Jan. 9. 1923. 1,441,703.

J. E. MUHLFELD ET AL.

FURNACE AND MEANS FOR FEEDING FUEL THERETO.

FILED FEB. 5, 1918.

Fig 1

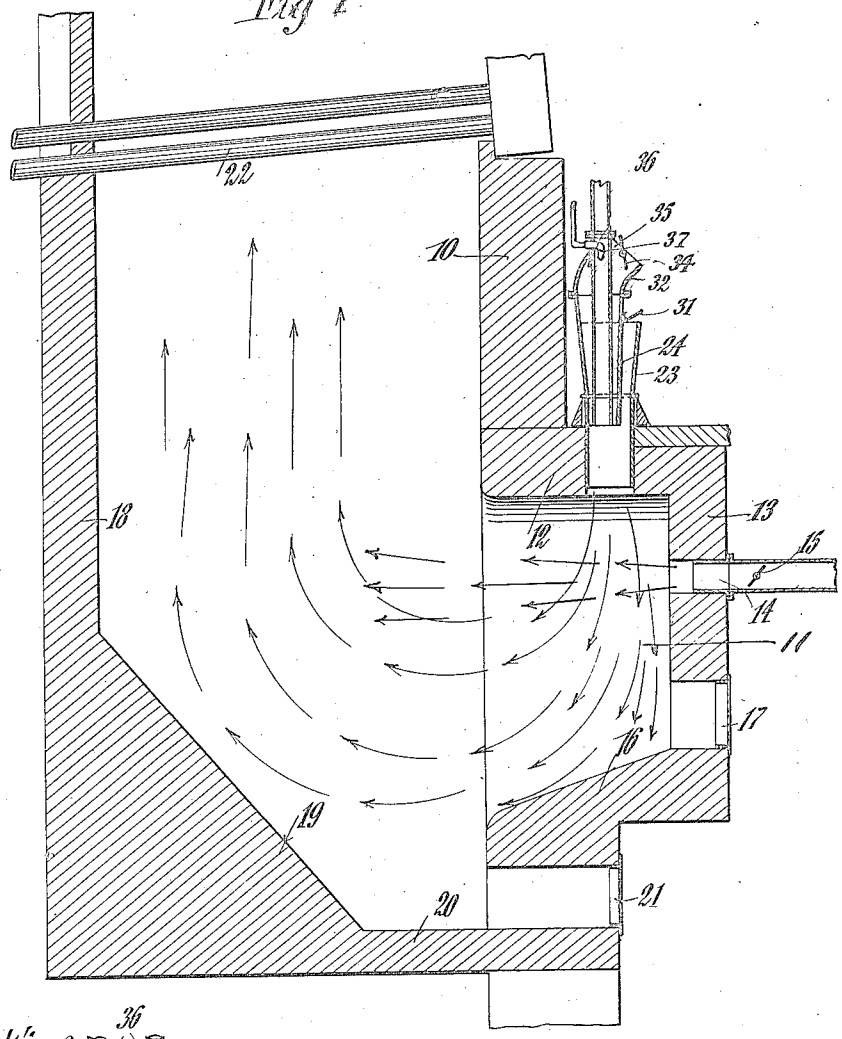


Fig: 2.

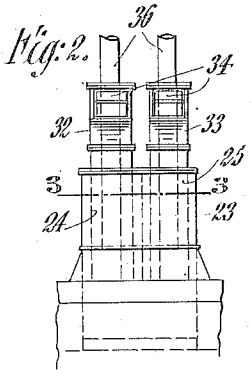
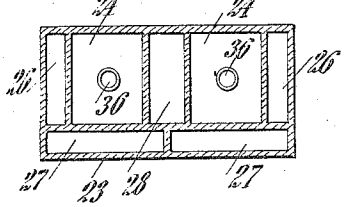


Fig: 3.



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UNITED STATES PATENT OFFICE.

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FURNACE AND MEANS FOR FEEDING FUEL THERETO.

Application filed February 5, 1918. Serial No. 215,428.

To all whom it may concern:

Be it known that we, JOHN E. MUHLFELD and VIRGINIUS Z. CARACRISTI, citizens of the United States of America, the former a resident of Scarsdale, in the county of Westchester and State of New York, and the latter a resident of Bronxville, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Furnaces and Means for Feeding Fuel Thereto, of which the following is a specification.

