(No Model.)

B. BAYLISS, Sr.

HEATING FURNACE.

No. 253,150. Patented Jan. 31, 1882.

Fig. 1.

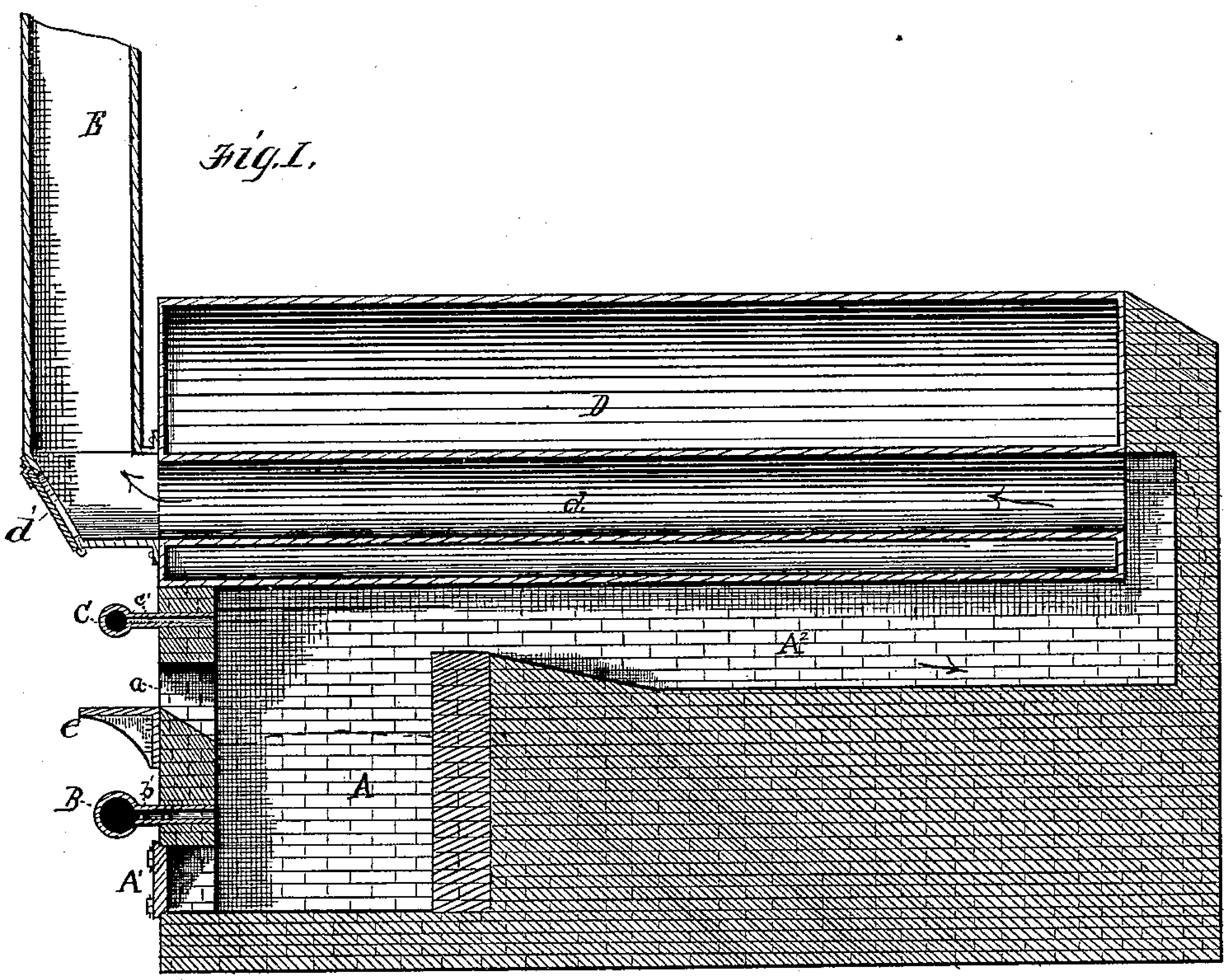
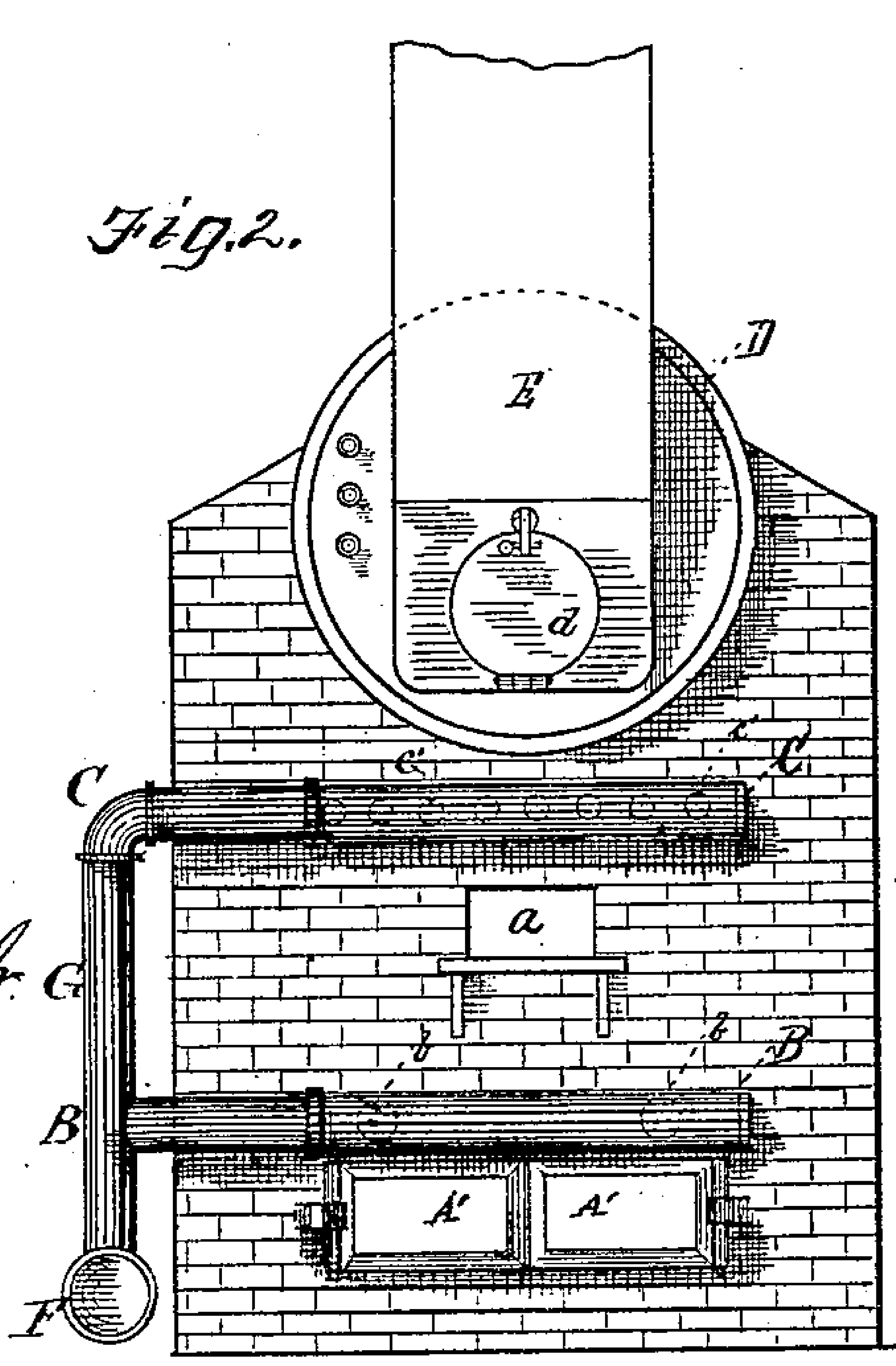


Fig. 2.



