

Feb. 2, 1926.

1,571,179

H. ADAMS

METHOD OF AND APPARATUS FOR CONTROLLING AND DIRECTING BURNING FUEL OR GASES

Filed Jan. 23, 1923

3 Sheets-Sheet 1

FIG. 2

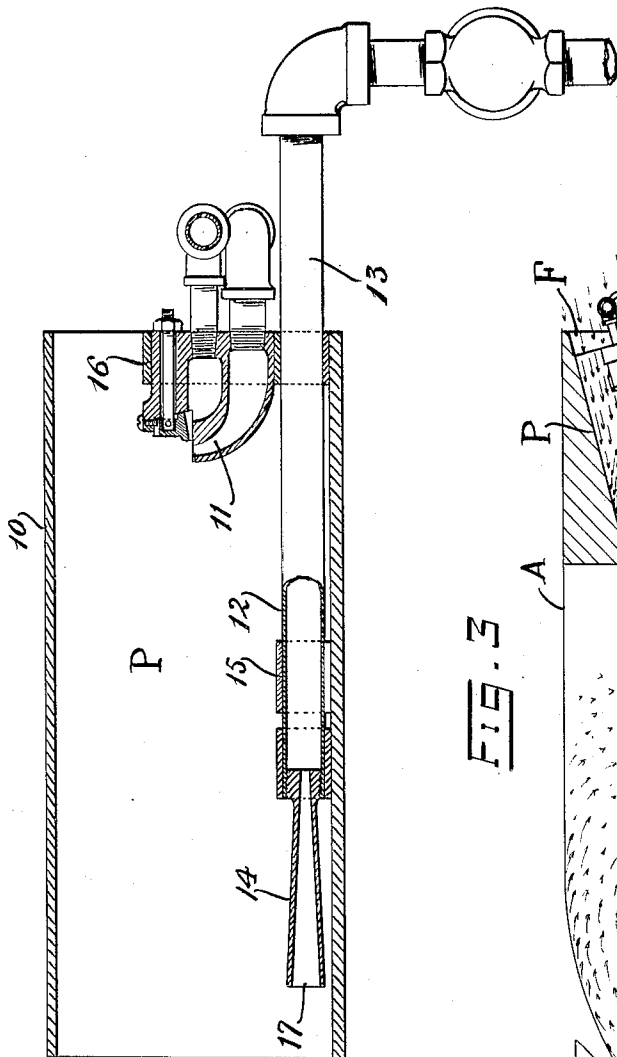


FIG. 3

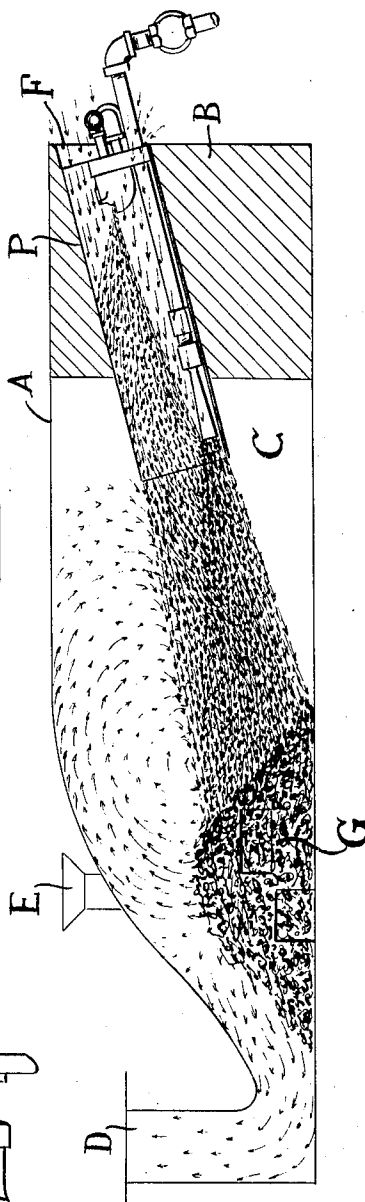
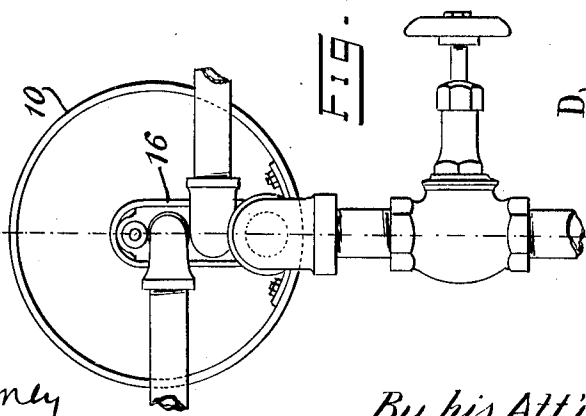


