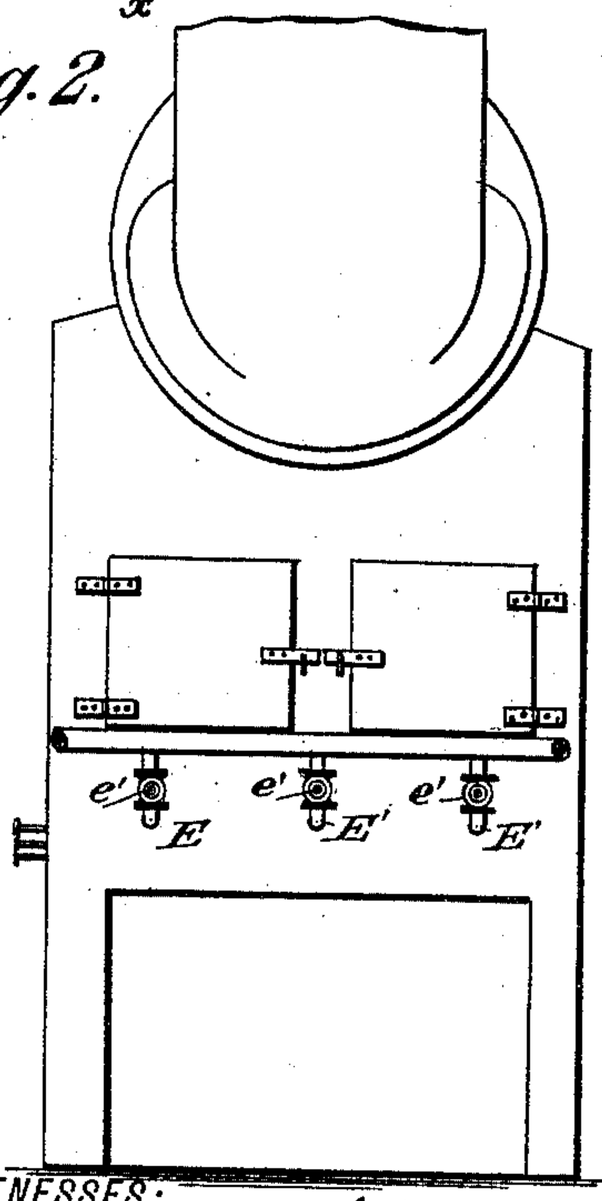
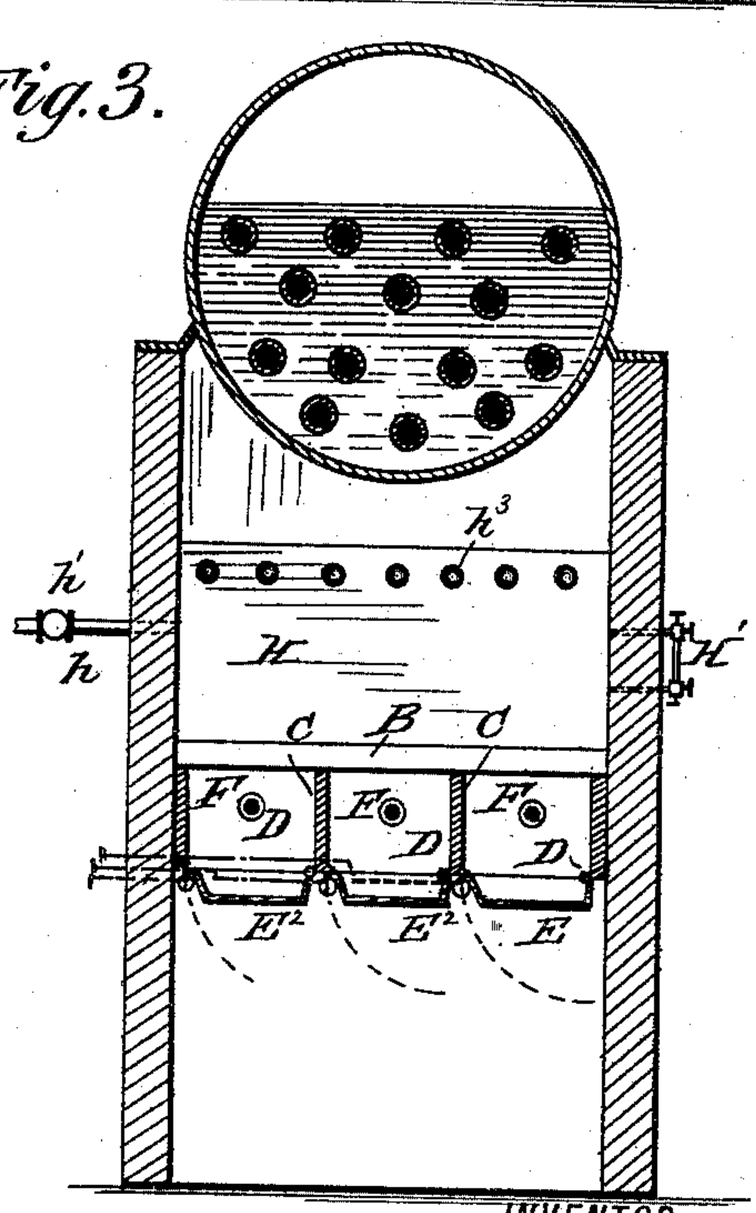


