No. 704,353. Patented July 8, 1902.

H. B. MEECH.

STEAM BOILER FURNACE.

(Application filed Nov. 14, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

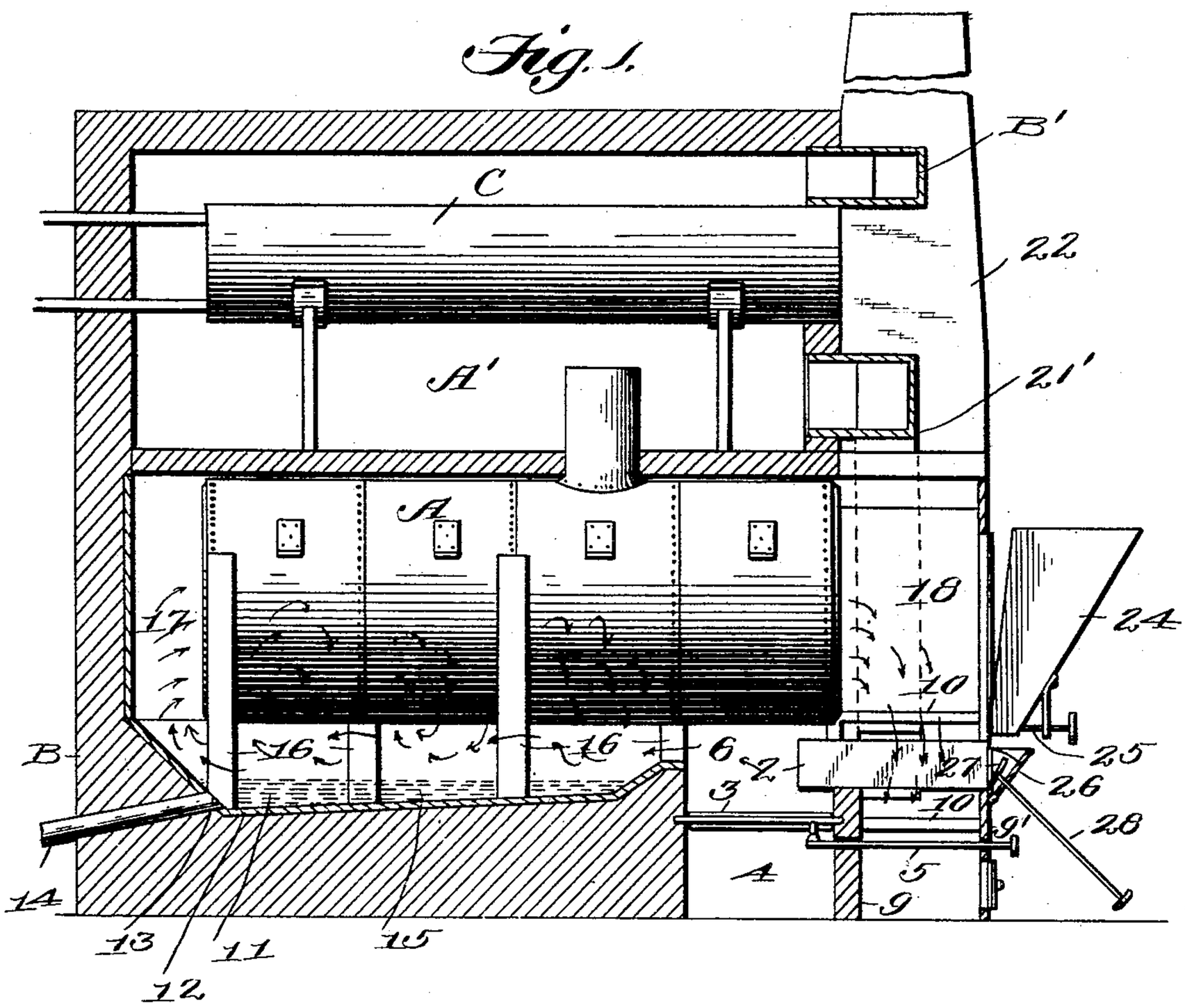
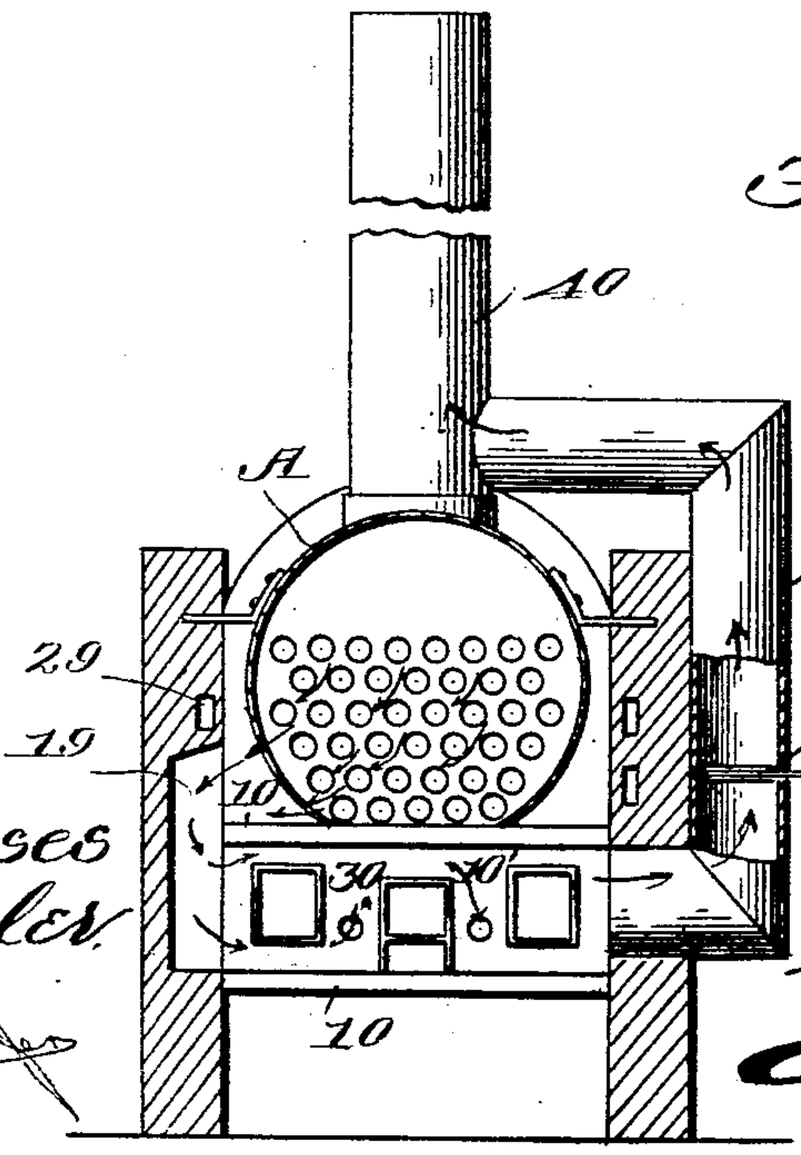