FIG. 1



Witnesses

H. J. Penney

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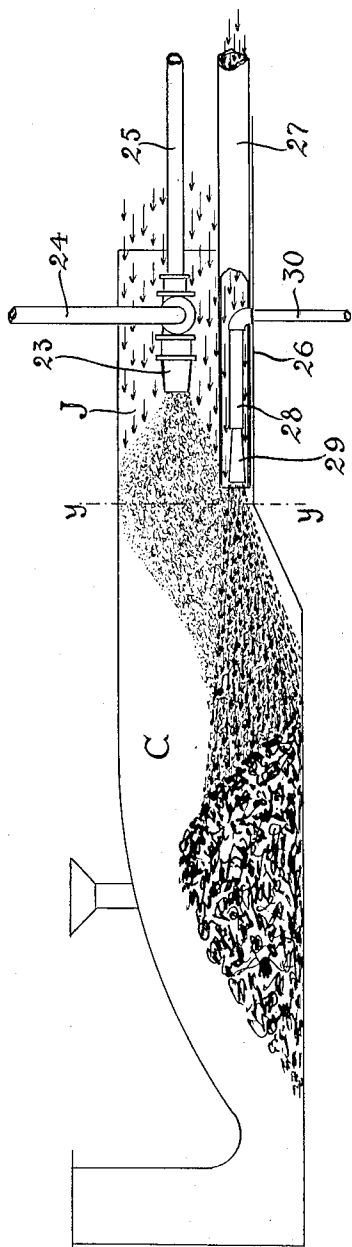
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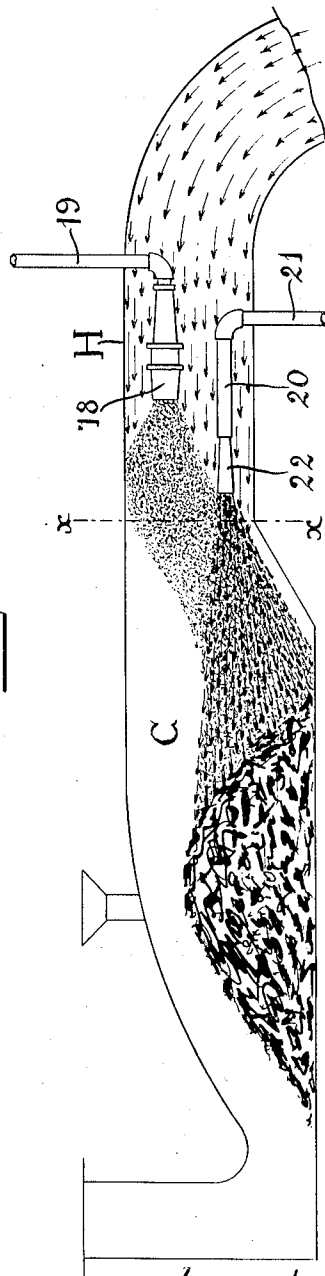
FIG. 5



Witnesses:

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FIG. 4



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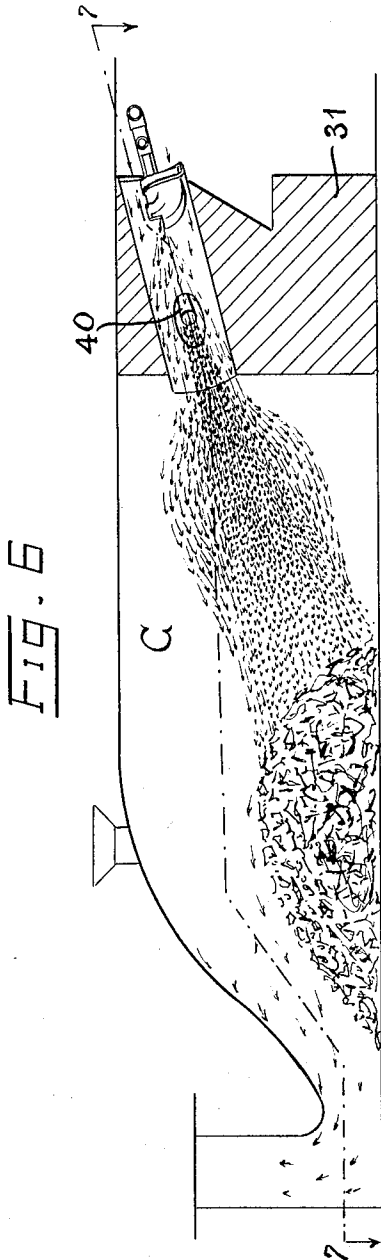
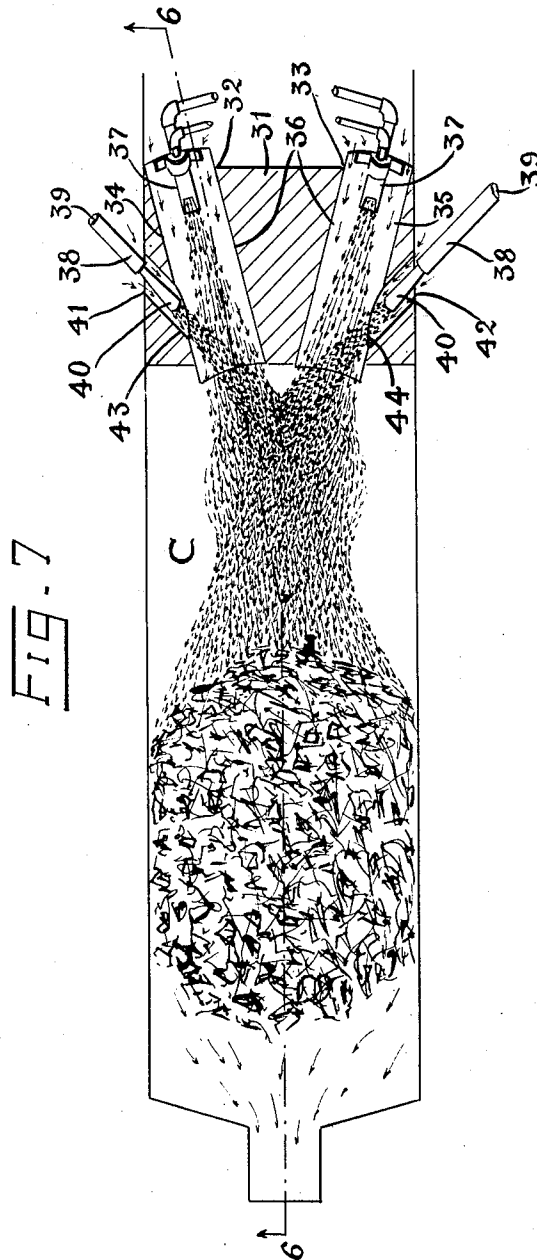
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3 Sheets-Sheet 3



Witnesses:

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UNITED STATES PATENT OFFICE.

HENRY ADAMS, OF PLAINFIELD, NEW JERSEY.

METHOD OF AND APPARATUS FOR CONTROLLING AND DIRECTING BURNING FUEL OR GASES.

Application filed January 23, 1923. Serial No. 614,419.

To all whom it may concern:

Be it known that I, HENRY ADAMS, a citizen of the United States, residing in Plainfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Methods of and Apparatus for Controlling and Directing Burning Fuel or Gases, of which the following is a specification.

The present invention relates to a method of and apparatus for controlling burning fuel or gases, and particularly relates to a method of and apparatus for controlling burning fuel and gases in furnaces, and one object of the invention is to provide a method of and apparatus for controlling the burning gases as soon as they are delivered to the furnace, or as soon as they are produced from the fuel, or as they are being produced.

Another object is to provide a method of and apparatus for controlling the burning fuel or gases after they leave their respective burners or producers, and directing the heat thereof and causing it to travel to the desired location where the work is to be done.