Witnesses.

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BENJAMIN BAYLISS, SR., OF PITTSBURG, PENNSYLVANIA.

HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 253,150, dated January 31, 1882.

Application filed October 5, 1881 (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN BAYLISS, Sr., of Pittsburg, Pennsylvania, have invented a new and useful Improvement in Heating-Furnaces, which improvement is fully set forth in the following specification, reference being had to the accompanying drawings.

Similar letters of reference indicate corresponding parts.

This invention relates to an apparatus for the more perfect combustion of fuel, and hence the greater economy of the same. It is sometimes said that "smoke once formed cannot be consumed in the same furnace"—that it is irreconcilable with the operations of nature. The formation of smoke arises out of the failure of some of the processes preparatory to combustion or the absence of some one of the conditions which are essential to perfect combustion. Smoke is the very result of a deficient supply of heated air. Seeing that if such heat and air had been supplied smoke would not have existed, therefore I desire to remark for the more clear understanding of my invention that a distinction should be made and observed between the prevention of smoke and the formation of smoke. With my invention I prevent smoke by not making it. The color of smoke does not determine the combustible gases wasted and carried off. Carbonic oxide, carbureted hydrogen, and various other hydrocarbons are carried off invisibly in the form of vapor, and as they are all combustible they are so much loss of fuel. To overcome this waste of combustible gases, to consume them, and to avoid the nuisance of smoke is the object of my invention. Often the products of combustion pass off unconsumed for the want of space to evolve or expand, not having room for the mixing or commingling it with the proper supply of atmospheric air, either cold or heated, and thus it is wasted. To supply this demand I enlarge the flue in rear of the bridge-wall by a gradual inclination of the back of the bridge-wall from the top rearward, and thus form a diving-flue. By this means the air from the uppermost supply-nozzles not only drives back the intense heat, but causes a complete admixture of the gases, and by this intimate mixture complete combustion is the result. By the enlargement of the rear flue or auxiliary combustion-chamber I am enabled to expose to the heating-surface a greater surface of the boiler-plate. This chamber by its inclination and enlargement forms not only a greater heating-surface than has heretofore been presented, but also forms a reverberatory chamber where the combustible gases escaping from the forward chamber are thoroughly mixed and ignited and entirely consumed, thus preventing the formation of smoke, and thereby the consequent economy of fuel and the heat of the furnace being utilized as far as possible.

It may be further stated that the grate is entirely dispensed with, and that a less quantity of fuel is required for the generation of a given quantity of steam than by any other furnace known to me, and this result I produce by the reverberatory and evolving action of the flame and gases in the enlarged portion of the furnace and increased area of plate-surface.

To this end my invention consists in forming the principal combustion-chamber with a solid bottom, and supplying said combustion-chamber with fuel to a point nearly on a level with the bottom of the fuel-supply door, as shown by the dotted lines. Through this mass of fuel I force a blast of air by means of pipes adapted for that purpose. At nearly the upper surface of this chamber I locate another blast-pipe and above the line of the top of the bridge-wall, so that the gases evolving from the mass of fuel below are instantly transferred to the enlarged combustion-chamber in the rear, where the air from the upper blast and the combustible gases are thoroughly mixed, ignited, and consumed.

It is absolutely essential to perfect combustion to have sufficient space for the thorough intermingling of air and gases, and to perfect this mingling the air must be highly heated, so that a union may take place between them. Then to heat the air I pass it entirely through the front combustion-chamber, striking the gases at the throat formed by the bridge-wall and the boiler-surface. The air thus heated unites with the flame and escaping combustible gases, expands in the rear combustion-chamber, and by its enlarged area the mixture has time to be temporarily in a quiescent state, and thus the mixture is complete when it becomes a clear, pure, and incandescent heat.

Between the upper and lower blasts is located a projecting slab or piece, and at a point

on a level with the bottom of the feeding-door. The object of this piece is twofold—first, to prevent the fuel from falling, and, secondly, prevent it from falling upon the air-supply pipe.

