

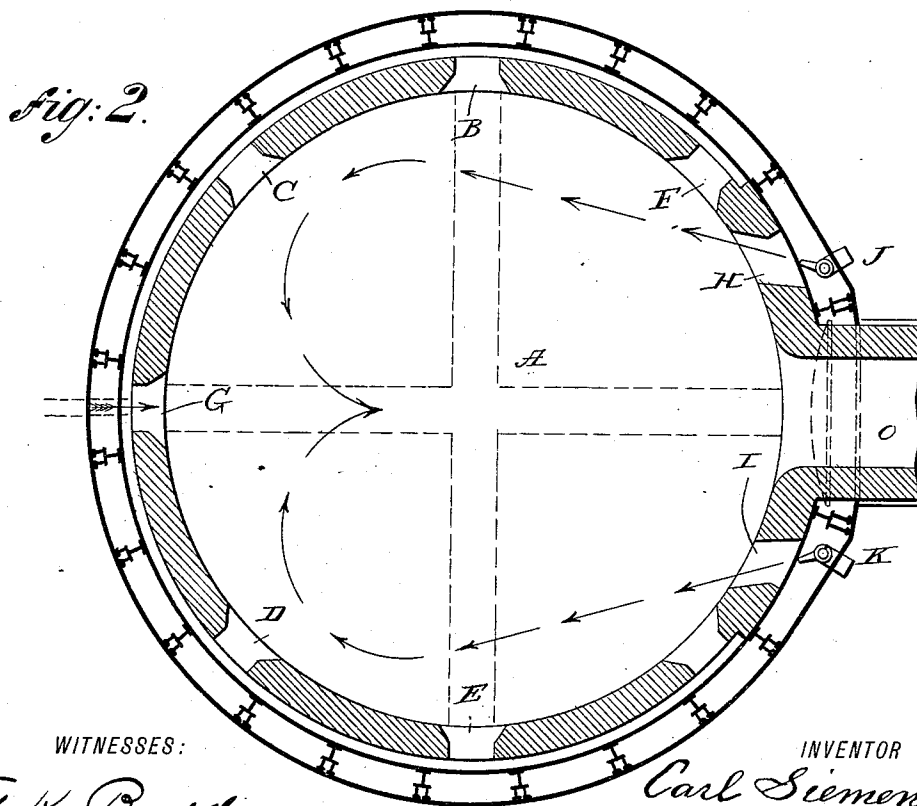
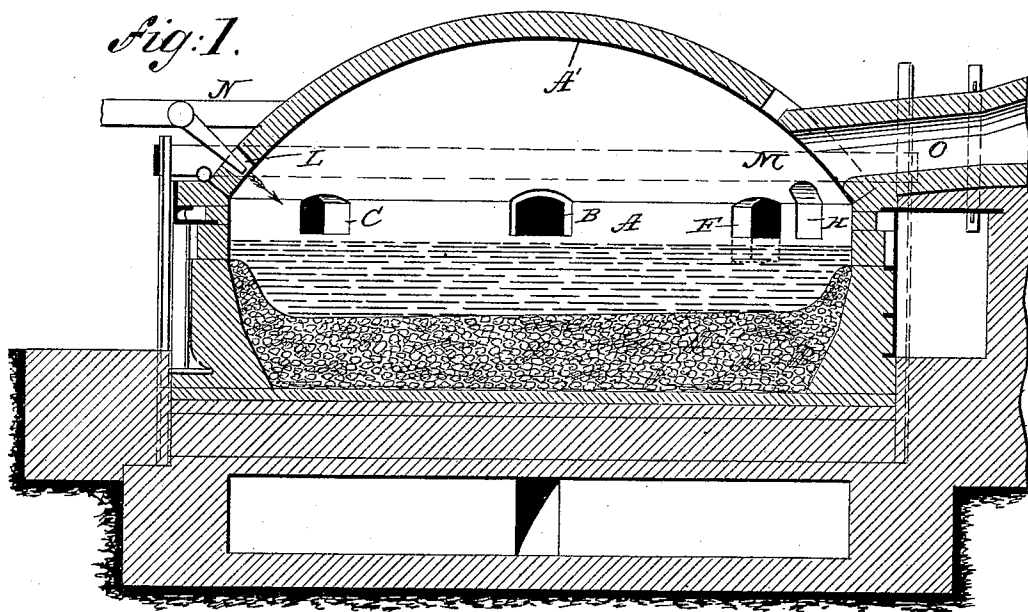
(No Model.)

