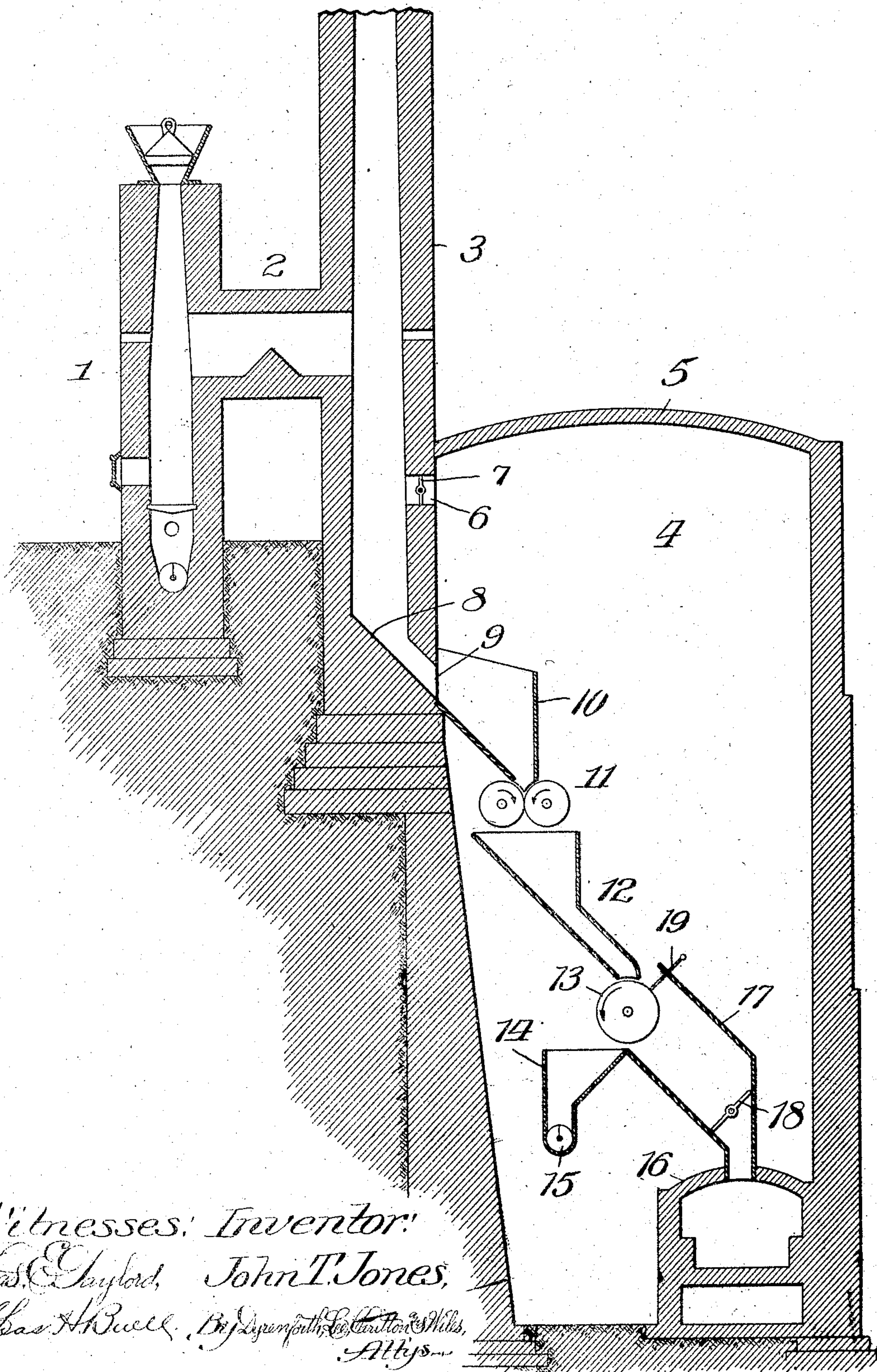


No. 891,549.

PATENTED JUNE 23, 1908.

J. T. JONES.
ORE REDUCING FURNACE.
APPLICATION FILED DEC. 23, 1907.



Witnesses: Inventor:
Ed. Gaylord, John T. Jones,
Chas. H. Buell, By *James H. Smith & Co.*
Attys.

UNITED STATES PATENT OFFICE.

JOHN T. JONES, OF IRON MOUNTAIN, MICHIGAN, ASSIGNOR OF ONE-HALF TO GEORGE A. ST. CLAIR, OF DULUTH, MINNESOTA

ORE-REDUCING FURNACE.

No. 891,549.

Specification of Letters Patent.

Patented June 23, 1908.

Application filed December 23, 1907. Serial No. 407,767.

To all whom it may concern:

Be it known that I, JOHN T. JONES, a citizen of the United States, residing at Iron Mountain, in the county of Dickinson and State of Michigan, have invented a new and useful Improvement in Ore-Reducing Furnaces, of which the following is a specification.

My invention relates, more particularly, to an improvement, in the nature of an adjunct, on the furnace forming the subject of my application for Letters Patent, Serial No. 374,981, filed May 22nd, 1907; though my present invention is not necessarily limited, for its use, to that particular construction of ore-reducing furnace.

Generally described, my aforesaid furnace involves an ore-stack communicating at its base with a cooling-chamber and having a flue-connection near its base with a carbonaceous-fuel-burning furnace at a point between its upper and lower sections to adapt the flue to take and mix the gases from the incandescent fuel in the lower section of the furnace-chamber, and the volatilized hydrocarbons, distilled by the heat of the burning fuel, from the upper section of the chamber, and direct the mixture, to the exclusion of air, upward through the column of ore in the stack, with the result of reducing the oxygen in the ore and leaving the iron or other metal in a metallic state.