Another object is to provide a method of and apparatus for controlling burning fuel or gases after they leave their respective burners or producers, and supplying automatically, or by regulation, sufficient air to afford perfect combustion.

Another object is to provide a method of and apparatus for controlling burning fuel or gases in furnaces, especially reverberatory furnaces, open hearth furnaces, and the like, whereby to obtain the best efficiency from the burning fuel or gases and obviating the specially constructed roofs, high stacks or chimneys, etc. of such furnaces, and whereby the direct heat can be applied and kept at a point desired, perfect control as to the flame produced can be had, and either a reducing or oxidizing flame can be afforded at will.

Another object is to provide a method of and apparatus for controlling the heat of burning fuel or gases in furnaces whereby the heat is carried to the bath or charge in the furnace, and maintained and carried over the bath or charge the entire length thereof, and directly applied to the bath or charge, thereby doing away with the necessity for the major portion of deflected or radiated heat from the roof of the furnace.

I attain these and such other objects, features and advantages as may appear during the subjoined description by way of example of several of the possible embodiments of the invention, shown in the accompanying drawings forming part of this specification, in which Figure 1, is a rear end view of a preferred form of a controller and director for burning fuel or gases, used in my invention, and showing connections thereof to sources of supply.

Figure 2, is a sectional side view of the form of controller and director shown in Fig. 1, and connections thereof to sources of supply.

Figure 3, is a sectional side view of a reverberatory furnace and the controller and director shown in Figs. 1 and 2 applied thereto.

Figure 4, is a sectional side view of a reverberatory furnace and a modified form of controller and director applied thereto.

Figure 5, is a sectional side view of a reverberatory furnace and still another form of controller and director applied thereto.

Figure 6, is a sectional view of a reverberatory furnace and duplicate controllers and directors applied thereto, only one of which is shown, the view being taken on the line 6—6 of Fig. 7.

Figure 7, is a sectional view of a reverberatory furnace and duplicate controllers and directors applied thereto, the view being taken on the line 7—7 of Fig. 6.

Similar reference characters denote similar parts throughout the several views.

According to this invention, in order to control the heat and obtain the full effective amount of direct heat, a velocity high pressure jet of air or steam, the steam preferably being superheated, is employed which cooperates with projected burning fuel or gases together with sufficient air or oxygen to afford perfect combustion, the jet of steam being arranged for carrying and directing the burning fuel or gases to the desired point, and also carrying sufficient air or oxygen to the desired point when the complete combustion is desired. In order to obtain the full velocity of the burning fuel or gases a suitable nozzle is used the high velocity steam jet from which carries along with it the burning fuel or gases to the point where complete combustion is required, the burning fuel or gases due to this velocity

being drawn along by the steam jet and travelling more or less along the line of direction of the steam jet, and thereby focalizing the heat, and in the case of reverberatory furnaces doing away with the large amount of radiated and deflected heat ordinarily required and providing direct heat instead, and consequently reducing the expenses of construction and operation.

Referring to Fig. 3 there is shown the reverberatory furnace A having the end wall B, and having the combustion chamber C, and provided with the stack D for waste gases and the inlet E for material, there being the necessary outlets for finished material and residue from the furnace which are not shown as being considered unnecessary for the purposes of this description. The end wall B has therethrough the circular opening F arranged at an incline downwardly towards the bottom of the combustion chamber and the combustion chamber C is shown as having therein the mass G of ore, or other material to be acted upon, located below the inlet E.

The inclination of the opening F is so arranged that means for projecting burning fuel or gases may be located in the opening, such means being adapted to control and direct the burning fuel or gases in such manner that the heat therefrom will be directly exerted upon the mass G, and for this purpose I provide as one means the controller and director P.

The controller and director P comprises the case 10, the fuel burner or producer 11, and the high velocity steam projector 12.