The present invention relates to improvements in furnaces and method of feeding fuel thereto, the present disclosed embodiments of our invention relating particularly to boiler furnaces in which pulverized fuel is burned.

It is an object of the invention to provide an improved method of feeding and mixing with air, to the end that the greatest efficiency is obtained from the furnace, and the furnace may be maintained in proper condition with facility, and without interference with the operation thereof.

Heretofore those parts of the furnace which deteriorated rapidly were inaccessible during the operation of the furnace, and it was therefore not possible to repair or renew the same without putting the furnace out of use. It is proposed in the present invention to enable the renewal of these parts while the furnace is in use, and at the same time greatly improve the process of combustion. A further object is to provide an improved feeding means, whereby a more perfect mixture of the fuel and combustion air is afforded, permitting rapid combustion to take place, and to this end we propose in one embodiment of our invention to feed the fuel in separate streams independently embraced by air.

With these and other objects in view, embodiments of our invention are shown in the accompanying drawings, and these embodiments will be hereinafter more fully described with reference thereto, and the invention will be finally pointed out in the claims.

In the accompanying drawings;

Figure 1 is a diagrammatic sectional view of a furnace, showing one embodiment to a stationary boiler furnace;

Figure 2 is a front elevation of the fuel feeding burners;

Figure 3 is a sectional view along the line 3—3 of Figure 2.

Similar reference characters indicate corresponding parts throughout the several figures of the drawings.

Referring to the drawings, and more particularly to Figures 1 to 3 thereof, the furnace shown therein comprises a combustion chamber, in the front wall 10 of which there is provided a projecting mixing oven 11. In the top wall 12 of the mixing oven, which is preferably arched, there are provided the substantially vertically disposed fuel feed burners hereinafter more fully described, while in the front wall 13 there are provided auxiliary horizontally disposed air feed pipes 14, having controlling dampers 15 therein, a suitable number of these being provided, depending upon the width of the oven, and the rate of combustion required.

The floor 16 of the oven is disposed directly beneath the feed burners, and may be inclined downwardly from the door 17, forming a target and deflecting wall for the products of combustion and fuel impinged thereon, as will be presently pointed out.

The rear wall 18 of the combustion chamber may be inclined at its lower portion 19, this inclined portion being spaced from and extending above and below the target wall. The floor 20 of the combustion chamber extends in spaced relation below the target wall to form an outlet for slag, which may be removed through the door 21.

Water tubes 22 to be heated, are disposed across the combustion chamber. This is an arbitrary arrangement, however, and other means to which heat is to be imparted may be suitably provided.

The feed burners disposed substantially vertically in the top wall 12 comprise a casing 23 in which there may be provided a plurality (two in the present disclosure, although one or any suitable number may be provided) of channels 24, extending above the casing, and having their lower ends at a point above the lower end of the casing. Air

spaces 26, 27, 28 shown in plan in Figure 3, surround the channels at their front and sides, and are controlled at their upper ends by valves 31. At the upper ends of the channels 24 there are secured nozzle supports 32 and 33, having their open ends bent outwardly, and each controlled by a valve or damper 34.

A vertically disposed nozzle supporting sleeve 35 is provided in the upper side of the said supports 32 and 33, and a nozzle pipe 36 is mounted therein and extends to the lower end of the channel. A downwardly turned jet nozzle 37 may be inserted in the nozzle pipe, which may inject air under pressure, steam or other suitable gaseous medium into the pipe for induction.

In operation, the pulverized fuel enters through the nozzle pipe 35, fed by means of air under pressure or by induction produced by the induction jet from the nozzle 36 causing the fuel to enter at a relatively high velocity. A combined mixture of fuel and air is forced by air pressure or induction through the fuel nozzle 36. This stream is surrounded and mixed with additional air entering by induction through the channel 24, which mixture of fuel and air is again surrounded and mixed with additional air entering by induction through the channels 26, 27, 28. The fuel being now mixed with sufficient air for combustion and subjected to the radiant heat from the incandescent target wall 16 burns. The process of combustion is assisted by the air entering the air openings 14, which tends to break up the surrounding layer of consumed gas by causing eddies and permitting additional air to come into intimate contact with the partially consumed gas in the core of the flame causing complete combustion. The mixture impinges against the target wall 16, and by reason of the inclination of the said wall, is deflected in the direction of the arrows toward the inclined rear wall 19, which guides the same upwardly through the furnace. The target wall is incandescent during operation of the furnace, and causes ignition of the fuel.

