(No Model.)

W. HAY & W. M. KEARNS.

AIR AND GAS MIXING APPARATUS.

No. 518,451. Patented Apr. 17, 1894.

Fig. 1.

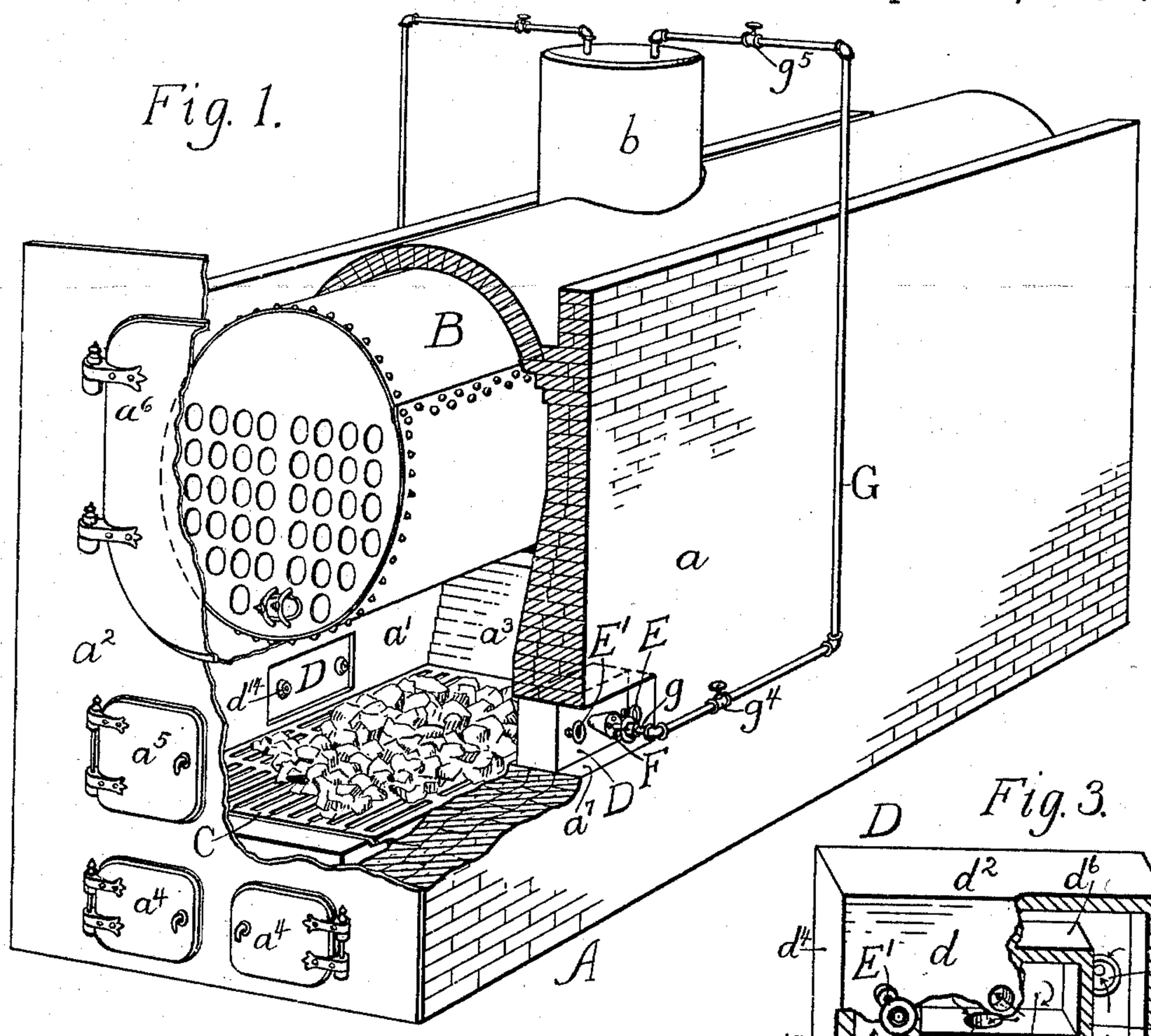


Fig. 2.