The case 10 is cylindrical in form and is snugly received in the opening F of the furnace end wall, the forward or inner end of the controller and director P extending for a distance into the combustion chamber C and the rear or outer end thereof being located at the outer end of the opening F, the case being open at both ends and the interior of the case constituting a chamber or zone for confining the burning fuel or gases in the longitudinal interior of the case for a time subsequent to their discharge from the burner or producer 11 and prior to their entrance into the combustion chamber C, during which period of confinement the burning fuel or gases discharged from the burner 11 are subjected to the drawing or carrying-along effect of the high velocity stream discharged from the high pressure projector 12, whereby the burning fuel or gases and the heat thereof are carried along with and directed by the high velocity stream of the projector 12 into and through the combustion chamber C and into direct contact with the mass or ore in the furnace, and air is also carried along when complete combustion is desired.

The fuel or gas burner 11 is adapted to

project the burning fuel or gas longitudinally of the case 10, and comprises an oil or gas outlet and an air or steam outlet cooperating therewith, the air being under pressure, and the line of discharge of the air or steam from the burner 11 preferably being substantially on the axial line of the case 10.

The high pressure projector 12 comprises the pipe 13 operatively connected to a source of supply of high pressure steam, the steam preferably being superheated, as superheated steam more closely resembles a perfect gas rather than a vapor, and because of its heat intensifying quality. The pipe 13 has inserted in one end thereof, or otherwise operatively connected to one end thereof, the nozzle 14, which flares towards its mouth for increasing the velocity of the steam in passage there-through, the pipe 13 and nozzle 14 being supported in the case 10, as by the straps 15 and 16, the strap 16 also supporting the burner 11. The pipe 13 and nozzle 14 are arranged parallel to the line of discharge of burning fuel or gas from the burner 11 and are located adjacent to one side of the case 10, the mouth 17 of the nozzle 14 being positioned in the case 10 such distance inwardly from the discharge end or mouth of the case 10 that the stream from the mouth 17 in its expansion will clear the end of the side of the case 10 adjacent to the mouth of the case as shown in Fig. 3, and the lower line of the increased expansion of the stream when in the combustion chamber C will contact with the mass or ore G at the bottom line of the furnace, while the upper line of the expanding stream will contact with the mass or ore substantially at the top thereof, suitable positioning of the mouth 17 being accomplished as by loosening the bolts of the straps 15 and 16 and moving the pipe 13 and nozzle 14 inwardly or outwardly in the case 10 and securing the pipe and nozzle in the desired position by readjustment of the bolts.

In operation: The case 10 being open at both ends for passage of atmospheric air under control by means not shown but understood, draft through the case is provided, and additional oxygen afforded for the burning fuel or gases discharged from the burner 11. The stream of superheated high pressure steam passing through the pipe 13 with velocity in excess of the velocity of the burning fuel or gases discharged from the burner 11, and this velocity being increased by the form of the nozzle 14 and increasing while the steam is in the case 10 and still further increasing after entrance of the steam into the combustion chamber C, the burning fuel or gases are drawn along with and into the stream of superheated steam and mingle therewith, this action, due

to the positioning of the nozzle 14 in the case 10, commencing in the case and continuing until the burning fuel or gases intensified by the stream of superheated steam and controlled and directed thereby are brought into contact with the mass or ore G in the furnace, extending in their effect over the side of the mass or ore from the bottom to the top thereof and projected thereinto.

Referring to Fig. 4, there is shown a reverberatory furnace having at one end thereof a reduced or constricted portion H extending inwardly of the furnace to about the line $x-x$ and there merging in the combustion chamber C, and constituting a zone of temporary confinement for the burning fuel or gases, into which portion or zone H atmospheric air under control by means not shown but understood, is admitted. The burner 18 adapted to project pulverized coal in the longitudinal line of the furnace, is arranged in the portion H a short distance outwardly from the line $x-x$ and somewhat above the central longitudinal line of the portion H, the burner 18 being operatively connected as by the pipe 19 to a source of pulverized coal supply. The high velocity projector 20 is arranged in the zone of confinement H below and parallel to the line of discharge from the burner 18, and spaced away a distance from the lower side of the zone H. The projector 20 is operatively connected as by the pipe 21 to a source of superheated steam supply and has a flaring nozzle 22, the mouth of which is positioned a short distance inwardly from the line $x-x$, the line $x-x$ being considered as the discharge end or mouth of the zone H, whereby the drawing-along effect before described of the stream of superheated steam from the nozzle is exercised upon the liberated burning gases given off by the pulverized coal projected from the burner 18 while the coal is still within the zone of confinement H, the burning coal being drawn along with and into the stream from the projector 20 and so controlled and directed thereby as to contact with the bed of the furnace adjacent to the mass or ore therein and into contact with the mass or ore on one side thereof from bottom to top of the side. The jet of steam also draws in through zone H air or oxygen so as to afford perfect combustion at the point desired in the furnace, which air or oxygen can be regulated either by suitable valves or by the velocity of the stream from the nozzle 22.