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

F. HARRIS.

FURNACE.

No. 396,869. Patented Jan. 29, 1889.

Fig. 4.

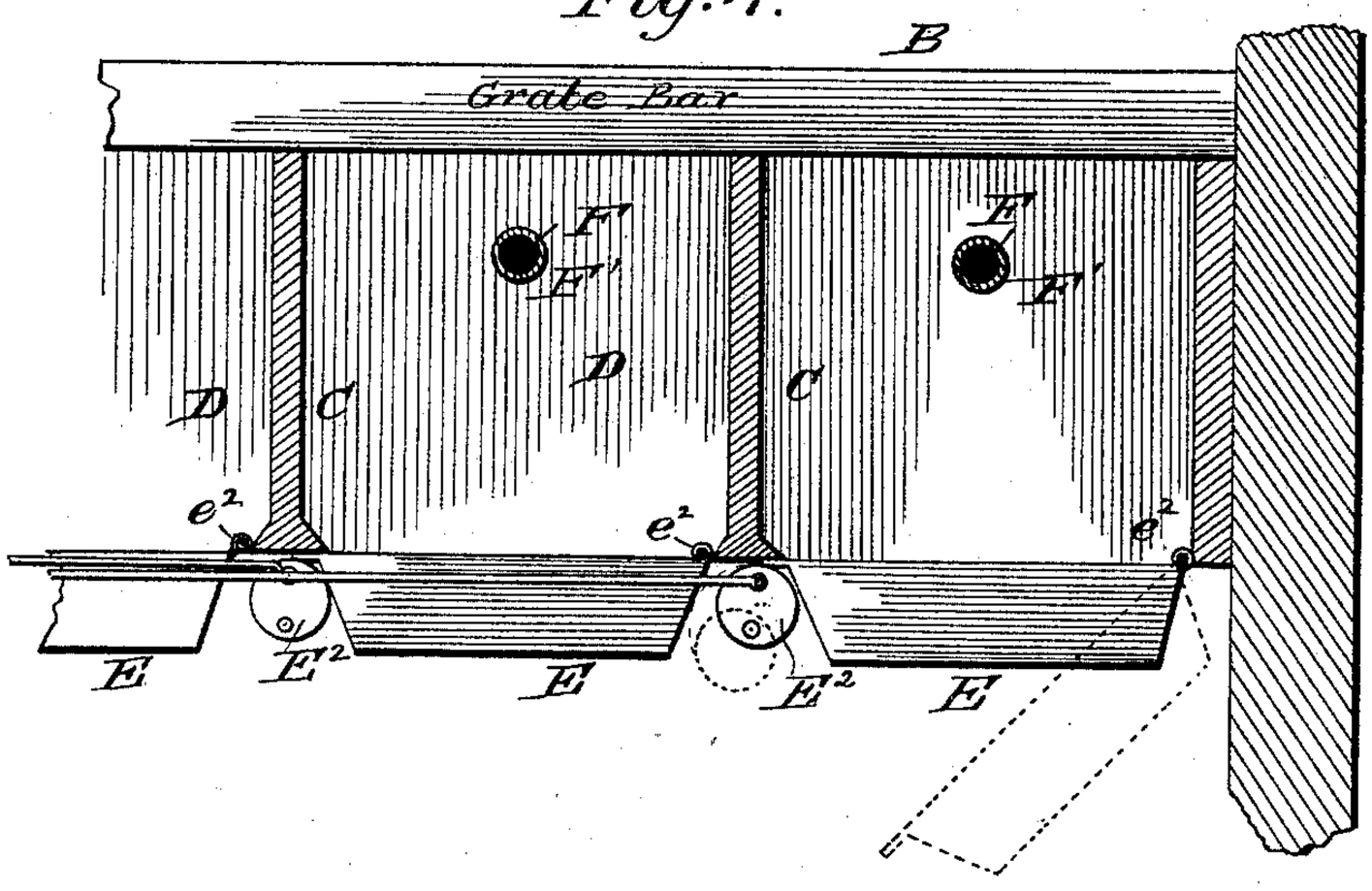


Fig. 5.