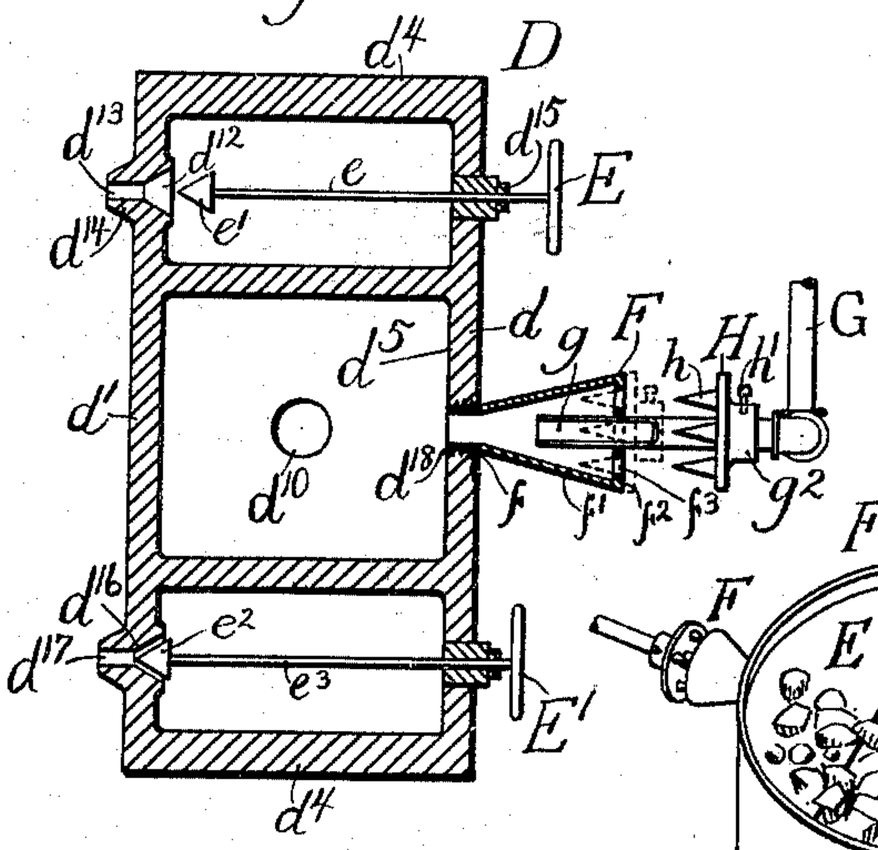


Fig. 3.

Fig. 4.

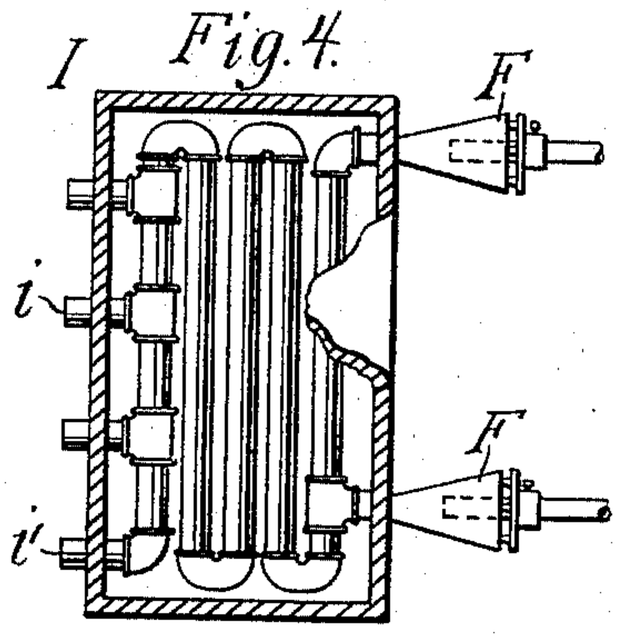
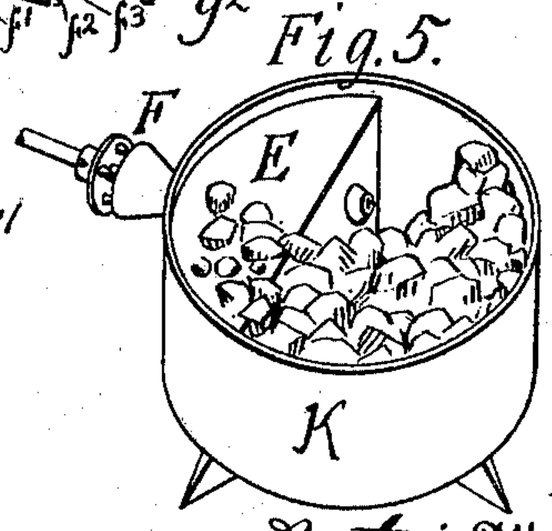


Fig. 5.