Referring to Fig. 5, there is shown a reverberatory furnace having at one end thereof a reduced or constricted portion J extending inwardly of the furnace to about the line $y-y$ and there merging in the combustion chamber C, and constituting a zone of temporary confinement for the burning fuel or

gases, into which portion or zone J atmospheric air under control by means not shown but understood, is admitted. The burner 23 adapted to project pulverized coal in the longitudinal line of the furnace, is arranged in the portion or zone J preferably about the central longitudinal line of the portion or zone, the burner being connected as by the pipe 24 with a source of pulverized coal supply, and connected as by the pipe 25 with a source of steam supply. The auxiliary air projector 26 comprises the pipe 27 into which atmospheric air under control is admitted, this pipe being arranged in the portion or zone J adjacent to the lower side thereof and being positioned so that its inner end lies a distance inwardly, relative to the zone J, from the lines $y-y$ of the portion or zone J, so that a stream discharged from the inner end of this pipe will exercise the drawing-along effect before described on the burning pulverized coal or gases of the pulverized coal in the portion or zone J. The high velocity projector 28 having the flaring nozzle 29, is enclosed by the pipe 27, the mouth of the nozzle being positioned slightly inwardly, relative to the discharge end of the pipe 27, for exercising the drawing-along effect of the stream from the nozzle upon the air passing through this pipe, the projector 28 being operatively connected as by the pipe 30 with a source of superheated steam supply. In its control and direction and its effect upon the mass or ore in the furnace this form of the invention is substantially the same as that described relative to the form shown in Fig. 4.

Referring to Figs. 6 and 7, there is shown a reverberatory furnace having an end wall 31 provided with two inclined circular openings 32 and 33 therethrough, these openings converging as shown in Fig. 7, the controllers and directors 34 and 35 being arranged in the openings 32 and 33. Each of the controllers and directors 34 and 35 comprises a circular case 36 having arranged therein a burner 37, preferably on the axial line of the case, and a high velocity projector 38 operatively arranged for cooperating with the burner. The case 36 is open at both ends for the passage of atmospheric air therethrough under control by means not shown but understood. Each high velocity projector 38 comprises the pipe 39 and the flaring nozzle 40 for cooperating therewith, the pipe 39 being operatively connected to a source of superheated steam supply. The end wall 31 has extending therethrough at an angle to the openings 32 and 33 and communicating therewith the side openings 41 and 42, which openings permit passage of atmospheric air therethrough under control by means not shown but understood. The cases 36 have side openings 43 and 44, a short distance from the discharge ends of

the cases, these side openings communicating with the side openings 41 and 42 of the end wall. The projectors 38 are arranged in the side openings 41 and 42, preferably on the axial lines of these openings, so that the nozzles 40 of the projectors discharge through the side openings 43 and 44 of the cases 36, and exercise upon the burning fuel and gases in the cases the drawing-along effect before described. The angles of inclination of the projectors 38 relative to the axial lines of the cases 36 and to each other are such that, if the axial lines of the nozzles 40 are extended into the combustion chamber C, the extended lines, and the steam and air discharged therefrom, will intersect in the combustion chamber C without contacting with the walls of the cases 36, about as shown by the darker arrows of Fig. 7, and then will deflect each other into a common jet in the direction of the axial line of chamber C, along the downwardly directed axial line of cases 36 as shown in Fig. 6, so that the burning fuel or gases from the burners 37 drawn along by the stream of superheated steam from the nozzles 40 will be controlled and directed thereby and brought into contact with the mass or ore in the furnace over the whole face of the mass from the top to the bottom and around the sides of the mass or ore.

Having thus described my invention, it should be understood that there may be modifications thereof and variations therein without departing from the spirit of the invention or exceeding the scope of the appended claims.