The resultant metal requires to be separated from the mass of other material in the stack, to adapt it to be prepared for use, as by melting it in an open-hearth furnace, or balling it in an ordinary balling, puddling or scrap furnace; and it must be shielded against re-oxidation while undergoing the separation and transfer to the smelting furnace.

The object of my invention is to provide, as an adjunct of such a furnace, novel, simple and effective means for pulverizing the treated ore discharged from the stack, separating the metal from the gangue of the pulverized product, and directing the separated metal to a smelting-furnace, all under closure against the contaminating action on the metal of the atmosphere. This object is accomplished by the apparatus illustrated in the accompanying drawing, which is a view in sectional elevation of the reducing furnace, with the upper part of the stack broken away, and my improved adjunct, the

parts of which are represented, in the main, conventionally.

The furnace 1 has the flue-connection 2 between its ends with the base-portion of the ore-stack 3, which may rise to a height of 60 a hundred feet, more or less. Adjacent to the base of the stack and extending to a considerable depth below it is a close chamber 4, of relatively large dimensions, the roof 5 of which is just above a gas-outlet opening 6 in the adjacent stack-wall containing a valve 7 adapted to be opened and closed by rotating it. The lower end of the stack is formed as a chute 8 leading to the ore-discharge outlet 9, which is covered by a 70 hopper-device or chute 10 discharging to a pair of ordinary power-driven crushing-rolls 11, the motor (not shown) driving them being of any suitable variety and located outside of the chamber 4. The discharge from 75 the rolls takes place through a hopper-device or chute 12 upon a rotary magnetic separator, indicated at 13, of any known suitable construction and which is driven, like the crushing-rolls, from without the chamber. 80 Below the separator is a hopper-device 14 containing in its closed lower end a rotary conveyer, indicated at 15, in position to receive the non-magnetic part of the gangue, which is carried off by the conveyer, and 85 from which the metal is separated by the magnetic action of the separator. On the bottom of the chamber 4 is provided an open-hearth furnace, indicated at 16, which is connected with the magnetic separator through 90 a chute-like hopper-device 17 containing a rotary shut-off valve 18 and supporting a scraper 19 which contacts with the periphery of the rotary separator.

During the crushing and separating operations, while the reducing action is proceeding in the stack, the valve 7 is open to admit from the stack through the opening 6 carbonic oxid gas to maintain an atmosphere thereof in the chamber for protecting the 100 metal against the access of air. The back-pressure of the reducing gases in the stack will cause them to pass through the opening 6 and fill the chamber, which is thereby rendered unfit for occupancy by human beings, 105 so that the machinery must be operated from outside. The treated ore feeds by gravity from the stack through the chute 8 upon the rolls 11, which crush it to a powder and whence the pulverized material feeds by 110

gravity through the device 12 upon the magnetic separator rotating in the direction of the arrow upon it to carry the gangue to and discharge it into the hopper 14, whence it is carried off by the conveyer 15, while the metal, under the attraction of the magnet is carried upon its surface to the scraper 19, which removes it and permits it to fall by gravity into the chute 17. The valve 18 being opened, the metal feeds past it into the furnace 16 to be smelted and thence tapped off and thereafter treated in usual ways.

What I claim as new, and desire to secure by Letters Patent, is—

1. In combination, an ore-reducing furnace of the character described having an ore-stack provided with a discharge-opening for the reduced ore, a close chamber communicating with the stack through a gas-outlet opening therein, and into which said discharge-opening leads, and an ore-separator in said chamber with means therein for directing the ore to it from said discharge-opening, for the purpose set forth.
2. In combination, an ore-reducing furnace of the character described having an ore-stack provided with a discharge-opening for the reduced ore, a close chamber communicating with the stack through a gas-outlet opening therein, and into which said discharge-opening leads, and an ore-crusher and a separator in said chamber with means therein for directing the ore to them successively, for the purpose set forth.
3. In combination, an ore-reducing furnace of the character described having an ore-stack provided with a discharge-opening for the reduced ore, a close chamber communicating with the stack through a gas-outlet opening therein and into which said discharge-opening leads, an ore-separator in said chamber with means therein for directing the ore to it from said discharge-opening, and a smelting-furnace to which said separator discharges, for the purpose set forth.

4. In combination, an ore-reducing furnace of the character described having an ore-stack provided with a discharge-chute in its base for the reduced ore, a close chamber communicating with the stack through a gas-outlet opening in its lower part and into which said chute leads, and an ore-separator below the plane of said chute in said chamber with gravity-feeding means therein between said separator and chute, for the purpose set forth.

5. In combination, an ore-reducing furnace of the character described having an ore-stack provided with a discharge-chute in its base for the reduced ore, a close chamber communicating with the stack through a gas-outlet opening in its lower part and into which said chute leads, an ore-crusher and a separator, one below the other, in said chamber with gravity-feeding means therein for directing the ore to them successively, and a smelting-furnace having a gravity-feed connection with said separator, for the purpose set forth.

6. In combination, an ore-reducing furnace of the character described having an ore-stack provided with a discharge-chute in its base for the reduced ore, a close chamber adjacent to and extending below the base of the stack and communicating therewith through a gas-outlet opening in the stack-wall, an ore-crusher and a separator, one below the other, in said chamber, a chute extending between said crusher and separator, a smelting-furnace in said chamber below the separator with a chute extending between them, and a hopper in the chamber adjacent to the separator to receive the gangue - discharge therefrom and provided with a conveyer, for the purpose set forth.

JOHN T. JONES.

In presence of—

K. M. CORNWALL,
R. A. SCHAEFER.