Thomas R. Crampton.

Improvements in Burning Powdered Fuel and Furnaces therefor.

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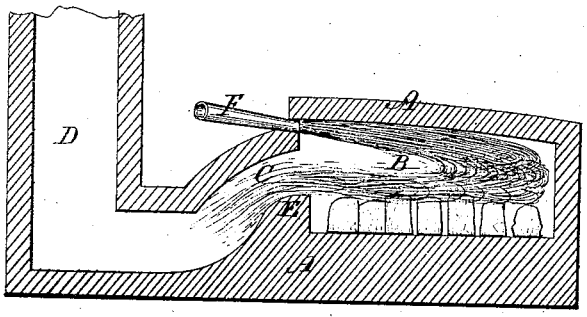

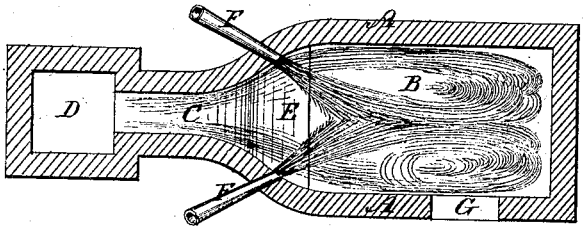

Witnesses.
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Thomas R. Crampton, Inventor,
By his Attorney,
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United States Patent Office.

THOMAS RUSSELL CRAMPTON, OF WESTMINSTER, LONDON, GREAT BRITAIN.

Letters Patent No. 111,616, dated February 7, 1871.

IMPROVEMENT IN FURNACES FOR BURNING PULVERIZED FUEL.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, THOMAS RUSSELL CRAMPTON, of Westminster, London, in the county of Middlesex, in the Kingdom of Great Britain, have invented certain new and useful Improvements in Burning Powdered Fuel and in Furnaces therefor; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable those skilled in the art to which my invention appertains to make and use the same.

This invention consists in constructing a furnace in which a plain combustion-chamber also constitutes the working-chamber, and in which the mixture of air and powdered fuel is introduced near the neck or exit-flue thereof, in a manner to cause them to move toward the closed end of the chamber in a circuitous course therein, to prevent their separating from one another; and also to cause the several currents diverging from the incoming stream or streams of air and coal, to mingle and unite with one another, so as to keep the mixture good.

My invention also consists in the arrangement of the issues of the conducting pipes, so that the streams of fuel-charged air will pass near the upper surface of the furnace and be mixed by causing them to impinge upon and against each other on their route to the closed end and return mixed between the incoming currents and the material under treatment; the direction of the issues of these pipes being such as to cause the incoming currents to traverse through the center of the chamber, or nearly so, because, if the stream of fuel-charged air were directed on one side of the chamber by a single jet, particularly if unmixed on entering the chamber, and traversing its outline, the air and fuel would not keep together sufficiently on their route to produce the best results, and carbon dust would be in most cases deposited in the chamber and on the material under treatment, and cause considerable waste of fuel and inconvenience.

In a patent bearing even date herewith I have described and represented the mechanism for and mode of feeding, dividing, conducting, and injecting fuel-charged air in proper proportions for keeping up a good mixture in the furnace; a description, therefore, of these things is deemed unnecessary here.

The accompanying drawing represents a vertical and horizontal section of a furnace, A having a single plain chamber, B, extending from the front end thereof to the neck C of the chimney D, so as to have the use of the entire furnace as a working-chamber, thus having but one chamber within which to consume the fuel and do the work. This chamber is closed, and is without grate-bars or draught openings whatever.

The fire-bridge E is formed across the neck of the furnace so as to raise the exit-opening above the bottom of the furnace, and thus form a chamber or basin for molten metal, from which it may be tapped through a door in the side or end of the furnace.

From the top of this bridge the neck of the chimney descends so as to bring the end of the neck which which forms a junction with the chimney-flue below the bottom of the working-chamber.

The conducting-pipes F for the fuel-charged air are arranged to enter the back end of the chamber at or near the top thereof, so as to inject the currents of fuel-charged air into the furnace in a direction away from the chimney or outlet.

These pipes are also arranged to enter the furnace so that the currents therefrom will impinge upon each other obliquely at or near the middle of the width of the chamber and nearly above the fire-bridge.

By this means the currents are caused to take a central direction through the length of the chamber, and near the upper surface thereof, so that in passing toward the closed front end the products of combustion turn downward immediately over and upon the material placed on the bottom, spreading out to either side as the flame descends, whereby the larger particles in the stream of air and coal which are not consumed before reaching this point are consumed on their return passage toward the neck of the furnace.