What I claim and desire to protect by Letters Patent is:

1. In apparatus for controlling and directing burning fuel or gases, means for projecting burning fuel or gases, and means for projecting substantially in the line of projection of the burning fuel or gases steam or air of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling the same and after control thereof directing the burning fuel or gases for disposition of the heat thereof.

2. In apparatus for controlling and directing burning fuel or gases, means for providing a zone of temporary confinement for burning fuel or gases, means for projecting burning fuel or gases into said zone, and means for projecting into said zone in substantially the line of projection of the burning fuel or gases steam or air of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling the same in the zone of confinement and after passage of the burning fuel and gases from said zone directing them for disposition of the heat thereof.

3. In apparatus for controlling and directing burning fuel or gases, means for projecting burning fuel or gases, and means for projecting substantially in the line of projection of the burning fuel or gases a stream of gaseous fluid of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling the same and directing the disposition of the heat thereof.

4. In apparatus for controlling and directing burning fuel and gases, means for providing a zone of temporary confinement for burning fuel or gases, means for projecting burning fuel or gases into said zone and means for projecting into said zone substantially in the line of projection of the burning fuel or gases a stream of gaseous fluid of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling the same in said zone and after passage of the burning fuel or gases from said zone directing them for disposition of the heat thereof.

5. In apparatus for controlling and directing burning fuel or gases, the apparatus being associated with a furnace, means for projecting burning fuel or gases into the furnace, and means for projecting into the furnace substantially in the line of projection of the burning fuel or gases steam or air of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling them and directing them for disposition of their heat in the furnace.

6. In apparatus for controlling and directing burning fuel or gases, the apparatus being associated with a furnace, means for providing a zone of temporary confinement for the burning fuel or gases in the furnace, means for projecting burning fuel or gases into said zone, and means for projecting into said zone substantially in the line of projection of the burning fuel or gases steam or air of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling them in said zone and after passage of the burning fuel or gases from said zone directing them for disposition of their heat in the furnace.

7. In apparatus for controlling and directing burning fuel or gases, means for providing a zone of temporary confinement for burning fuel or gases, means for inlet of atmospheric air into said zone, means for projecting burning fuel or gases into said zone, and means for projecting into said zone substantially in the line of projection of the burning fuel or gases steam or air of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling

them in said zone and after passage of the burning fuel or gases from said zone directing them for disposition of their heat.

8. In apparatus for controlling and directing burning fuel or gases, the apparatus being associated with a furnace, means for providing a zone of temporary confinement for burning fuel or gases in the furnace, means for inlet of atmospheric air into said zone, means for projecting burning fuel or gases into said zone, and means for projecting into said zone substantially in the line of projection of the burning fuel or gases steam or air of greater velocity than the velocity of the burning fuel or gases for drawing along therewith the burning fuel or gases for controlling the burning fuel or gases in said zone and after passage thereof from said zone directing them for disposition of their heat in the furnace.

9. In apparatus for controlling and directing burning fuel or gases, means for providing a zone of temporary confinement for burning fuel or gases, means located in said zone for projecting burning fuel or gases into the zone, and means located in said zone for projecting into the zone in proximity to the burning fuel or gases and substantially in the line of projection thereof steam or air of greater velocity than the velocity of the burning fuel or gases for directing the latter to a point of application by means of rarified atmosphere due to the drawing along of the burning fuel or gases by the steam or air.

10. In apparatus for controlling and directing burning fuel or gases, means for providing a zone of temporary confinement for burning fuel or gases, means for inlet of atmospheric air to said zone, means located in said zone for projecting burning fuel or gases into the zone, and means located in said zone for projecting into the zone in proximity to the burning fuel or gases and substantially in the line of projection thereof steam or air of greater velocity than the velocity of the burning fuel or gases for directing the latter to a point of application by means of rarified atmosphere due to the drawing along of the burning fuel or gases by the steam or air.

11. In apparatus for controlling and directing burning fuel or gases, the apparatus being associated with a furnace, means for providing a zone of temporary confinement in the furnace for burning fuel or gases, means located in said zone for projecting burning fuel or gases into the zone, and means located in said zone for projecting into the zone in proximity to the burning fuel or gases and substantially in the line of projection thereof steam or air of greater velocity than the velocity of the burning fuel or gases for directing the latter to a point of application in the furnace

by means of rarified atmosphere due to the drawing along of the burning fuel or gases by the steam or air.