In order to promote the production of a perfect mixture of the fuel and air, and to prevent the impinging of the fuel upon the target wall in spots, air is admitted transversely of the incoming streams from the burners through the pipes 14, the effect of this being to thoroughly mix the fuel and air and to exert a change in the course of the fuel to the extent that it impinges upon the entire surface of the incandescent target wall.

The pipes 14 are preferably arranged alternately of the vertical burners, so that air is admitted between and at the sides of the streams, the general effect being to flow transversely past the incoming vertical streams into the combustion chamber, to the end that perfect combustion takes place therein, these transverse streams of air meeting the ignited fuel as it is deflected or guided upwardly by the inclined wall 19.

The target wall because of its intense heat and the impingement of the fuel thereon, very rapidly deteriorates, the bricks becoming melted, burnt out and otherwise affected so that renewal becomes necessary. Heretofore renewal or repair of such parts necessitated the putting out of operation and complete cooling of the furnace. According to the present invention, we propose to permit the renewal of the target wall surface during operation of the furnace. To this end, the target wall is disposed laterally adjacent the front wall of the mixing oven or other point at which accessibility may be possible, and by opening the door, 17 bricks may be inserted and placed upon the target wall by a suitable tool, or the same may be thrown therein, thereby providing a new surface. Slag and the melted and burnt out refractory material forming the target wall, flow into the base 20 and may be removed through the door 21. By enabling this renewal of the target wall surface at frequent intervals, the furnace may be maintained at its maximum efficiency at all times, without necessitating any loss of time or heating effect.

In addition to the general effect above noted, it should also be observed that the air entering through pipes 14 is relatively cold as compared to the fuel and flame stream and since such air is induced its velocity is lower than that of the incoming fuel. Two results flow therefrom. First the incoming fuel is, as it were, projected through or caused to flow past a slower moving body of air, and therefore, each burning particle of solid is insured of being brought into contact with fresh air, i. e., air containing oxygen, as it traverses the combustion space, which means not only that oxygen for combustion is always at hand, as combustion proceeds, but also that a sort of scouring action takes place by virtue of which the gases emanating from the particles are stripped therefrom and the surface of the particles kept exposed to air. The other result is that while eddying is set up at the outer surfaces of the fuel and flame stream, complete admixture of the fuel and air does not occur at once. This follows from the fact that a relatively cold stream of air, because of its temperature, follows a stream line course or path, well defined and definite until its temperature is considerably raised when complete commingling occurs. The downcoming fuel stream of higher velocity determines the path of the incoming air to a large extent, by virtue of its force effects, and this with the feature above noted, causes the in-

coming air to follow the general stream line course of the fuel and flame stream, with some air at the lower region thereof, until the temperature is sufficiently raised for complete commingling. Thus a body of air into which heavier particles of the fuel will find oxygen in gravitating, is insured. Furthermore, the admission of air through the pipes 14 protects the front wall and makes it possible to shift the admission means or burner near such wall, which in turn makes possible the U-shaped course of the fuel and flame stream in the chamber.

We have illustrated and described preferred and satisfactory embodiments of our invention, but it is obvious that changes may be made therein within the spirit and scope thereof, as defined in the appended claims.

No claim is made herein to the process disclosed, the same being made the subject matter of a divisional application, Serial No. 464,849, filed April 27, 1921.

We claim:

1. In apparatus for burning pulverized coal, the combination of a furnace chamber having an outlet in an upper part and draft creating means, heat absorbing surfaces exposed to the outlet flow, means for introducing the pulverized coal in an upper part of said chamber in a downward direction adjacent the front wall of the chamber and at a velocity greater than the outlet flow, the coal admission means being located to one side of the outlet so that the fuel and flame stream describes a U-shaped course through the chamber to the outlet under the action of the draft, said chamber being provided with means through which a flow of air is induced thereinto by the draft near the entering fuel whereby the entering fuel particles flow past a slower moving bordering body of air.