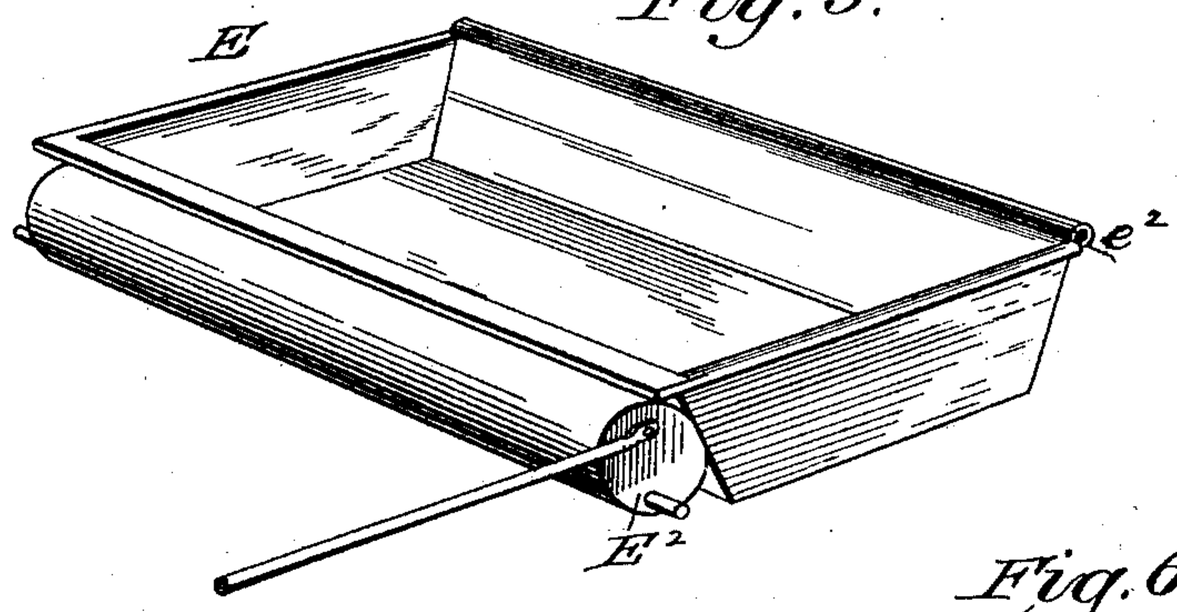
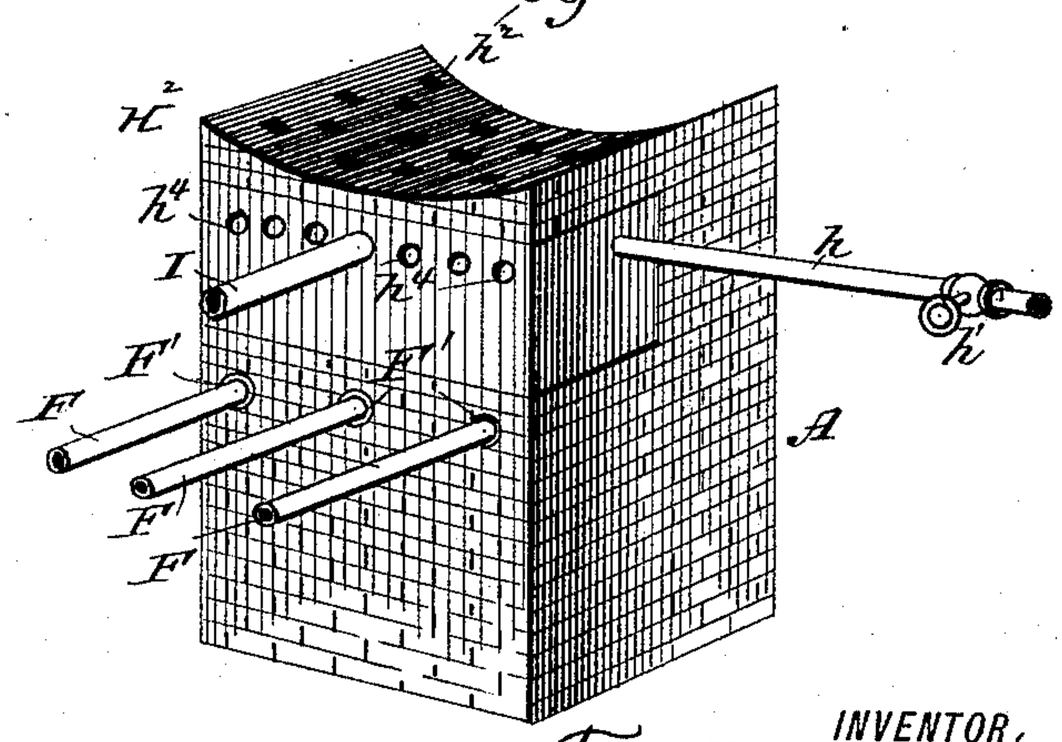


Fig. 6.



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UNITED STATES PATENT OFFICE.

FRADELSHON HARRIS, OF ST. LOUIS, MISSOURI.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 396,869, dated January 29, 1889.

Application filed June 28, 1888. Serial No. 278,487. (No model.)

To all whom it may concern:

Be it known that I, FRADELSHON HARRIS, of the city of St. Louis, in the State of Missouri, have invented a new and useful Improvement in Furnaces, of which the following is a specification.

My invention is an improvement in furnaces, seeking, among other objects, to provide novel constructions and combinations of parts whereby hot air mingled with vapor arising from heated water will be decomposed by the heat in the furnace, setting free the hydrogen gas, which, by burning, intensifies the heat and renders the carbon more available for its combination with the oxygen.

The invention consists, broadly, in a vessel adapted to contain water and arranged adjacent to the fire-chamber, combined with an air-blast pipe arranged to force the vapors arising from said vessel into the fire.

The invention consists, further, in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a vertical longitudinal section of a furnace constructed according to my invention. Fig. 2 is a front view thereof. Fig. 3 is a section on about line *x x*, Fig. 1. Fig. 4 is a detail enlarged section. Fig. 5 is a detail view of one of the trough-like bottoms and the latch for securing same, and Fig. 6 is a detail perspective view of the rear of the main bridge-wall and of some of the parts attached thereto.

