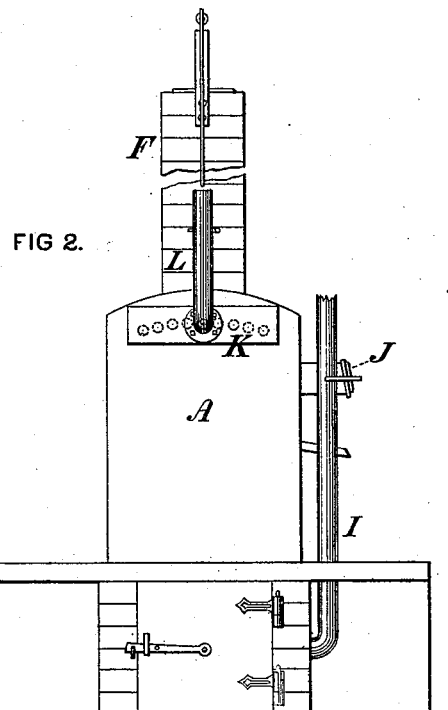
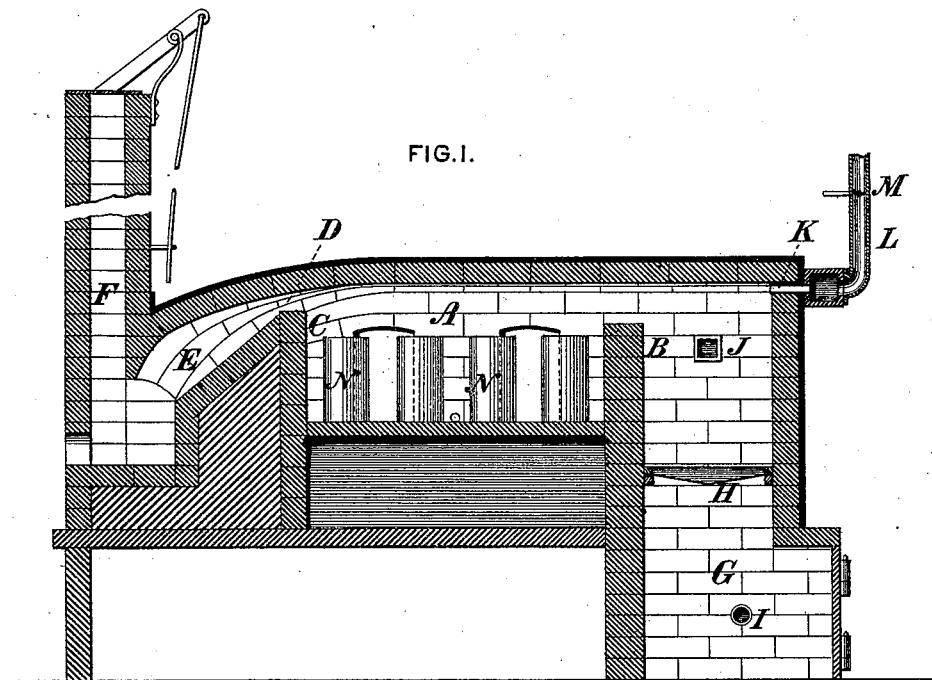


C. M. DUPUY.
Furnace for Reducing Oxide Ores.

No. 215,726.

Patented May 27, 1879.



WITNESSES.

J. Thomson Bell.
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IMPROVEMENT IN FURNACES FOR REDUCING OXIDE ORES.

Specification forming part of Letters Patent No. **215,726**, dated May 27, 1879; application filed December 23, 1878.

To all whom it may concern:

Be it known that I, CHARLES M. DUPUY, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Furnaces for Reducing Ores from their Oxides, of which improvements the following is a specification.

In the practical operation of the improved process of obtaining wrought-iron or steel direct from the ore, for which Letters Patent of the United States No. 194,340 were granted to me under date of August 21, 1877, I have found that the most thorough and rapid reduction and consolidation of the ore is best attained in a furnace so constructed that the canisters or charges will be enveloped in a deoxidizing atmosphere the temperature of which may be raised to a very high degree at and during any part of the reducing process without materially increasing the oxidation of the metal. This degree of heat cannot be secured and maintained uniformly in the ordinary reverberatory furnaces, which are usually regulated by a damper on the stack, the raising or lowering of this damper increasing or diminishing the temperature throughout the entire chamber. When this damper is low, a smoky carbonic-oxide atmosphere is obtained more readily than when the draft is increased; but then the furnace becomes more or less chilled, and the gases lose more or less of their deoxidizing efficiency, which is secured only by keeping them at the proper temperature. On the other hand, when the damper is raised, the temperature of the chamber is proportionally elevated; but at the same time the gases become more or less active in oxidizing the metal. The problem thus presented for solution was how to secure and maintain uniformly a regulated heat best adapted to the reduction of the ore without oxidizing, and thus wasting the metal.

