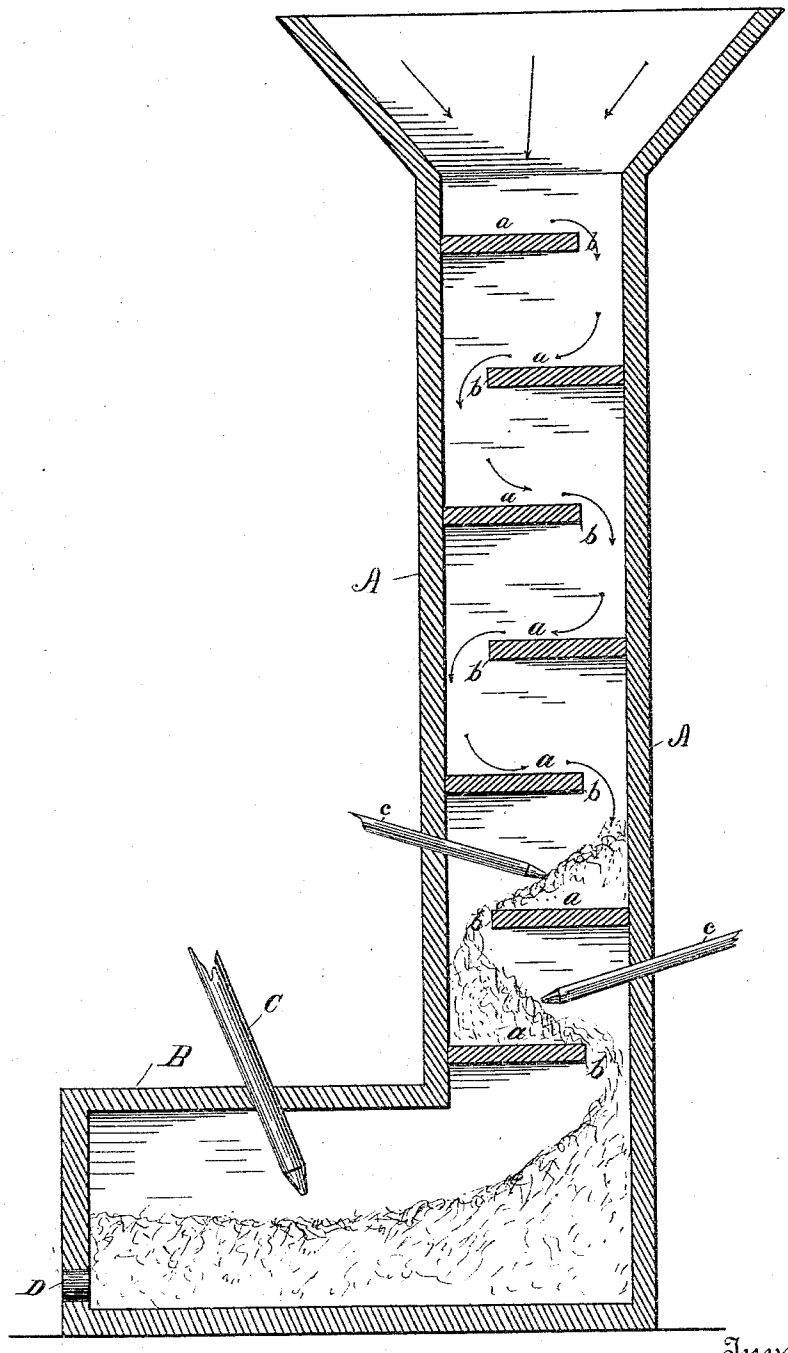
(No Model.)

W. E. NORRIS.

PROCESS OF REDUCING AND MELTING MAGNETIC OXIDE OF IRON.

No. 369,361. Patented Sept. 6, 1887.



Witnesses
J. A. Taubenschmidt
J. B. Kelly

Inventor
William E. Norris
By his Attorney
W. N. Walton

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM E. NORRIS, OF SAN FRANCISCO, CALIFORNIA.

PROCESS OF REDUCING AND MELTING MAGNETIC OXIDE OF IRON.

SPECIFICATION forming part of Letters Patent No. 369,361, dated September 6, 1887.

Application filed January 3, 1887. Serial No. 223,504. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. NORRIS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a new and useful Process of Reducing and Melting Magnetic Oxide of Iron, commonly known as "Black Sand;" and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawing, forming a part of this specification, which is a transverse section of a furnace embodying my invention.

Prior to my present invention it had been proposed to reduce ores of the metals to the metallic state by causing them to descend from shelf to shelf of a shaft-furnace, and finally melting them at the base of said furnace in a reverberatory furnace connected therewith, the products of combustion from said reverberatory furnace traversing the shaft and subjecting the descending materials to a preliminary heating. It has also been proposed to drop pulverulent ores, and among them magnetic iron oxide, through a vertical shaft upon a melting-hearth, the ore during its descent being met by jets of flame admitted at the sides of the shaft.

My invention differs from these and other proposed methods for reducing magnetic iron oxide in the manner of conducting the furnace operation, whereby a notable economy is secured in the expenditure of fuel and a product of great purity obtained.

In carrying out my invention I make use of a furnace of the general character illustrated in the drawing, wherein A indicates a shaft-furnace provided with a series of cross-shelves, *a*, projecting alternately from opposite sides of the walls of the shaft, so as to direct the descending stream of ore from one to the other during its descent to the melting-hearth. It is evident that the height of the shaft and the number of shelves employed may be varied within wide limits, it being desirable, however, to employ a sufficient number of shelves and to carry the shaft to a sufficient height to fully utilize the heat of the products of combustion from the melting-hearth.

The melting-hearth B is preferably a reverberatory furnace of an ordinary type, suitably lined with refractory material, and provided with a tapping-hole, D, and slag-hole E. An inclined tuyere, C, provided with means, as shown, for admitting a compound blast of a reducing agent—such as crude petroleum or its equivalent—is arranged in such manner as to impinge upon the surface of the partially-melted ore as it enters the melting-hearth from the vertical shaft. If desired, additional tuyeres for the introduction of a like mixture may be located, as at *c c*, at different altitudes within the vertical shaft for the purpose of assisting in the reducing operation.

The ore, partially melted, descends upon the melting-hearth proper, substantially in the manner indicated in the drawing, forming an incline consisting of a main body of partially-melted ore of a highly basic character, having a surface flow toward the tapping-hole. By means of the intense heat generated within the furnace, the ore is largely deoxidized before reaching the main tuyeres of the melting-hearth, and at the point of impact of said tuyeres upon the surface passing by them complete deoxidation takes place, the chemical reactions being analogous to those taking place at the reducing zone of the blast-furnace, with the exception that the resultant product is but slightly carbonized, and is in practically the state of malleable or wrought iron. The metal thus reduced at the surface of the mass within the melting-hearth, in flowing over the bed of iron oxide below it, is relieved of any impurities that it may possess or that would otherwise be left in it from contact with impurities accidentally introduced by the fuel employed, the basic character of the slag preventing the introduction of metalloids into the iron.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

The process of reducing magnetic oxide of iron to the metallic state, which consists in feeding it through a vertical shaft-furnace upon a hearth of the same material, subjecting it during the feeding operation to a preliminary heating by means of the products of combustion from said hearth, and finally reducing it to the metallic state by causing it to flow over the incline of said hearth, at the same time causing a reducing-flame to impinge upon its surface.

WILLIAM E. NORRIS.

Witnesses:
J. HALL,
S. JEROME.