In carrying out the invention suitable masonry may be provided to support the boiler and to form the casing of the furnace, as shown; but while the invention is shown in connection with a steam-boiler, it will be understood that I do not desire to be limited to the use of the furnace in such connection.

The bridge-wall A is suitably arranged within the furnace, and in front thereof I arrange the grate-bars B, supported on plates or partitions C, which form the space immediately below the grate-bar into box-like chambers D, having their bottoms E made in the form of troughs or pans, constituting water-receiving vessels, pipes E′, having cocks *e′* leading from a suitable water main or source of supply, so the troughs can be supplied with water at will. By preference these troughs are hinged at one edge, e^2, and are adapted at their opposite edges for engagement by a latch-like holder, E^2, which may be suitably adjusted to secure said troughs in horizontal position or to release said troughs, so they may fall, as will be understood from the drawings. It is also preferred to provide a number of chambers D and of troughs E, as shown; but manifestly the use of a single chamber and trough would involve no departure from some of the broad principles of my invention.

An air-blast pipe, F, leads into each of the chambers or boxes D from the rear, extended through the bridge-wall, and connected at its rear end to a suitable blower, G. Between the blower and the connection of pipes F with the chambers or boxes D provision is made for heating the air in the pipes F, as will more fully appear hereinafter.

In order to provide for conveniently removing and replacing the pipes F when burned out, I provide in the bridge-wall tiling or fire-clay tubes F′ for the passage of pipes F, suitable packing of clay being used in practice to secure air-tight fitting of the pipes F in the tubes F′.

In operation the water in the troughs is heated by radiation from the fire above and emits a volume of steam. When the blast of hot-air is forced into the chambers or boxes D, it mixes with the steam, and the mixture is forced upward between the grate-bars into the fire, forming large quantities of hydrogen gas, increasing thereby the heat and assisting the oxygen to produce more complete combustion. The construction also prevents the rapid burning out of the grate-bars. It will also be seen that the clinkers which fall through the grate-bars are immediately extinguished, thus avoiding the formation of carbonic-acid gas under the grate to interfere with the combustion.

In the rear of the bridge-wall I support a water-tank, H, which may extend the whole length of the bridge-wall or be of any smaller size desired. This tank is in practice partially filled with water and has a supply-pipe, *h*, and cock *h′* therein, and I also provide in connection with such pan a water-gage, H′, in

view of the attendant, so the height of water in the pan may be at all times easily ascertained. A suitable cover, H^2, is fitted over this tank and has openings h^2 formed through it, the covering being preferably formed of fire brick or clay, and the openings being secured by upright tubes extended through said cover, as shown. Openings h^3 are also formed through the bridge-wall, leading from a point immediately above the water in the tank H forward and opening above the fire on the grate, these openings being also preferably lined with tubes, as shown. Openings h^4 are also provided, opening rearwardly from the tank. A blast-pipe, I, leads from the blower G into the tank H above the water therein, means being provided, as in the case of the pipes F, for heating the air in its passage through such pipe, as will be hereinafter described. The upright openings h^2 send a blast of heated hydrogen gas to come in contact with the escaping carbon gas and smoke on the top of the bridge-wall and ignite the same. In such operation the hydrogen gas, producing great heat, brings the escaping carbon to the igniting-point, while the accompanying oxygen from the blast produces complete combustion by the union of two equivalents of oxygen and one of carbon, forming Co_2. The rear openings, h^4, permit the passage of part of the blast back into the second combustion-chamber, presently described.

To check the flow of the unignited gases and smoke before they pass from the furnace, I build a second or auxiliary bridge-wall, J, about from three to six feet back of the first or main bridge-wall, forming a second combustion-chamber. This second bridge-wall, J, is higher than the first to check the rush of the draft and send the products rolling downward between the walls, and which, meeting the current of blast through the rear wall of the tank, become ignited, leaving only the heated nitrogen and C_2^2 to pass out of the furnace, no soot or smoke to amount to anything passing out therewith, as will be understood. The blast-pipes F and I pass through this auxiliary bridge and second combustion-chamber, and are heated in their passage, as will be readily understood. The fire in this second combustion-chamber also operates to heat the water in the tank.

