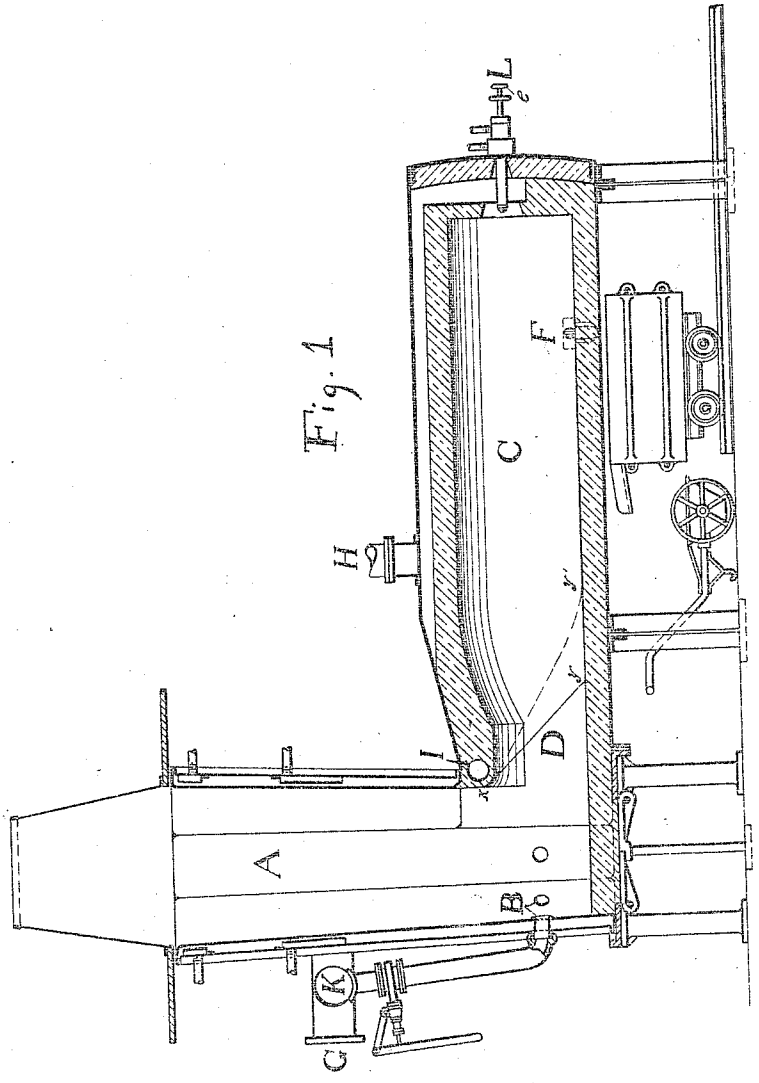
J. W. NESMITH, DEC'D.
H. M. ORAHOOD, EXECUTOR.
APPARATUS FOR SMELTING ORES.
APPLICATION FILED OCT. 26, 1910.

995,365.

Patented June 13, 1911.

2 SHEETS—SHEET 1.

Fig. 1



WITNESSES:
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2 SHEETS—SHEET 2.

Fig. 2.

