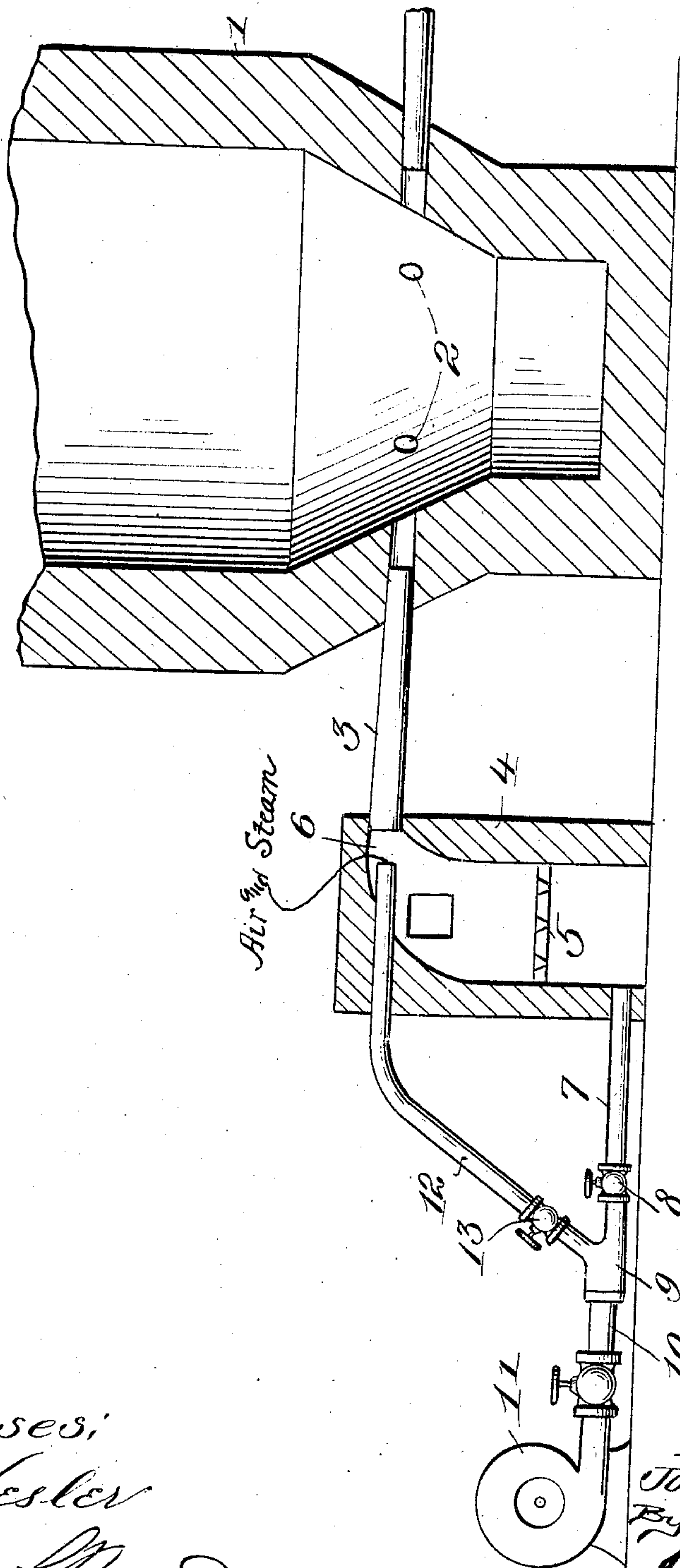


No. 874,336.

PATENTED DEC. 17, 1907.

J. C. HARDIE.  
METHOD OF SMELTING ORES.  
APPLICATION FILED JAN. 11, 1905.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

JOHN C. HARDIE, OF HELENA, MONTANA.

## METHOD OF SMELTING ORES.

No. 874,336.

Specification of Letters Patent.

Patented Dec. 17, 1907.

Application filed January 11, 1905. Serial No. 240,623.