In order also to effect perfect combustion of a stream or streams of air and fuel blown into a furnace, or into a combustion chamber, the fuel-charged air must be injected at such a velocity that the currents shall not strike or but slightly strike against the opposite side or end of the furnace to that at which they are injected.

In the example shown it will be seen that the momentum of the incoming streams is absorbed by the counteracting effect of their impingement upon each other at an angle, and the equilibrium of the charge of fuel and air is thereby more thoroughly diffused and maintained, and all tendency to undue separation of air and fuel into separate streams or to the deposit of inefficiently-consumed fuel is avoided.

The conducting-pipes enter the chamber obliquely from the opposite sides of the furnace, and there may be two or more such pipes entering the chamber at the same or different angles, so as to direct the streams parallel, or nearly so, to the top of the furnace; or a series of issues placed parallel to each other and lengthwise of the chamber may be used to project the currents in the same manner and cause the products of combustion to return in the chamber between the work and the incoming streams.

The velocity of the incoming streams should not

be great enough to cause them to impinge against the end of the furnace with any considerable force, because the greater the force of impingement, the more excessive the wear of the furnace, which should be avoided.

It must be understood, however, when furnaces are working with a partial vacuum that there must be sufficient force in the injected mixture of air and fuel to enter the chamber freely when the vacuum of the furnace is reduced by the door being opened, or otherwise, so as to prevent the fuel and air being retained in the conducting pipes, particularly where the pipes are of some length and contain bends; also to prevent the fuel-charged air blowing back in the event of the fuel being fed into the pipes close to the furnace, or otherwise. But as the proportion which the conducting pipes should bear to the pressure of the injected charge is described in my patent aforesaid, reference is made thereto for a further description of this matter.

In this furnace also the work is performed by the combustion of the air-charged fuel, and no massive fuel is used except at the beginning of the operation, and then only as kindling, to heat the furnace and to produce the proper ignition of the fuel-charge.

The working-chamber of the furnace is made of fire-resisting material, and forms at the same time the combustion chamber, thus combining the two in one, and by this arrangement I am enabled to obtain a much smaller furnace than heretofore, combining the capacity of the two separate chambers heretofore built in the same furnace.

Among the advantges of this form and arrangement of furnace and injecting pipes is the utilization of the waste heat of the escaping products of combustion by causing them to pass in contact with the incoming streams of fuel and air.

The furnace is charged and the fire is kindled through a door, G, in the side of the furnace.

The issues of the pipes may be merged into a narrow thin jet, in which case care must be taken that the change from the round to the narrow form must be gradual, in order to insure the mixture being maintained at the end of the furnace, but I prefer separate round jets.

The air and fuel issuing from each jet are not, as a rule, properly mixed, particularly where curves or bends are made in the introducing-pipes near the furnace.

In such cases it will be found that the particles of fuel carried in suspension in the streams of air, gather on the outside of the bend in the pipes, by reason of their greater specific gravity; and in order to insure that the surcharged and undercharged portions of such streams shall impinge upon and against each other, I place the bends of the pipes in opposite directions, and in this way produce a compensating mingling of the streams, and maintain the equilibrium of the fuel-charge, as more fully described in another patent granted to me.

I do not claim injecting or floating pulverized fuel into the body of a furnace, as described in the patents of Whelpley and Storer, dated March 13, 1866, reissue No. 3,857, and May 31, 1870, No. 103,695.

In my improvement the pulverized fuel mixed with air, enters at the rear of the furnace, and is turned back, so as to leave in a direction opposite to that at which it entered, so that the incoming streams of air and fuel pass over, and are heated by the reflected or out-going current within the combustion chamber, as shown.

Having described my invention,

I claim—

1. The fuel-charged air, for the combustion, injected into the furnace at the rear end thereof, and near the neck, in the opposite direction from that in which the products of combustion escape, as described.

2. The fuel-charged air, for the combustion, injected into the furnace at or near the top thereof so as to be caused to pass toward the front end of the chamber, turn down and return between the incoming streams and the metal under treatment, as described.

3. A furnace, constructed and adapted to receive the fuel-charged air at its rear end, and in which the work is done in one and the same chamber within which the combustion takes place, as described.

4. The arrangement of an incoming and returning current of air and fuel within the combustion chamber, so that the former is heated by the latter, as shown.

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