It is well known in practice that very large lumps of coal, often weighing from twenty-five to fifty pounds, are thrown into the furnace. Should these fall on the pipe, which is put transversely across the front of the furnace, they would loosen the joints and cause them to leak. This plate thus protects the said pipe from injury.

It will be observed that the sill of the feeding-door inclines inwardly from the top of the projecting piece. The object of this is to facilitate the emptying of the shovel of coal and the instantaneous shutting of the door, thereby preventing the admission of cold air to the gases, which would be detrimental and injurious.

Having set forth the principles upon which my invention is based, and to enable others skilled in the art to which it appertains to understand it, I will refer to the accompanying drawings, forming part of this specification, and point out the various parts by letters of reference which will denote like parts in all the figures.

Figure 1 illustrates a vertical longitudinal section through the center of the furnace and boiler. Fig. 2 represents a front elevation, clearly showing the various outer parts in position, the blower contrivance not being shown.

A is the combustion-chamber, which is preferably filled with fuel to a point nearly even with the feeding-door. The walls of the furnace form the bottom, a grate being dispensed with.

D is the boiler, being of the ordinary kind, although other kinds of boilers may be used; or an arch such as is used in metallurgy may be substituted, preserving, however, the throat feature of the apparatus.

A^2 is the flue or rear combustion-chamber, having the enlarged sides and rear downward inclination.

A′ A′ are the ash or clinker removing doors, and B and C the horizontal air-supply blast-pipes.

F is the main air-flue to blower, and G the upright service-pipe connecting pipes B and C.

It will be observed that the air-supply pipes B and C have different number of nozzles—B the lesser and C the greater. The nozzles in pipe B are larger than those in pipe C. The object of this is that the lower chamber to nearly the surface of the fuel is a coking-chamber or gas-generator, and requires but a small quantity of air, sufficient to support combustion, which may be regulated as conditions may require.

The upper pipe, C, is provided with numerous small nozzles for jets of air, for the reason the air supplied through the upper series must be well broken up or divided, in order that it may be in a better condition to unite with the fine particles of carbon and other gases rising from the mass of fuel below.

It may sometimes happen that a fierce fire is required for many reasons, among others the complete burning out of any ashes or cinders. Then the blast in the lower pipe and nozzles is increased, when a perfect bed of incandescence is produced, burning out entirely all that is combustible in the furnace, leaving nothing but a veritable slag.

a is the feeding-door; *b*, the lower nozzles in pipe B, and *c* the smaller nozzles in pipe C.

d′ is the door to the uptake; and *e* the door, slab, or piece, either built in the wall or supported on brackets.

d is the boiler-flue, and E the chimney or uptake.

The rear flue-connection may be rectangular or concave, as shown in dotted lines. The latter is preferred, as it is more in accordance with natural draft.

Operation: When the fire is to be started a fire is made of some light material on the hearth or bottom of the furnace. The doors A′ A′ are left open. When the fire is strong enough or sufficiently under way the coal or fuel is thrown in, and when sufficient to create a blast or run the fan to blow a blast the doors are shut, when the furnace is ready for operation, as above set forth.

I am aware that combustion-chambers having solid bottoms and without grates, chambers in which blasts of air, gas, or steam are introduced into the mass of fluid therein, as well as above the fuel, through a series of pipes, and reverberatory chambers or flues with enlarged sides and rearwardly-inclined upper walls, are old, and I do not therefore claim these features separately or broadly in combination; but

What I do claim, and desire to secure by Letters Patent, is—

In a heating-furnace, the combination and arrangement herein set forth of the horizontal air-supply blast-pipes B C, the said pipes provided with a different number of air-jet nozzles *b* and *c*, the pipe B having the lesser number and larger jets and the pipe C the greater number and smaller jets, the upright service-pipe G, connecting the pipes B and C, the main air-flue F, and the combustion-chamber A, with solid stationary bottom without a grate, substantially as described.

BENJAMIN BAYLISS, SR.

Witnesses:
A. H. MOESER,
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