2. In apparatus for burning pulverized coal, the combination of a furnace chamber having an outlet in an upper part and draft creating means, heat absorbing surfaces exposed to the outlet flow, means for introducing pulverized coal and air in an upper part of said chamber in a downward direction adjacent the front wall of the chamber and at a velocity greater than the outlet flow, the coal admission means being located to one side of the outlet so that the fuel and flame stream describes a U-shaped course through the chamber to the outlet under the action of the draft, said chamber being provided with means through which a flow of air is induced thereinto by the draft near the entering fuel whereby the entering fuel particles flow past a slower moving bordering body of air.

3. In apparatus for burning pulverized coal, the combination of a furnace chamber having an outlet in an upper part and draft creating means, heat absorbing surfaces exposed to the outlet flow, means for introducing pulverized coal and air in an upper part of said chamber in a downward direction adjacent the front wall of the chamber and at a velocity greater than the outlet flow, the coal admission means being located to one side of the outlet so that the fuel and flame stream describes a U-shaped course through the chamber to the outlet under the action of the draft, said chamber being provided with means in the front wall thereof through which a flow of air is induced into the chamber by the draft near the entering fuel whereby the entering fuel particles flow past a slower moving bordering body of air.

4. In apparatus for burning pulverized coal, the combination of a furnace chamber having an outlet in an upper part and draft creating means, heat absorbing surfaces exposed to the outlet flow, means for introducing pulverized coal and air in an upper part of said chamber in a downward direction adjacent the front wall of the chamber and at a velocity greater than the outlet flow, the coal admission means being located to one side of the outlet so that the fuel and flame stream describes a U-shaped course through the chamber to the outlet under the action of the draft, said chamber being provided with means through which a flow of air is induced thereinto by the draft near the entering fuel providing a body of air on the convex side of the fuel and flame stream into which the heavier particles gravitate and find oxygen for combustion.

5. In apparatus for burning pulverized coal, the combination of a furnace chamber having an outlet in an upper part and draft creating means, heat absorbing surfaces exposed to the outlet flow, means for introducing pulverized coal and air in an upper part of said chamber in a downward direction adjacent the front wall of the chamber and at a velocity greater than the outlet flow, the coal admission means being located to one side of the outlet so that the fuel and flame stream describes a U-shaped course through the chamber to the outlet under the action of the draft, said chamber being provided with a battery of openings in its front wall through which a flow of air is induced by the draft into the chamber in the space between such wall and the entering descending portion of the fuel and flame stream whereby the particles of fuel flow past a slower moving body of air and whereby also air is provided on the convex side of the fuel and flame stream into which heavier particles of fuel gravitate and find their oxygen.

6. In apparatus for burning pulverized coal, the combination of a furnace chamber having an outlet in an upper part and draft creating means, heat absorbing surfaces exposed to the outer flow, and means for in-

troducing pulverized coal and air in an upper part of the said chamber in a downward direction adjacent the front wall of the chamber and at a velocity greater than the outlet flow, such means being located to one side of the outlet so that the fuel and flame stream describes a U-shaped course through the chamber to the outlet under the action of the draft, together with means for admitting a trough-shaped body of air adjacent to the incoming fuel, the base of said trough-shaped body being on the convex side of the fuel and flame stream.

7. In a furnace of the class described, a fire brick structure providing an essentially vertical combustion chamber having an outlet in the upper part thereof, and an extension to a side of said outlet, means creating a draft, burner means to one side of the outlet introducing pulverized coal and a portion of the air required for combustion downwardly at the upper part of said extension whereby the fuel and flame stream takes a U-shaped course looping back on itself in its traverse through the combustion space under the influence of the draft and as combustion proceeds, and a battery of air inlets in the front part of the extension through which additional air is admitted for combustion, said inlets being located below the point of fuel admission and well above the bottom of the chamber so that the additional air for combustion is supplied to the entering and descending fuel stream, said burner means introducing the fuel at a velocity higher than that of the air admitted through said battery of inlets.

In testimony that we claim the foregoing as our invention, we have signed our names in presence of two subscribing witnesses.

JOHN E. MUHLFELD.
VIRGINIUS Z. CARACRISTI.

Witnesses:
C. G. MILLER,
J. C. CHAPPLE.