C. SIEMENS.

METHOD OF WORKING OPEN HEARTH FURNACES.

No. 470,713.

Patented Mar. 15, 1892.



F. K. Buad.
Geo. M. Parry

INVENTOR
Carl Siemens
BY
Geo. H. Benjamin
ATTORNEY.

UNITED STATES PATENT OFFICE.

CARL SIEMENS, OF ST. PETERSBURG, RUSSIA.

METHOD OF WORKING OPEN-HEARTH FURNACES.

SPECIFICATION forming part of Letters Patent No. 470,713, dated March 15, 1892.

Application filed December 5, 1890. Serial No. 373,711. (No model.)

To all whom it may concern:

Be it known that I, CARL SIEMENS, a subject of the Emperor of Russia, and a resident of St. Petersburg, Russia, have invented a new and Improved Method of Working Open-Hearth Melting-Furnaces, of which the following is a specification.

My invention relates to open-hearth furnaces of the class in which gaseous fuel is consumed, especially to that type of gas-fired furnaces wherein the reduction of the charge is accomplished by the heat radiated from the flame rather than from the direct action of the flame on the metal in the reducing-chamber.

My invention consists, essentially, of combining with an open-hearth furnace a source of gaseous fuel, this source so arranged relatively to the melting-chamber of the furnace as to deliver a stream of gaseous fuel on each side of the port-opening of the melting-chamber, through which the products of combustion leave the melting-chamber on their way to the chimney-stack, whereby there is formed within the melting-chamber two horseshoe flames, which are brought together and leave the melting-chamber by the same exit-port. In practice I have found that two horseshoe flames have a greater heating value in a furnace of a given size than where a single horseshoe flame is used, consuming the same quantity of gaseous fuel, and, further, that the two flames may be more readily controlled than is possible with a single long flame.

In order to more fully describe my improved method of operating open-hearth furnaces, I will refer to the accompanying drawings, in which similar letters of reference indicate like parts.

Figure 1 is a vertical section. Fig. 2 is a sectional plan view.

A represents a melting-chamber provided with an arched roof A'. The melting-chamber I prefer to make circular in section, though it may be elliptical or of any other desired shape. The object of making the chamber circular in section is to prevent any contact between the flame and the walls of the chamber or the material on the furnace-bed, and thereby obtain a better heating effect due to the radiation flame or flames, as fully set forth

and described in United States Letters Patent No. 341,285, granted May 4, 1886, to Frederick Siemens, of Dresden, Germany. In the furnace described in the aforesaid patent the roof is made somewhat higher than in ordinary furnaces in order to allow for the free development of flame. In my improved furnace, as a double flame is used, I prefer to make the roof still higher. The furnace shown in the drawings is preferably made about twenty (20) feet in diameter, and the height of the roof eight (8) feet from the bottom of the furnace-bed. I do not limit myself to the dimensions herein mentioned, but merely state them to give the proper relative proportions for a furnace adapted to carry out my improved method of operating the furnace.

The furnace is provided with working doors B, C, D, and E, in which the materials to be melted may be charged upon the hearth.

F is a tap-hole which is cut lower than the other ports and by which the molten metal is drawn from the lower zone of the melting-chamber.

G is a tap-hole through which the slags are drawn off.

H and I are ports in which are located hydrocarbon-burners J and K.