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

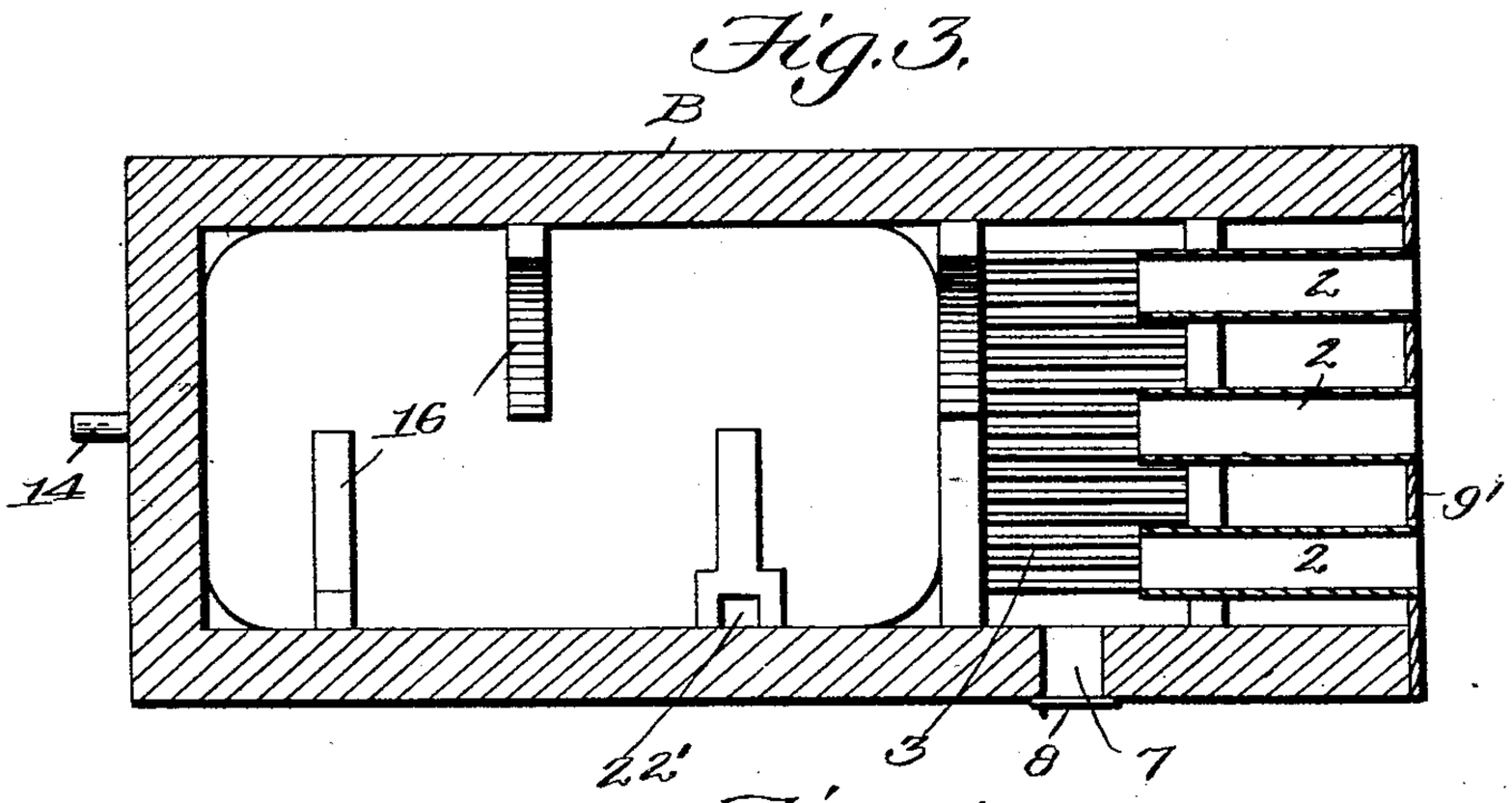
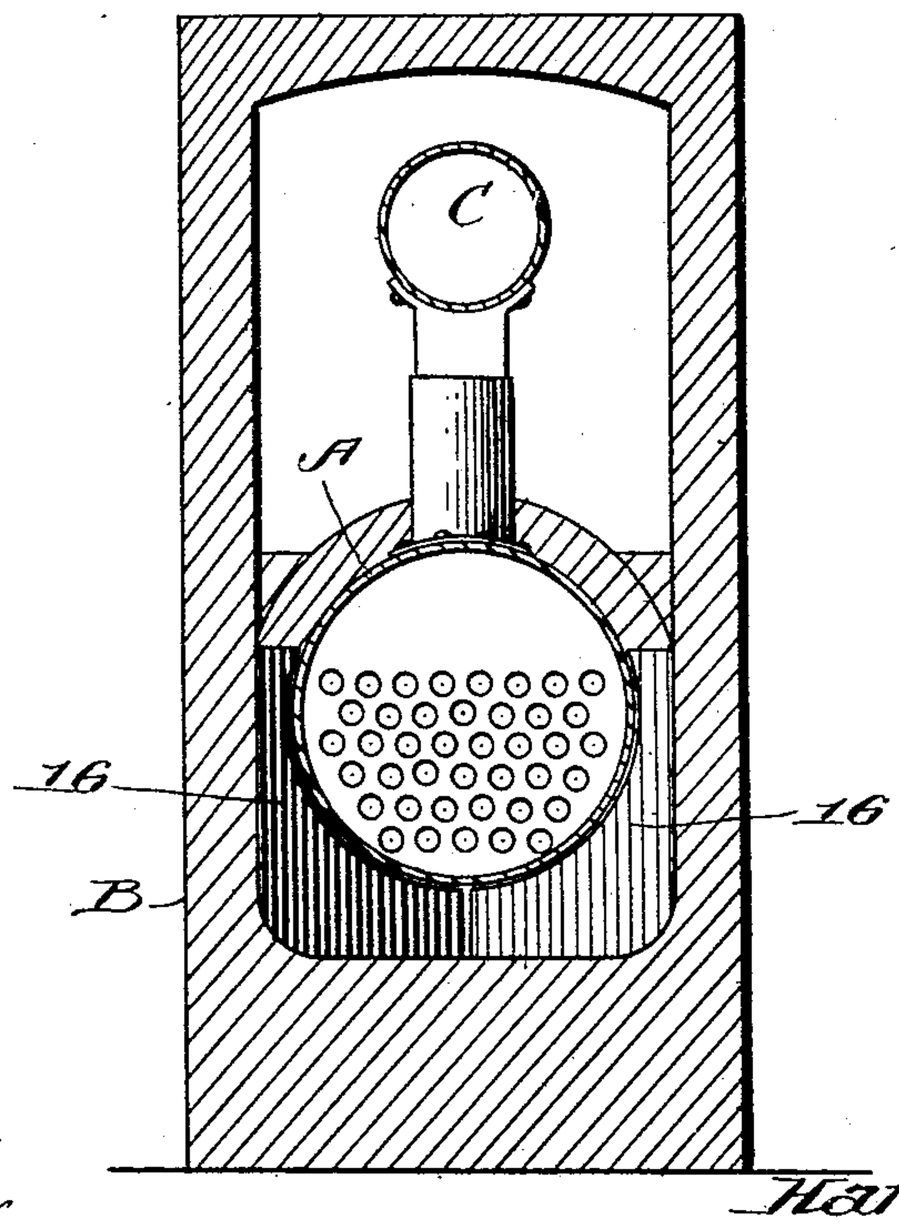