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AIR AND GAS MIXING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 518,451, dated April 17, 1894.

Application filed July 26, 1893. Serial No. 481,565. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM HAY and WILLIAM M. KEARNS, citizens of the United States, and residents of Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Air and Gas Mixing Apparatus; and we do hereby declare that the following is a full, clear, and exact description thereof, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

Our invention has for its object: First: The admixture of decarbonizing gas, with the ordinary products of combustion, so as to economize the consumption of fuel. Second: To decompose live steam, and combine the gas so liberated with the surrounding air by the agency of the heat employed to decompose the steam. Third: To regulate the admixture of the air with the live steam. Fourth: To control the mixed gases within the superheating case in passing outward to be burned.

Our invention further consists in the novel construction and combination of parts of the apparatus such as will first be fully described and specifically pointed out in the claims.

In the drawings: Figure 1 is a view in perspective of a steam boiler furnace with a portion of the side and front furnace walls broken away to show the boiler and grate, also showing the superheating case within the side wall of the furnace, and the steam conducting pipes connected with the dome of the boiler, and also with the retort on the superheating case. Fig. 2, is a horizontal sectional view of the superheating case and retort as seen in Fig. 1. Fig. 3 is a view in detail of the superheating case with the front plate broken away to show the passages for the gases. Fig. 4, is a view of an alternate form of superheating case, with the top broken away, showing an interior coil of pipe for superheating the steam. Fig. 5, is a view of the combined superheating case, and retort applied to an ordinary chafing disk.

Similar letters of reference indicate corresponding parts in all the figures.

In the treatment heretofore of fuel to obtain the highest units in degrees of heat, especially in boiler furnaces the union of the agent has been directly with the products of combustion, without diminution in the amount of fuel supply. To economize in both directions is the result of the present invention.

Referring to the drawings, A represents a steam boiler furnace.

a represents one of the vertical side walls and *a'* the other of the furnace.

a^2 is the front furnace plate or wall.

a^3 is the bridge wall.

a^4 a^4 are the lower doors in the furnace front plate, which lead to the ash pit.

a^5 is the door in the furnace front, through which fuel is passed to the grate.

a^6 is a door in the furnace front plate opposite the end of the boiler.

B represents the steam boiler, which is arranged horizontally between the walls *a*, *a'* of the furnace, and above the bridge wall a^3, and extends from the front furnace wall a^2 rearwardly the distance described by the walls *a*. *a'*.

b represents the dome or chamber upon the upper side of the boiler in which the live steam from the boiler is confined.

C represents the furnace grate which is directly beneath the forward end of the boiler, and above the horizontal position of the doors a^4 a^4, to the ash pit, and extends from the inner side of the furnace front plate, a^2 to the bridge wall a^3.

Through the side wall *a* of the furnace a short distance above the line of the upper surface of the grate C, and between the furnace front a^2 and the bridge wall a^3 is a transverse opening a^7, which is preferably rectangular in form. In the opening a^7 is inserted our improved superheating case D. Said case is made nearly of the same dimensions of the opening a^7 in the wall *a*, in length and width, so as to fit snugly within said opening, the thickness of the case D, being about one third less than the thickness of the wall *a*, and arranged a slight distance inwardly from the inner surface of the said wall. Said case consists of the front wall *d*, rear wall *d'*, top d^2, bottom d^3, and ends d^4 d^4.

Within the case D is a gas mixing compartment d^5 the walls of which compartment extend from the inner side of the front wall *d* of case D to the inner side of the wall *d'*, in the transverse direction of the case D.

In the longitudinal direction of the case D, the upper and lower wall d^6 d^7 extends from a point about one third the distance from the inner side of the end d^4 of case D to a point a like distance from the other end of said case, and are connected at each end by the respective vertical walls d^8 d^8. Between the inner side of case D, and extending around the walls d^6 d^7 d^8 d^8 is a passage d^9 for the gases. Through the bottom d^7 of the compartment d^5 is an opening d^{10}. Between the end wall d^8 of the compartment d^5 and the inner side of the end wall d^4 of the case D, and also at a point equi-distant from the top and bottom of said case, and in the inner side of the rear wall d', of case D, is a valve seat d^{12}. Through the wall d', and opposite the valve seat d^{12} is a perforation d^{13}. Extending beyond the outer side of the wall d', and around the perforation d^{13} is a tubular extension or jet d^{14}.