L and M are ports in the roof of the furnace through which steam or air blasts may be directed on the molten metal on the hearth from the jets N.

The hydrocarbon-burners J and K are located so as to direct a spray of diffused fuel toward the sides of the furnace in the direction shown by the arrows.

In operating my improved furnace I may use any fuel which assumes the nature of a gas when introduced into the melting-chamber. For instance, I may use produced gas made in an ordinary producer, as commonly employed in connection with open-hearth furnaces, and in the manner usual to such furnaces—that is to say, the produced gas commingled with regenerated air. Both the gas and the air may be regenerated; or I may employ a liquid fuel—such as petroleum, naphtha, or any liquid residuum due to the distillation of petroleum—and such liquid fuel combined with air or steam by a suit-

able burner and properly mingled with regenerated air for consumption in the melting-chamber.

Where a hydrocarbon fuel is used, it is my practice to introduce the regenerated air over the spray of liquid fuel which enters the furnace, and the heated air being heavier than the gas resulting from the decomposition of the hydrocarbon fuel they unite to form a gaseous body which is consumed in the melting-chamber.

Where either produced gas or gas derived from the decomposition of the hydrocarbon fuel is employed, I arrange to have them enter the melting-chamber under pressure, so that the gases will flow over the body of the melting-chamber, as shown by the arrows. The gases introduced into the melting-chamber through the ports H and I traverse the body of the furnace and then turn to leave the furnace by the exit-port O.

My method of working the furnace in the reduction of copper ore is as follows: Successive charges of about two (2) tons of fluid ore are introduced into the furnace until the furnace-bed is full. After the furnace is fully charged, as great a heat as possible is maintained in the furnace. For this purpose, in addition to the gaseous flames burning in the furnace, an air-blast is turned on from the jets N through the openings L and M, which materially aids in the formation of slag. This heat is continued from two (2) to three (3) hours, after which the slag is drawn out through the opening G, and subsequently the molten metal is tapped out through the tap-hole F into the ladles or to the casting-pit, as desired, leaving in the furnace a portion of coarse metal, which serves as a heat-reservoir and materially aids in the reduction of the material subsequently charged over it.

In place of employing jets of air for aiding in the formation of slag and increasing the heat of the mass of molten metal on the hearth I may use jets of steam, which serve to heat the molten metal by their oxidizing action and also aid in the formation of slag.

I make no claim to the apparatus shown and described herein, as it is embodied in separate applications by me pending herewith,

filed December 5, 1890, Serial Nos. 373,710 and 373,711.

I am aware that a method of working an open-hearth furnace has heretofore been employed, which consists in introducing into the top of the melting-chamber and in a downward direction two streams of commingled air and fuel, causing said streams to flow over and in contact with the materials to be heated, and finally conducting the products of combustion of said streams from the heating-chamber, and such I do not claim as my invention.

Having thus described my invention, I claim—

1. An improved method of working an open-hearth furnace, which consists in introducing into the melting-chamber two independent streams of gaseous fuel and causing said streams to move horizontally around said chamber, the combined streams to be freely developed therein and to leave said chamber between the incoming streams of gaseous fuel without touching the walls or sides of the chamber or the material upon the bed or bench thereof, substantially as and for the purpose set forth.

2. An improved method of working an open-hearth furnace, which consists in introducing into the melting-chamber two independent streams of gaseous fuel and two or more streams of air or steam under pressure and causing said commingled streams of gaseous fuel and air or steam to move horizontally around said chamber and to be freely developed therein without touching the walls or sides of the chamber or the material upon the bed or bench thereof, substantially as and for the purpose set forth.

In witness whereof I have hereunto set my hand and affixed my seal this 3d day of November, 1890.

CARL SIEMENS. [L. S.]

Witnesses:

ALFRED KROEGER,
Commoner of Pernau.

ROBERT LELLEKEN,
Commoner of Narva.