Fig. 4.



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UNITED STATES PATENT OFFICE.

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STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 704,353, dated July 8, 1902.

Application filed November 14, 1901. Serial No. 82,308. (No model.)

To all whom it may concern:

Be it known that I, HARRISON B. MEECH, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Steam-Boiler Furnaces, of which the following is a specification.

This invention relates to steam-boiler furnaces.

The object of my invention is to produce a greater quantity of heat from coal and to utilize the heat to the utmost of its efficiency.

The invention consists in coking the coal and liberating the gases and then burning the coke and gases with hot air on the grates, thereby preventing smoke and producing a better combustion and a greater quantity of heat from the coal.

The invention consists, further, in the combination of a reverberatory-furnace bed under the boilers so constructed that the flames from the coke, gases, and air reverberating under the boiler, in connection with a radiating calcine-bed or molten liquid on the furnace-bed, will produce a better continuous flame and a greater radiation of heat on the boiler.

The invention further consists in a better and more complete utilization of the heat so produced. After the flame passes the boiler-tubes it is conducted around the retorts to coke the coal and then to the water-heater to heat the water and air to be used in the generation of steam.

In the drawings forming a part of this specification, Figure 1 is a sectional side elevation of a steam-boiler furnace including my invention. Fig. 2 is a transverse sectional front elevation of said furnace, but with the water-heater omitted. Fig. 3 is a sectional plan view of the same. Fig. 4 is a transverse sectional elevation of a portion of the furnace.

Like characters refer to like parts in all the figures.

On reference to Figs. 1 and 2 I have shown at A a tubular steam-boiler inclosed by the brickwork of the reverberatory furnace B, while the water-heater C is located above the boiler A and may be sustained in any convenient manner. In the front of the furnace I arrange a coking-retort or a series of such retorts, as 2, three of them being shown, and as horizontally disposed in a line or row. The inner ends of these retorts, which are of tubular form, are open and are located above the grate 3, and the outer ends of said retorts are situated in line with the outer wall of the furnace. The grate 3 is located above the ash-pit 4, and said grate may be of the shaking and dumping kind, it having a shaking-rod 5 extending forwardly therefrom and through the front wall of the furnace. The fire-box or grate-chamber is denoted by 6, and it has a side opening 7, provided at its outer end with a hinged door 8, by which access may be readily had to the fire-box or grate-chamber. The row of coking-retorts 2 is supported at or near the inner ends of said retorts by the wall 9, and the said retorts are sustained at their outer ends by the face-plate or front wall 9′ of the furnace.

A pair of horizontally-disposed partitions is denoted by 10, they being superposed and located above and below the row of retorts and being connected with the side wall of the furnace, so as to form a chamber 10′, in which said retorts are located and which insures the heat passing around said retorts.

The bed of the furnace is denoted by 11, and it has a depression or concavity, as 12, having a tap-hole 13, communicating with the pipe 14, built into the brickwork of the furnace. This pipe is inclined and is normally plugged, (the plug not being shown;) but when the plug is withdrawn the contents of the depression or concavity can be run off. The depression or concavity 12 is located in the line of heat-currents passing from the fire-box 6, and it is adapted to contain a suitable molten and heat-radiating material, (designated by 15,) such as silica, salt, and lime, or any combination that will melt easily. The heat-currents passing from the fire-box are applied directly to this material 15, and the heat radiating from the same is applied directly to the boiler with great intensity, and the flame passes through the tubes of said boiler without soot or ashes. The bottom of the furnace-bed, which is basin-shaped or concaved and which receives the molten mass 15, slopes rearwardly toward the tap-hole 13. A small quantity of ashes is taken off at times with the products of combustion, and such ashes strike the upright baffle-walls or half-

partitions 16 and are thereby caused to fall into the molten mass 15, being thereby prevented from passing through the boiler-flues, and hence into the stack. When the said molten mass loses its efficiency, which it will do eventually by reason of an accumulation of the ash therein, I draw off the same through the tap-hole 13 and deliver into the basin or concavity 12 a fresh supply of such material. I arrange in the path of the heat-currents and resting upon the bed of the furnace the partition 16, said partition extending approximately half-way across the furnace and being arched to agree with the curvature of the boiler and being contiguous to said boiler. The reverberatory partitions are arranged in staggered form to cause the heat-currents to traverse a circuitous path. The heat-currents after leaving the concaved bed 11 pass into the chamber 17 at the rear of the boiler and then through the boiler-tubes into the chamber 18 at the front of the boiler. The forward chamber 18 is connected with the retort-inclosing chamber 10′ by a conduit or passage 19, formed suitably in one wall or side (shown as the left in Fig. 2) of the furnace. The heat-currents then circulate around the retorts 2 for the purpose of coking their contents. One of the walls of the furnace is provided with a passage 22′, into which the heat-radiating substances can be suitably delivered, said passage opening into the depression or concavity 12 of the furnace-bed 11. The heated air-currents passing from the chamber 10′ enter the conduit 21′ and traversing the same enter the chamber A′, in which the water-heater C is located, passing from thence by the short conduit B′ to the stack 22, and said conduit 21′ is furnished with a damper 23.