It is the object of my present invention to keep the canisters or charges of ore mixture while undergoing deoxidation enveloped in a deoxidizing atmosphere, which may have its temperature increased and maintained at its regulated elevation, so as to insure the most efficient reduction of the ore without suffering deterioration from an excess of oxygen; and to this end my invention consists in so con-

structing and operating the furnace that a regulated temperature of oxidizing quality may be maintained in the upper part of the chamber and above the canisters or charges, while a regulated temperature of deoxidizing quality may be maintained in the lower part of the chamber about and around the canisters or charges, the deoxidizing lower stratum of heat protecting the canisters or charges from the oxidizing action of the upper stratum, and the oxidizing upper stratum of heat acting immediately upon the lower stratum and immediately upon the canisters or charges, so that while the higher temperature is thus made available for the reduction of the charge, the charge is not subjected to the oxidizing action of this temperature, this invention being based upon my discovery of the fact that two such distinct degrees of heat and qualities of gas may be maintained in the chamber, and their respective action and effect regulated and controlled by means of the improved apparatus hereinafter described.

In the accompanying drawings, which form part of this specification, Figure 1 is a longitudinal section through a furnace constructed and provided with the appliances for the practice of my improved process, the canisters or charges of ore mixture being shown in elevation; and Fig. 2 is an end elevation of the furnace and its appliances.

The furnace-chamber A has preferably an iron bottom or hearth, covered with cinder, sand, coke, or other suitable material.

The fire-bridge B is to be higher than the canisters to be reduced, and the flue-bridge C must be higher than the fire-bridge, and much nearer than usual to the top of the furnace, so that only a small throat or opening, D, is left between the top of the flue-bridge and the under side of the furnace-roof. This throat D opens into the flue E and stack F, provided with a damper, as shown.

The ash-pit G and grate H are arranged in the usual manner at the end of the furnace opposite the stack, and a blast-pipe, I, provided with a regulating-valve, conducts the air to the fuel on the grate, the fuel being fed in through a hopper or stoke-hole, J.

Across the back end of the furnace I arrange a series of tuyeres, K, opening into the furnace

just below the roof, and in the blast-pipe L, which conducts the blast to the tuyeres, I arrange a regulating-valve, M.

The canisters N are filled with the ore mixture, as described in my former patent already mentioned, and are charged in upon the hearth or bottom of the chamber A through the doors O, which are then properly closed and secured.

The fire being started, the blast is turned on through the pipe I under the grate, and regulated by its valve, thus forcing the air through the fuel and generating the supply of gas, which rises up toward the top of the furnace between the fire-bridge B and the end wall. The hot-blast, regulated by the valve M, is also turned on through the pipe L, and drawn and forced horizontally across the furnace to the flue through the throat D with a greater or less force, according to the position of the damper on the stack F and of the valve M in the blast-pipe. The gases rising from the fuel encounter this horizontal blast in the upper part of the furnace, and are ignited and consumed in the line of this blast; but below this horizontal blast the gases are rolled over the fire-bridge B toward and against the flue-bridge C, and, remaining unignited, fill the lower part of the furnace-chamber A and envelope the canisters. The ignited gases in the upper part of the furnace are meanwhile creating a high temperature, which is largely absorbed by the roof of the furnace and reflected down therefrom upon the unignited gases below, these gases being thus heated and expanded, so that they not only act upon the canisters and reduce the ore without detrimental oxidation, but also exert an outward pressure, which counteracts the tendency of the atmospheric air to enter through openings or crevices in the furnace. This pressure is regulated by the damper on the stack, and as the blast across the furnace is thus increased or diminished the unignited gases will be rolled back from the flue-bridge with greater or less force.

The characteristic of my improved construction of the furnace is in this adaptation of the fire-bridge and the flue-bridge to the operations above described, the fire-bridge being high enough to direct the gases from the grate to the horizontal blast, but not so high as to prevent it from being deflected from the upper part of the chamber, as described; and the flue-bridge being high enough to interrupt the lower stratum of the gases, which would otherwise be drawn and forced into the chimney, yet not so high as to prevent the due regulation of the force of the horizontal blast across the furnace; and by these provisions I am enabled to maintain in the chamber two degrees and two qualities of heat, as hereinbefore specified.

I have described the horizontal blast as a hot-blast, and deem it best to use such; but a cold-blast may, of course, be used instead.

I have also described a grate upon which the fuel is burned, but contemplate also using in lieu thereof a gas-producer from which the gas may be conducted upward into the furnace-chamber, as is well understood.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

The combination, in a reverberatory furnace, of a fire-bed from which proceeds an upward blast, one or more tuyeres from which proceed a horizontal blast along the top of the furnace, a fire-bridge, and a flue-bridge higher than the fire-bridge, whereby the throat is elevated and contracted, the combination being and operating substantially as described, to maintain in the furnace two different degrees of heat and qualities of gas, for the purposes set forth.

CHARLES M. DUPUY.

Witnesses:

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J. WALTER DOUGLASS.