Through the outer wall d of case D, in a direct horizontal line, with the perforation d^{13} in the wall d' is a screw threaded perforation d^{15} through which is inserted one end of a valve stem or rod e, at one end of which stem is a valve e', which fits within the valve seat d^{12}, and at the outer which is screw threaded a suitable distance is an operating handle E. At the other end of case D, and in the inner side of the rear wall d', between the end wall d^8 of the compartment d^5, and the inner side of the end wall d^4 of the case D in a horizontal line with the valve seat d^{12} is a valve seat d^{16} in which fits a valve e^3, provided with a stem e^3, and an operating handle E' in precisely the same manner as described by the valve, and stem e. e'. From the valve seat d^{16}, is a tubular extension d^{17} for the passage of the gas as described by the extension d^{13}. In the outer wall d, in line horizontally with the valve stems e, e^3 is a screw threaded opening d^{18}, which extends within the compartment d^5, in which opening is fitted the screw threaded end f of a retort F. Said retort consists of a closed case, circular in form, and from the end portion of which enters the opening d^{18}. The sides f' of said case are extended outwardly in the shape of a funnel. The outer end of the case is closed by a cap or cover f^2 united firmly to the sides of said case. In the center of the cap f^2, is an opening through which is inserted one end g of a steam supply pipe G, which end extends within the case to a point about one-half the distance described from the cap f^2 to the screw threaded end of the said case. In the cap f^2 in a circular line of direction, and at a short distance from the pipe g, are a number of perforations f^3, for the admission of air. On the pipe g in rear of the cap f^2 is a flat movable plate H, which is circular in form, and of the same diameter as the said cap. Upon the side portion of the plate H, toward the cap f^2 are rigidly attached projecting pins which extend outwardly the same distance from plate H, and each terminates in a point. The number of the pins upon plate H correspond with the number of perforations in the cap f^2, and are so arranged as to enter the perforations when moved toward said cap, and close the openings in the desired degree. To the other side of the plate H, and extending around the pipe g, is a collar g^2 in which a set screw h' binds upon the pipe g, where the plate H is adjusted in position. The other end of the steam supply pipe G, is bent at right angles to and a short distance from its point of connection, with the retort F, and thence extended rearwardly along side of the furnace wall a, about one-half the described length of said wall, thence bent at an angle, and continued in an upward direction to the height of the dome b, on the boiler B, thence bent in the direction of, and inserted within the top of the said dome b. In the steam supply pipe G, near the retort F, is a cut off valve g^4, and near the dome b, in the same pipe is a similar cut-off valve g^5. Upon the other side of the furnace, and in the wall a', within an opening in said wall similar to the opening a^7 is placed a superheating case D', which is made in precisely the same manner as the case D, and provided with a retort, and connecting steam supply pipe, leading to the dome b, in the same manner as described by the retort E, and pipe G.

In the employment of our apparatus in furnaces for steam boilers, the fuel is placed upon the grate C, in a sufficient quantity, and ignited. The valves g^4 g^5 in the pipe G are reopened so as to admit the live steam in the dome b, to the retort F. The fuel should properly lay below the exits d^{13} d^{17} in the superheating case D, so that the heat from the flame may be communicated to the said case, and cause it to become heated to a high degree, or nearly a white heat. At this stage the live steam in the superheating case D, is confined in the chamber d^5, the valves e' e^2 being closed so that no steam is permitted to escape. The steam is decomposed, and hydrogen gas is formed. The valves e' e^2 are then opened a sufficient distance to permit the escape of the gas in a slight degree in which operation the live steam under the pressure of the steam in the boiler is forced within the retort F, and in passing to the chamber a^5 a suction is immediately caused within the retort upon the air, which flows through the perforations f^3 in the cap f^2, and mixes with the superheated steam, which is also passing into the chamber d^5, thence passes through the opening d^{10} in the bottom of the said chamber into the space d^9, beneath said chamber, and subjected to the intense heat the decomposed steam, and oxygen of the air unites, forming oxy-hydrogen gas, which gas passes upwardly on both sides of the chamber d^5 to the burners or orifices d^{13} d^{17}, and thence becomes ignited from the flame of the fuel on the grate, and burns with intense heat, so great in fact that the fuel supply upon the grate may be diminished,

and only an amount supplied to keep a flame for the ignition of the oxy-hydrogen gas, the case D after once becoming heated is thus maintained at the same degree of heat produced by the burning gas.