The bridge-wall J is preferably made hollow, with openings j through its front portion and openings j' extending out of its top, a blast-pipe, K, being provided, leading from the interior of said wall J to the blower G. Each of the pipes F, I, and K is provided, usually adjacent the blower, with dampers 1, so the blast of air can be regulated or stopped.

The operation and the advatages resulting from the several parts arranged, combined, and connected as shown, will be understood from the foregoing description.

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

1. In a furnace, the combination of a vessel adapted to contain water and arranged adjacent to the fire-chamber, and an air-blast pipe arranged to direct a current of air to mingle with and force the vapors arising from said vessel into the fire, substantially as and for the purposes specified.

2. In a furnace, the combination, with the grate, of a water trough or vessel arranged therebelow and an air-blast pipe having its discharge arranged to open above the said trough between the same and the grate, substantially as set forth.

3. The grate and the partitions or plates arranged below the same, forming chambers, combined with the water-trough bottoms for said chambers hinged at one edge, catches for securing the opposite edges of the troughs, and the air-blast pipes arranged to open into said chambers above the troughs, substantially as set forth.

4. The combination, in a furnace, of a vessel adapted to contain water and arranged adjacent to the fire-chamber, and an air-blast pipe extended into the furnace from the rear, whereby the air will be heated in its passage through the pipe, the said pipe being arranged to direct a current of air to mingle with and force into the fire the vapors arising from the vessel, all substantially as and for the purposes specified.

5. In a furnace, the combination of the fire-chamber, the main bridge-wall, a vessel adapted to contain water and arranged adjacent to the fire-chamber, the second or auxiliary bridge-wall arranged in rear of the main bridge-wall and made hollow, and having exit port or ports, the air-blast pipe leading into the second bridge-wall, and the air-blast pipe arranged to direct a current of air to mingle with and force the vapors from the water-vessel into the fire, all substantially as and for the purposes specified.

6. A furnace, substantially as herein described and shown, consisting of the casing, the grate, the partitions or plates C, the trough-like bottoms E, the catches for securing said bottoms, the main bridge-wall, the tank located in rear thereof, a cover for said tank, vents or openings being provided leading from the tank, the hollow auxiliary bridge-wall having vents or openings, and the air-pipes I, F, and K, all substantially as and for the purposes specified.

7. In a furnace, the combination of the bridge-wall, the tank located in rear thereof, a cover for said tank, vents or openings being provided leading from the tank, and the air-blast pipe opening into said tank, all substantially as and for the purposes specified.

8. The combination, substantially as herein described and shown, of the bridge-wall, the tank located in rear of said wall, a cover for the tank, openings being provided leading upward through said cover, forward through the bridge-wall and rearwardly through the back wall of the tank, the blast-pipe opening into the tank, and the auxiliary bridge-wall

forming a second combustion-chamber in rear of the main bridge-wall, the combustion in said second chamber operating to heat the water in the tank, substantially as set forth.

9. The combination, in a furnace, of the main bridge-wall, the second or auxiliary bridge-wall arranged in rear of the main bridge-wall, forming a second combustion-chamber, said second bridge-wall being made hollow and having vents leading outward from its interior, the air-blast pipe leading into said second bridge-wall, the water-tank arranged in the rear of the main bridge-wall, a cover for said tank, openings being formed through the said cover and through the bridge-wall leading forward from said tank, and perforations being formed in the rear wall of such tank, an air-blast pipe leading into the tank, the grate, the troughs arranged below the grate, and the air-blast pipes arranged to discharge adjacent to said troughs, substantially as set forth.

FRADELSHON HARRIS.

Witnesses:
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M. L. KELLY.