On the forward side of the furnace is arranged a row of hoppers, as 24, corresponding in number with the retorts 2 and adapted to deliver material into the respective retorts, said hoppers having gates or valves, as 25, at their lower ends, which are independently operative and by which the discharge from the several hoppers can be manually governed. The retorts are supplied with coal at their front ends, and said ends are equipped with doors, as 26, hinged at their lower edges to the lower walls of the respective retorts, so that said doors can be dropped down to effect the charging of the retorts. The said retorts inclose followers or plungers, as 27, rigidly secured at the ends of rods 28, passing through the respective doors. Means of a suitable nature are provided to normally hold these doors shut; but when one is dropped down and the valve or gate 25 of a hopper over the same is opened coal can fall onto said door and be fed into the retort by manipulating the rod 28, and thereby the follower or plunger. When the desired quantity of coal has been delivered to the retort, its door will be closed.

Suitable flues, as 29, open into the furnace. Other gases than coal can be introduced into the furnace through the holes 30, which are shown as located between the retorts, or such holes may be located at any other desired places.

First, fire is made on the grates. The coal is broken up to about chestnut size, then placed in hoppers 24, let into the mouth of retorts 2 by slide-valves 25, doors 26 being closed by raising follower-rods 28, and with the followers or plungers 27 the coal is pushed forward toward the grate, and when coked it is pushed onto the grate, then refilled. The two or three retorts are filled alternately, so that the gases from one retort will burn on the grate with the coke of the previous retort and so continue.

It is a well-known fact that coal coked in a retort generates gas without smoke; also, that the coke will burn longer and give more heat than the same amount of raw coal. By this invention I coke the coal, generate the gases, burn the gases and hot air and gases by the heat of the coke on the grates, producing complete combustion and an intensely-hot flame. The flame heats the fire-brick and calcines and melts the material in the bottom of the furnace. The molten material can be made of silicate, salt, and lime or any combination that will melt easily and that will consume the ashes. Thus this great heat radiates on the boiler. The flame passes through the flues of the boiler without soot or ashes. The boiler and flues continue clean to receive the heat of the flame. Such a combination will generate more steam with less coal than is used by the old process.

My improved furnace makes no smoke. It consumes all the gases and chemically transforms the coal into heat and continues to burn in flame through the tubes of the boiler and around the retorts and to the water-heater. The reverberatory furnace, with its hot fire-brick, reverberatory partitions, and molten calcine bottom, will radiate more heat upon the boiler with less coal than is generally used.

My retorts can be made of fire-brick or fire-clay molded and placed level with the grates horizontally or upright or at any convenient position, or the retorts may be long and extend farther under the boilers. The coal may be shoveled into the retorts and shoved in with a follower or pusher. Slack-dust coal can be also used, although good clean coal is preferable. The grates are made to preferably shake and dump by a lever from without. The flues of the boiler may be cleaned by opening the doors in front; but as there is no soot or ashes to foul the tubes they will not require much cleaning. The gases escaping from the retorts are burned in the heated top of the coke. Other gases and hot air may be used in combination with the gases of the coal to produce flame heat. Hot-air pipes may be laid in and along the walls

of the furnace to heat air or gases, so that as much heat as possible may be utilized. In some cases I may dispense with the staggered half-partitions 16, which rise from the concaved bottom 12 of the combustion-chamber of the furnace.