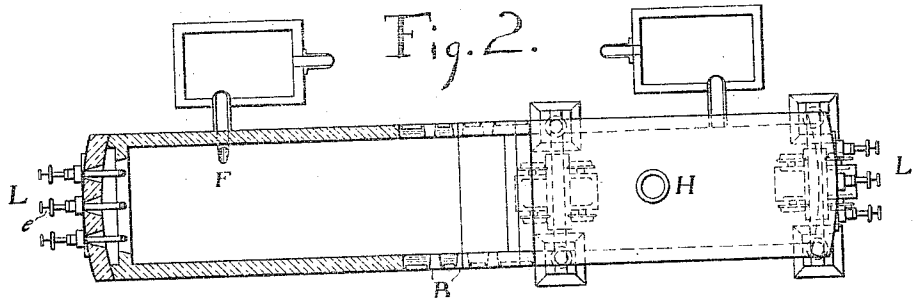
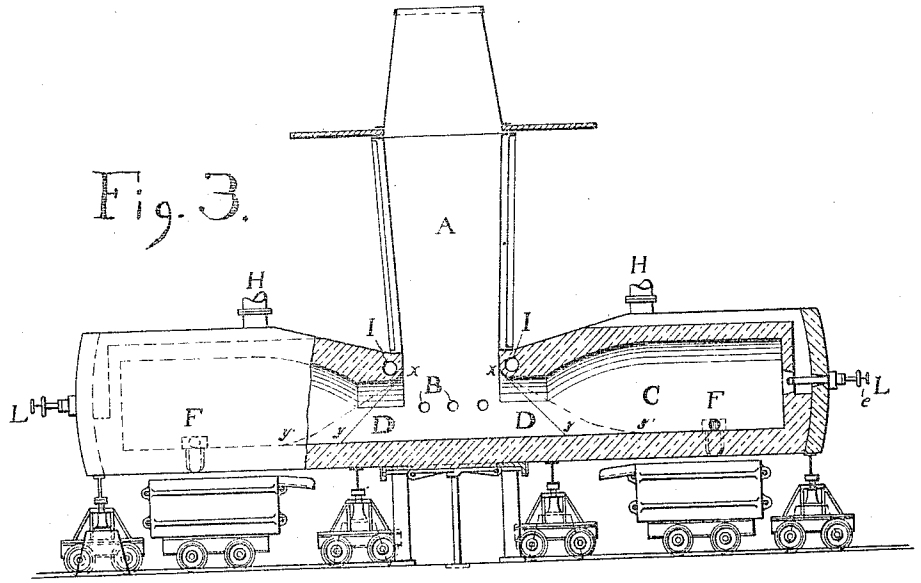


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN W. NESMITH, DECEASED, LATE OF DENVER, COLORADO, BY HARPER M. ORAHOOD, EXECUTOR, OF DENVER, COLORADO, ASSIGNOR TO COLORADO IRON WORKS COMPANY, OF DENVER, COLORADO, A CORPORATION OF MAINE.

APPARATUS FOR SMELTING ORES.

995,365. Specification of Letters Patent. Patented June 13, 1911.

Application filed October 26, 1910. Serial No. 589,273.

To all whom it may concern:

Be it known that JOHN W. NESMITH, deceased, late a citizen of the United States, and resident of Denver, Colorado, did invent certain new and useful Improvements in Apparatus for Smelting Ores, of which the following is a specification.

This invention relates to a method of smelting ores in what is designated a hydrocarbon blast furnace having one or more external or auxiliary combustion chambers permanently or removably attached thereto and made a part thereof, wherein hydrocarbon or other fluid or pulverized solid fuel is burned for the production of smelting heat, and this heat is projected or introduced by convection into the blast furnace and into contact with the ores charged therein.

In the accompanying drawings, Figure 1 is a vertical section through a form of furnace adapted to carry out the process of the invention. Fig. 2 is a plan view partly in section of a modification, and Fig. 3 is an elevation partly in section of the same.

In these figures an ordinary furnace stack is shown at A provided with a bustle pipe K, and an air supply pipe G. While it is preferred to use in carrying out the invention a vertical stack of the general type shown, the invention is not limited in this connection.

It will be observed that the combustion chamber indicated at C is relatively large, and this has been found to be necessary for the successful carrying out of the process involved. The best results are secured by the use of a chamber having a volume of space not less than 35 cubic feet for each pound of combustible burned per minute. Ore is charged into the top of the stack and the base of the column fills the opening D leading to the combustion chamber, the ore taking the natural slope of such loose material, usually of about 45°, or as shown approximately by the dotted line *x*—*y*. Combustion sufficiently intense for the purpose of smelting ores is maintained in the combustion chamber C, the heated gases passing out through the ore body which they enter along the surface of the slope and thence to escape through the blast furnace stack A, heating the body of ore first along the surface of its slope *x*—*y*, where it begins first to fuse or melt, and, as it softens its natural slope becomes flatter toward its lower end, or, say 30 degrees, as represented by the curved line *x*—*y'*, and when fully molten or fluid at the lower extreme, will seek a level on the hearth of the combustion chamber C in any space not occupied by the solid or semi-molten material, and may be tapped off from the combustion chamber C at F. In the meantime, fresh ore partly fused is constantly entering from the stack A, and so maintains a slope of some surface outline, on which the heat of combustion radiates and through which the heated gases pass on and out through the ore.

