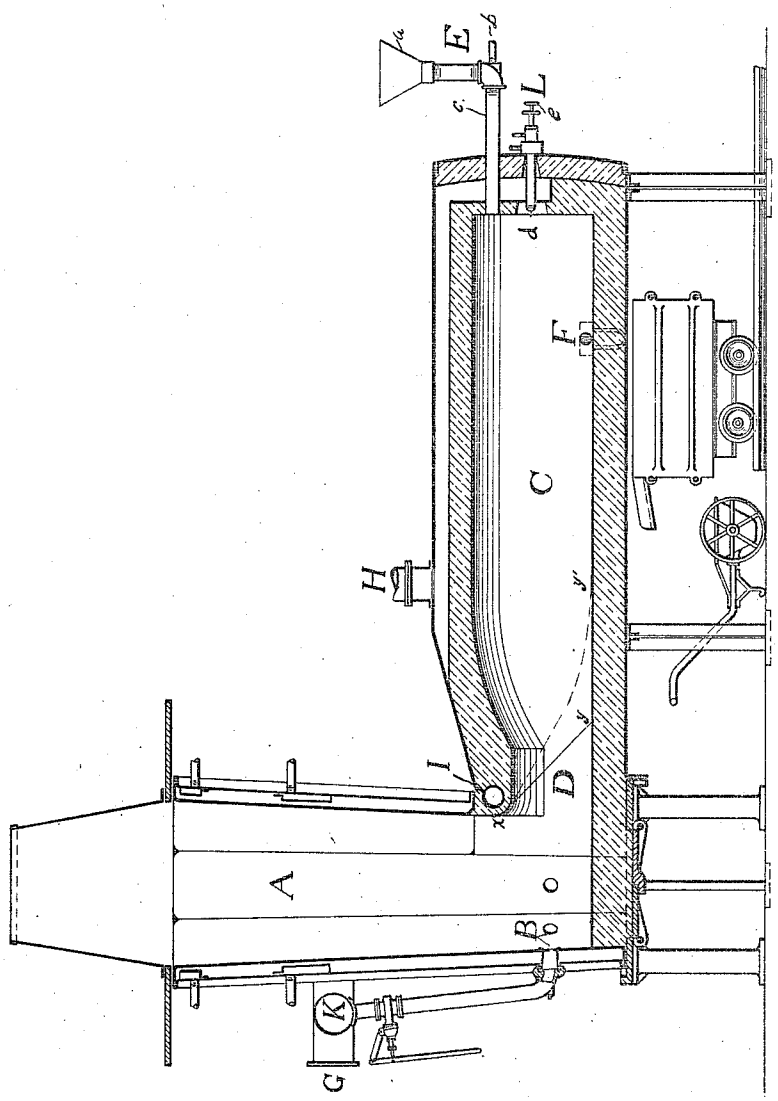
J. W. NESMITH, DEC'D.
H. M. ORAHOOD, EXECUTOR.
METHOD OF SMELTING.
APPLICATION FILED OCT. 26, 1910.

995,366. Patented June 13, 1911.



INVENTOR:
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Harper M. Orahood, Executor of his Estate
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ATTORNEYS.

WITNESSES:
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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 COLORADO.

METHOD OF SMELTING.

995,366. Specification of Letters Patent. Patented June 13, 1911.

Application filed October 26, 1910. Serial No. 589,274.

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 Methods of Smelting, of which the following is a specification.

This invention relates to the treatment of concentrates, sulfid fines and other fine ores, flue dust, and the like by subjecting them while in suspension to a high degree of heat, with or without chemical reactions depending upon the nature of the atmosphere in which they are suspended, and causing them, while in such highly heated or fused condition to fall upon and unite with a bath of already smelted material, provision against the escape of the fines being made as will be described.

The invention may be conveniently carried out in what may be termed a hydrocarbon blast furnace, which is a furnace wherein the heat necessary to be produced by carbonaceous fuel or its equivalent, as petroleum or other hydrocarbon or sulfur for its smelting operation, is produced in a fire box or combustion chamber, and is projected or introduced by convection, together with the gaseous products of its combustion, into the blast furnace and thus into contact with the coarse ores being charged in above, and it is not necessary that fuel be burned in the blast furnace stack in contact with the ores.

The improvement consists essentially in converting the coarse ore in the stack to a fused or molten condition by a smelting heat generated in a combustion chamber, and projected into the blast furnace, and continuously or intermittingly projecting fines into the combustion chamber under pressure and substantially horizontally whereby they are subjected to an intense heat and undergo such chemical reactions as are caused by the nature of the atmosphere within the combustion chamber and are placed in a condition to become a part of the bath on the hearth of the combustion chamber.

The drawing shows a vertical section of a furnace for carrying out the invention.

The coarser ores are charged into the blast furnace stack A in the usual way, while the sulfid fines and other fine ores, flue dust, and the like, are projected by pressure as of air into the atmosphere of the combustion chamber C, where they are melted or burned mostly in suspension, mixing and combining with the smelting or fusing product of the coarser ores. The fines are forced in horizontally by the air or other pressure and are highly heated and otherwise prepared before uniting with the molten products occupying the hearth of the chamber C and passing into it through the opening D connecting the chamber C with the blast furnace stack A, the heated gases passing on up through the ore column in the stack A, heating and fusing that in turn, such part of the fines as does not fall upon the bath of molten material in the combustion chamber being intercepted as it passes through the interstices of the semifused ore charge.