Coal theoretically being a chemical physical production, when heated in a muffle-retort excluded from the air the heat vaporizes the excess chemical combination, which passes off in fumes and gases, leaving the more solid carbon called "coke," which is red-hot, but will not be consumed and give off its heat without air, (oxygen.) The chemical fumes and gases released from the coal are not consumed, but fly away, but if passed over and in a hot fire would ignite and make hot flame. It is at this point in this invention that I create an economic process. The coke, red-hot, is pushed from the retort onto the grates, there coming into contact with air burns and gives off its heat-flame. The fumes and gases from the coal in the other retort come into contact with the heat of the coke on the grate and both produce heat-flame. Thence the flame proceeds into the reverberatory flame heat and there continues to make flame, which flame might be carried several feet with a supply of hot air. By this combination it is readily seen that I produce perfect combustion of the elements of fuel and by radiation return the heat to generate steam. This great principle of making heat produce heat is not in use as it should be or will be in the future. By the furnace above described it is calculated that a great percentage of the heat of the coal can be utilized over the ordinary way where only about ten (10) per cent. of the heat value of the coal is employed to useful effect.

In Fig. 2 I have omitted the water-heater C, and in this construction the conduit 21′ connects directly with the metal stack 40, sustained by and rising from the boiler A.

It will be understood, of course, that the improved furnace can be used either for manufacturing purposes or as a heater for water, air, or the like in dwellings or other buildings or for use in drying or melting various kinds of substances, for I do not limit the same to any particular use, and also that I may inject gases other than those set forth or hot air into said furnace at any point required to continue the flame.

It will be seen that the retorts 2, the grate 3, and the concavity or depression 12 are situated substantially in line or row and that the grate is between the retorts and the concavity or reverberatory bed of the furnace, so that the coal can be properly coked and the products of combustion can be caused to pass from the grate or fire-chamber directly above and in direct contact with the molten mass 15, thereby heating same, and the mass in turn applies its heat through radiation directly to the boiler or like device, so as to augment the effect of the products of combustion as they pass toward the stack. It will be seen that the walls 10, which are situated at opposite sides of the coking-retorts 2, are imperforate, so that the hot air from boiler-flues which enters one end of the chamber in which said retorts are disposed is caused to traverse the complete length of the chamber and is discharged at the opposite end thereof into the water-feed chamber or into the stack, whereby the full efficiency of such hot air is secured.

Having described the invention, what I claim is—

1. A steam-boiler furnace having a bed containing a substance capable of fusing by heat, a boiler free of such substance, and a fire-box, the products of combustion from which are adapted to pass between said boiler and bed to heat the boiler and fuse such substance, and such substance when fused serving to apply radiant heat to the boiler.

2. A steam-boiler furnace, having a bed provided with a substance capable of fusing by heat, a boiler above said bed, and a fire-box, the products of combustion from which are adapted to pass between said boiler and bed, to heat the boiler and fuse said substance, and the latter when fused serving to apply radiant heat directly to the boiler.

3. A steam-boiler furnace, having a bed provided with a substance capable of fusing by heat, a boiler above said bed, a fire-box, the products of combustion from which are adapted to pass between said boiler and bed, to heat the boiler and fuse said substance, and the latter when fused serving to apply radiant heat directly to the boiler, and a coking-retort adapted to be heated by such products of combustion, and to discharge its gases into said fire-box.

4. A steam-boiler furnace having a concaved bed, the concavity of which is adapted to contain a substance capable of fusing by heat, a plurality of staggered partitions extending partially across and rising from said bed and connected with the walls of the furnace, a fire-box the products of combustion from which are adapted to pass between said boiler and concaved bed to heat the boiler and fuse such substance, and the latter when fused serving to apply radiant heat to the boiler.

5. A steam-boiler furnace having a bed provided with a substance capable of fusing by heat, a boiler above said bed, a fire-box the products of combustion from which are adapted to pass between said boiler and bed to heat the boiler and fuse such substance, and the latter when fused serving to apply radiant heat directly to the boiler, a coking-retort adapted to deliver its gas into such fire-box, imperforate partitions connected with the walls of the furnace at opposite sides of said retort to thereby form a chamber for inclosing said retort, a conduit for delivering such

products of combustion into said chamber and a second conduit adapted to carry the products of combustion from said chamber.