12. In apparatus for controlling and directing burning fuel or gases, the apparatus being associated with a furnace, means for providing a zone of temporary confinement for burning fuel or gases in the furnace, means for inlet of atmospheric air to said zone, means located in said zone for projecting burning fuel or gases into the zone, and means located in said zone for projecting into the zone in proximity to the burning fuel or gases and substantially in the line of projection thereof steam or air of greater velocity than the velocity of the burning fuel or gases for directing the latter to a point of application in the furnace by means of rarified atmosphere due to the drawing along of the burning fuel or gases by the steam or air.

13. In apparatus for controlling and directing burning fuel or gases, a case having at one end means for inlet of atmospheric air and having at its opposite end a discharge outlet, a jet disposed in the case and having its discharge end spaced away from said discharge outlet for projecting burning fuel or gases into the case, and a jet for projecting steam or air into the case and disposed in the case in a plane parallel to the plane of the first jet and spaced away from the first jet and having its discharge end spaced away from said discharge outlet a less distance than the discharge end of the first jet is spaced away from said outlet the steam or air being of greater velocity than the velocity of the burning fuel or gases.

14. The method of controlling and directing burning fuel or gases in a furnace which consists in subjecting the burning fuel or gases to a high velocity injection for directing the burning fuel or gases to a point of application in the furnace by means of rarified atmosphere due to the drawing along of the burning fuel or gases by the high velocity injection.

15. The method of controlling and directing burning fuel or gases which consists in subjecting the burning fuel or gases to the drawing along action of a gaseous fluid projected in proximity to the burning fuel or gases and substantially in the line of movement of the burning fuel or gases and of greater velocity than the velocity of the burning fuel or gases.

16. The method of controlling and directing burning fuel or gases which consists in subjecting the burning fuel or gases to the drawing along action of steam or air of greater velocity than the velocity of the burning fuel or gases and projected in proximity to the burning fuel or gases and substantially in the line of movement thereof.

17. The method of controlling and directing

- ing burning fuel or gases which consists in discharging the burning fuel or gases into a zone of temporary confinement and subjecting them to the drawing along action of a gaseous fluid of greater velocity than the velocity of the burning fuel or gases and projected substantially in the line of discharge of the burning fuel or gases.
18. The method of controlling and directing burning fuel or gases which consists in discharging the burning fuel or gases into a zone of temporary confinement and subjecting them to the drawing along action of steam or air of greater velocity than the velocity of the burning fuel or gases and projected substantially in the line of discharge of the burning fuel or gases.
19. The method of controlling and directing burning fuel or gases which consists in discharging the burning fuel or gases into a zone of temporary confinement and subjecting the burning fuel or gases while temporarily confined to the drawing along action of a gaseous fluid of greater velocity than the burning fuel or gases and which draws along and carries with it sufficient air or oxygen to afford desired combustion and which draws along and carries with it the burning fuel or gases and controls their direction.
20. The method of controlling burning fuel or gases which consists in discharging the burning fuel or gases into a zone of temporary confinement and subjecting the burning fuel or gases while temporarily confined to the drawing along action of steam or air of greater velocity than the burning fuel or gases and projected substantially in the line of discharge thereof and which carries along with it sufficient air or oxygen to afford desired combustion and which draws along and carries with it the burning fuel or gases and controls their direction.
21. The method of controlling and directing burning fuel or gases which consists in discharging the burning fuel or gases into a zone of temporary confinement and subjecting them while temporarily confined to superheated steam of greater velocity than the velocity of the burning fuel or gases and projected in proximity to the burning fuel or gases and substantially in the line of discharge thereof whereby the burning fuel or gases are drawn along and controlled in said zone and when released from temporary confinement are drawn along and directed for disposition of the heat thereof.
22. The method of controlling and directing burning fuel or gases which consists in discharging the burning fuel or gases into a zone of temporary confinement and subjecting them while in said zone to the drawing along action of matter having greater velocity than the velocity of the burning fuel or gases and moving in proximity to the burning fuel or gases and substantially in the line of discharge thereof.

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