In order that the supply of the oxy-hydrogen gas may be regulated, and danger to the boiler obviated by the intense heat, the plate H is moved in the direction of the cap f^2, so that the ends of the pins h center the perforations f^3, so far as to admit the air in limited quantities, or to prevent any admission of air, before the superheating case is prepared for the mixing of the gases in which movement the set screw h' is turned so as to relieve the plate H, after the adjustment of which the set screw is again turned to hold the plate from further movement.

In the admission of the steam from the dome b, it is well known that the steam so obtained is a dry steam, and therefore is more readily changed to a gaseous form in the superheating chamber. In the admission of the oxy-hydrogen gas to the flame from the fuel upon the grate the gas may be admitted from either end of the case D, and in sufficient quantity to economize in the consumption of fuel. Thus it will be seen that the supply of fuel for obtaining steam is reduced to the minimum. As the products of combustion pass upward from the fuel, and from the coals, which free the carbon in bituminous coal more especially the oxy-hydrogen gas, which is the more inflammable decarbonizes the products of combustion, and the carbon is thrown down, and the flame which passes outward beneath the boiler and thence to the chimney is freed entirely from smoke, both the walls of the furnace and the boiler, being freed from all deposits of smut or carbon. When the slower passage of the gases is desired in the superheating case, we make the superheating case I as seen in Fig. 4 with the interior gas mixing chamber composed of a coil of pipe i, the retorts F. F. being connected with the pipe at one end, and the discharge of the gas permitted through an increased number of jet pipes i'. The gas is thus mixed, and the steam decomposed in a slower degree.

In the adaption of the invention to other heating devices, such as stoves, &c., the superheating chamber is made in different forms, as is requisite to the occasion, as for instance in Fig. 5 in which the superheating chamber is applied to a chafing dish K, and the case E made in a semispherical form, and placed within the chafing dish, so that the ignition of the gas may be accomplished a slight distance above the coals the retort F extending through the side of the chafing dish into the superheating chamber as in the manner heretofore described in the superheating case D.

Having fully described our invention, what we now claim as new, and desire to secure by Letters Patent, is—

1. An apparatus for the mixture of decarbonizing gases, consisting of a retort having air passages, and a case provided with valves having an interior mixing chamber connected with the retort, and within the heating agent, and means for regulating the discharge of the mixed gases from the mixing chamber, substantially as and for the purpose described.

2. In an apparatus for mixing decarbonizing gases a retort having a pipe extending within said retort, and passages for the air in said retort, concentric with said pipe, and a plate upon said pipe having pins each tapering toward a point and extending with the said air passages as and for the purpose described.

3. In an apparatus for mixing decarbonizing gases, the combination with a retort having perforations to admit air, and a steam-supply pipe communicating with the interior of said retort, of a plate, tapering pins projecting from said plate, and means to adjust said plate so that the pins thereof shall engage the perforations of the retort, substantially as and for the purpose set forth.

4. The combination with a furnace of a superheating case for the mixture of decarbonizing gas, having gas mixing chambers, and discharge outlets, provided with valves and a retort for the admission of air, and steam connected with said superheating case, a boiler having live steam, and a conductor connected therewith, and extending to and within the said retort, said retort having orifices for its air in rear of the inner end of said conductor within said retort, means for creating a suction through the said conductor within said retort, and adjustable air closing valves for said orifices for the air as shown and described.

5. In a furnace an apparatus for mixing decarbonizing gases consisting of a superheating case arranged within the furnace and in proximity to the heat having interior gas mixing tortuous passages and valves for holding said mixed gases within said superheating case, means for operating said valves and a retort having a supply pipe and inlet for the live steam and air connected with the superheating case for the purpose described.

6. The method herein described of decarbonizing fuel within a furnace, consisting, first, in leading air and live steam into a compartment of a super-heated gas-mixing casing; secondly, in retarding the passage of the mixed air and decomposed steam within the casing until gas is formed by the agency of the heat from the furnace fuel; and, thirdly, in admixing the products of combustion of the fuel with the flame of the decarbonizing gas from the said casing, substantially as set forth.

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