6. A steam-boiler furnace having a bed provided with a substance capable of fusing by heat, a boiler above said bed, a fire-box the products of combustion from which are adapted to pass between said boiler and bed, to heat the boiler and fuse such substance, and the latter when fused serving to apply radiant heat to the boiler, a row of horizontally-disposed coking-retorts adapted to deliver their gas into the fire-box, superposed horizontal walls above and below said retorts and connected with the side walls of the furnace to form a chamber, a conduit connected with one end of said chamber for delivering products of combustion into one end of said chamber, and a second conduit connected with the opposite end of said chamber for carrying off the products of combustion therefrom.

7. A steam-boiler furnace, having a bed provided with a substance capable of fusing by heat, a boiler above said bed, a fire-box, the products of combustion from which are adapted to pass between said boiler and bed to simultaneously heat the boiler and fuse said substance, and the latter when fused serving to apply radiant heat directly to the boiler, a stack, a chamber in communication with the stack, and adapted to receive the products of combustion, and a coking-retort extending through said chamber, and the inner end thereof being located in the fire-box.

8. The combination of a combustion-chamber provided with a substance capable of fusing by heat, a receptacle arranged in said combustion-chamber, and a fire-box the products of combustion from which are adapted to pass between said receptacle and said substance, to heat said receptacle and fuse such substance, and such substance when fused serving to apply radiant heat to said receptacle.

9. A steam-boiler furnace having a combustion-chamber provided with a concaved bottom containing a substance capable of fusing by heat, a boiler above said concaved bottom, a fire-box the products of combustion from which are adapted to pass between said boiler and concaved bottom, to simultaneously heat the boiler and fuse such substance, and the latter when fused serving to apply radiant heat to the boiler, a plurality of staggered partitions extending partially across and rising from said concaved bottom, a chamber adapted to receive the products of combustion after the same have passed from said combustion-chamber, and a coking-retort extending through said last-mentioned chamber and its inner end being situated in the fire-box.

10. A steam-boiler including a concaved bed, a mass in the concavity of said bed capable of fusing by heat, a plurality of staggered partitions extending partially across and rising from said bed, and connected with the walls of the furnace, a retort, a grate between said retort and concaved bed, a steam-boiler having flues and arranged above said bed, a chamber inclosing said retort and communicating with the flues of the boiler, a second chamber above the boiler and in communication with the first chamber, a water-heater in said second chamber, and a stack connected with said second chamber.

11. A steam-boiler furnace, having a bed provided with a substance capable of fusing by heat, a boiler above said bed, a series of retorts, a fire-box having grates located between the retorts and furnace-bed, and the products of combustion from the fire-box being adapted to pass between said boiler and bed, to simultaneously heat said boiler and fuse said substance, and the latter when fused serving to apply radiant heat directly to the boiler, and a flue-chamber in communication with the front end of the boiler and inclosing said retorts, and in communication with the boiler-stack.

12. A steam-boiler furnace including a bed having a concavity, a substance in said concavity capable of fusing by heat, a plurality of staggered half-partitions in the furnace-bed, a series of retorts, a fire-box intermediate the retorts and furnace-bed, a series of hot-air tubes or pipes along the walls of the furnace, communicating with the fire-box, a flue or tubular boiler above said concavity and fire-box, and the products of combustion from the latter being adapted to pass between said boiler and concavity and serving to heat the boiler and fuse such substance and the latter when fused serving to apply radiant heat directly to the boiler, a flue-chamber connected with the front end of such boiler and passing around said retorts, and a chamber above the boiler containing a water-heater, communicating with a flue which surrounds said retorts, and in communication with the stack.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HARRISON B. MEECH.

Witnesses:

BJM. L. BURROWS,

WALLACE C. BEEBE.