It will be observed that the twyers B are located below the line of the top of the combustion chamber C for the reason that it has been found in practice that when located above the arch forming the passage D a smelting zone is formed secondary to that maintained through the heated products of combustion at the entrance D to the combustion chamber, the result being to liquate out the more fusible constituents which flow away and leave a skeleton hanging in the shaft thus obstructing or terminating the smelting operation. By locating the twyers near the hearth where the smelting takes place the oxidation blast may be added at a point where it does not interfere with the smelting action. This is rendered possible of course, by the fact that the fuel is burned in the combustion chamber apart from the ore.

In order to prevent the burning out of the arch at the point where the ore begins to slope and enter the combustion chamber a water pipe I is located at this point. If found desirable, the combustion chamber may be water jacketed.

The blast furnace stack A is not absolutely necessary for the application of this method to the smelting of some kinds of ores. Some other kind of appliance of suitable proportion for charging the ores into and properly connecting with the combustion chamber C would answer such purpose, but having twyers near the hearth through which an air blast may be blown adapts the blast furnace to preparing cer-

tain ores, such as heavy sulfids for this method, by oxidizing or burning off a part of their sulfur content, and hence to the blast furnace construction is given the preference for the application of this method.

It has been found in practice in the smelting of ores of gold, silver, lead and copper, by the hydrocarbon system, where the heat generated in the combustion chamber is caused to pass into the blast furnace, and in direct contact with the body of ore, that masses of ore become semifused, but not sufficiently fused or fluid to tap off as slag and matte—that is to say, not sufficiently fluid or molten thin enough whereby they properly separate. To overcome this difficulty prior to tapping, and to prevent the clogging of the taps, the method has been adopted as described of allowing the ore, in a semifused or thickly molten condition, to run or flow into the opening D formed by the junction of the combustion chamber with the blast furnace to present there a sloping surface whereby the semifused ore is exposed to the direct heat generated within the combustion chamber, and is thereby caused to flow downwardly in the combustion chamber, being constantly exposed to the heat generated therein. The surface continuously melts off to thinner and thinner consistency as it becomes sufficiently heated, and in the finally smelted and fluid condition necessary or desirable finds its level on the hearth of the combustion chamber, thence to be tapped off. It has been found, however, in practice that it is absolutely necessary to tap the fused product at a point which must be removed a considerable distance from the base of the slope of the ore column, as otherwise the tap will inevitably be clogged and to this end it will be observed that an elongated combustion chamber is used and the tap for the slag and matte is removed from the entrance D a distance which will absolutely preclude any clogging or choking of the outlet by the viscous or semi-fluid mass.

Fig. 2 is a plan and elevation, partly in section, showing a furnace having a plurality of combustion chambers, and illustrating how, in a furnace adapted to carry out this method, the combustion chambers may be made removable.

The reference letters designate corresponding parts in both drawings.

L represents an oil or other burner of any suitable construction, *e* being the controlling valve.

H represents the inlet of the main blast which passes through the passage above the combustion chamber and through the inlet shown in the front of the combustion chamber.

What is claimed is:

1. A furnace comprising a stack, a combustion chamber extending horizontally from the base of the stack and in communication therewith, means for supplying a blast to the stack, means for supplying fuel to said combustion chamber under pressure and a tap opening in the combustion chamber removed from the position of the base or slope of the ore column, substantially as described.

2. A furnace comprising a stack, an elongated combustion chamber extending horizontally from the base of the stack and in communication therewith, means for supplying a blast to the stack, means for supplying fuel to said combustion chamber and a tap opening in the combustion chamber in or near the end removed from the position of the base or slope of the ore column, substantially as described.

3. A furnace comprising a stack, a combustion chamber extending horizontally from the base of the stack and in communication therewith, means for supplying a blast to the stack, means for supplying fuel to said combustion chamber, twyers supplemental to the main blast for supplying air to the base of the ore column in the stack near the hearth, and a tap opening in the combustion chamber removed from the position of the base or slope of the ore column, substantially as described.

HARPER M. ORAHOOD,
Executor of the last will and testament of John W. Nesmith, deceased.

Witnesses:
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