*To all whom it may concern:*

Be it known that I, JOHN C. HARDIE, a citizen of the United States, residing at Helena, in the county of Lewis and Clark and State of Montana, have invented new and useful improvements in a Method for Smelting Ores, of which the following is a specification.

This invention relates to a method for smelting ores.

10 The invention aims to smelt ores through the medium of heat derived from a blast of carbon-dioxid with the addition of steam supplied to a furnace containing the material to be operated upon so as to obtain an increased temperature over that now generally employed for smelting, thereby facilitating the smelting operation.

15 In the method of smelting ores now in general use, the ores are smelted through the action of carbon monoxid gases which somewhat retard the smelting operation, owing to the temperature thereof, in this particular: that when such gases are employed to smelt the ores properly, it requires considerable time, whereas by the employment of a blast of carbon-dioxid gas with the addition of steam as the medium for the heat agency, the temperature is vastly increased, thereby shortening the duration of the smelting operation as compared with the time necessary when carbon monoxid gases are employed.

20 In describing the method in detail, reference is had to the accompanying drawings which show one form of an apparatus by which the method can be carried out, and said apparatus is shown in longitudinal section.

Referring to the drawing by reference characters, 1 denotes a smelting furnace provided with the twyers 2. One or more twyers can be employed, as desired. Communicating with the twyer or twyers 2 is a blast pipe or pipes 3 which is or are in communication with a gas generator 4 of any suitable construction. The pipe or pipes 3 can be dispensed with and the generator or retort placed in close proximity to the furnace so that the outlet 6 will open directly into the twyer or twyers.

50 The generator 4 is provided with a grate 5 for the fuel and an outlet 6 for the gas which

has been generated. Communicating with the generator 4 at the bottom thereof and below the grate 5, is a blow-pipe 7 having a regulating valve 8 and which communicates with a union 9 attached to an air-supply pipe 10 communicating with a fan or blower 11. Extending in the top of the furnace to a point near the outlet 6, is a blow-pipe 12 having a regulating valve 13 and which communicates with the union 9. If more than one blast-pipe is employed, a corresponding number of blow-pipes 7 and 12 are used. A steam supply communicates with the blow-pipe 12.

65 The manner in which the method of smelting according to this invention, is carried out, is as follows: The ore being placed in the furnace 1, above the twyers thereof and the fuel in the generator 4 ignited, air is passed through the bed of incandescent fuel by means of the blow-pipe 7 and which gives off carbon monoxid gas which ascends to the top of the generator 4 and there, is admixed with a blast of atmospheric air with the addition of steam through the medium of the pipe 12 and which admixes with the carbon monoxid gas at the top of the generating chamber and forms carbon dioxid gas, and, owing to the action of the blast through the pipe 12, the carbon dioxid gas is supplied to the blast-pipe or pipes 3 and through the twyer or twyers 2 into the furnace 1 and owing to the great heat given off from the carbon dioxid gas, the ore in the furnace is rapidly smelted. The valves 8 and 13 enable the regulation of the blast, as well as enable the regulation of the formation of the carbon monoxid and the carbon dioxid gases.

80 The essential feature of the invention is the formation of carbon dioxid gas in the manner set forth, exterior to the smelting furnace and the supplying of said carbon dioxid gas in the form of a blast with the addition of steam to the smelting furnace, said gas being the heat agency, thereby quickly and conveniently reducing the ores contained in the smelting furnace.

What I claim is:

100 A step in the reduction of a mass of ore in a chamber which consists in causing a direct blast of atmospheric air containing steam to

enter directly into a gas generating chamber  
and to direct to the ore a carbon dioxid gas  
formed from the admixing in the upper por-  
tion of said generating chamber of the blast  
5 with a carbon monoxid gas formed by pass-  
ing a blast of fluid containing air through an  
incandescent body of fuel.

In testimony whereof I have hereunto set  
my hand in presence of two subscribing wit-  
nesses.

JOHN C. HARDIE.

Witnesses:

N. L. BOGAN,  
G. M. BOND.