The combustion chamber is relatively large. It has been found in actual operation, using petroleum or residuum as the fuel that the volume of space in the combustion chamber should not be less than about thirty-five cubic feet for each pound of combustible burned per minute. More space is used for combustion with improved results and when at least the space stated has not been used the best results are not only not obtained but the smelting operation is retarded and even made impossible.

Efficient and accurate regulation of the air supply and of the tenor of the atmosphere in the chamber C, whether reducing, neutral or oxidizing, is constantly maintained. Proportionately much or little petroleum or other fuel may be burned in the combustion chamber C, depending on conditions and requirements. The sulfur in sulfid fines is conserved and utilized as fuel. If much sulfid fines are being treated then less oil is burned and a part of the sulfur of these fines is utilized for heat production, other going to the matte, the proportions depending on the condition of the atmosphere in the chamber, regulation of which is under easy and instantaneous control through the air and oil supply, whereby tenor of matte is determined.

When smelting oxidized ores or carbonates to black copper, or oxidized or roasted ores or lead carbonates to lead, the atmosphere of the combustion chamber C should preponderate reducing, but any over oxidation of metal or mineral that may take place there by reason of excess of air, is counteracted and the material arrested and com-

bined in the molten material coming in from the smelter stack A if a modicum of coke or charcoal is charged on with the coarse ore for that purpose keeping the atmosphere always reducing at that point.

In previous attempts to use auxiliary twyers for the purpose of securing oxidation, these, so far as known, have been so placed as to cause the formation of a smelting zone secondary to the smelting zone intended to be maintained, the result of which is to liquate out the more fusible constituents of the charge which flow away and leave a skeleton hanging in the shaft, thus obstructing or terminating the smelting operation. In this improved method the twyers are placed near the hearth where the smelting takes place and one is able to add the oxidation blast at a point where it does not interfere with the smelting. The fact that in this invention the fuel is burned apart from the ore, makes this possible.

In the drawings of the furnace the letters indicate at B the twyers; F the slag and matte taps; G the air supply to the blast furnace; H the air supply to the combustion chamber; K the bustle pipe on the blast furnace, and L the oil fuel burners.

A water pipe is provided as shown at I, to cool the bridge at the junction of the space D with the stack. The combustion chamber may also be water jacketed if found necessary or desirable.

In carrying out the invention it has been found that it is impossible to operate with the slag and matte taps directly beneath the stack, or indeed within range of the semi-fluid or viscous mass, the result being to clog the outlets and prevent the flow of metal. But by elongating the combustion chamber as shown, and arranging the slag and matte taps beyond the reach of the clogging effect of the viscous mass and at the point where nothing but the fluid materials can possibly reach the outlet, perfect results are secured. The fines are discharged into the hopper *a* and as they fall into the pipe E they come under the action of a jet of air entering at *b*, and are forced under pressure through the pipe *c* substantially horizontally into the combustion chamber C. The oil or like fuel is fed in through the burner *d* and the supply is controlled by suitable valves *e*.

It will be observed that the furnace shown is not designed solely for the purpose of treating fine ores, but for carrying out a method by which fine ores, concentrates, flue dust and the like, may be smelted simultaneously with coarser ores undergoing smelting in the same furnace, and forming the principal smelting operation, this main smelting operation proceeding continuously, while the feeding of the fine ore may be intermittent, if desired.

The advantages arising from the use of this method consist in the ability to smelt the current production of flue dust, as well as moderate quantities of fine ore and concentrates unsuitable as constituents of the main ore charge, and which ordinarily are treated only at great expense. Furthermore, in the case of concentrates rich in sulfur, the sulfur therein contained is utilized as fuel to a large extent, and reduces the amount of oil or other fuel necessary to be admitted through the burner L.

What is claimed is:

1. The herein described method of smelting coarse and fine ores, consisting in generating a smelting heat in a combustion chamber, converting the coarse ore to a fused or molten condition by such heat, and projecting fines horizontally into the combustion chamber where they are treated in suspension, substantially as described.

2. The herein described method, consisting in generating a smelting heat in a combustion chamber, converting ore thereby to a fused or molten condition, and as a secondary operation injecting fines under pressure to the combustion chamber whereby the fines are treated in an atmosphere of combustion, substantially as described.

3. The herein described method of smelting, consisting in generating a smelting heat in a combustion chamber, directing the heat to a column of ore to convert the ore to a fused or molten condition, and projecting fines intermittingly into the combustion chamber, substantially as described.

HARPER M. ORAHOOD,

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

Witnesses:

HARRY M. ROESCHLAUB,

H. B. LOWDEN.

Correction in Letters Patent No. 995,366.

It is hereby certified that in Letters Patent No. 995,366, granted June 18, 1911, upon the application of John W. Nesmith, deceased, by Harper M. Orahood, of Denver, Colorado, for an improvement in "Methods of Smelting," the State of incorporation of the assignee was erroneously given as "Colorado" whereas said State should have been given as *Maine;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of August, A. D., 1911.

[SEAL.]

E. B. MOORE,

Commissioner of Patents.