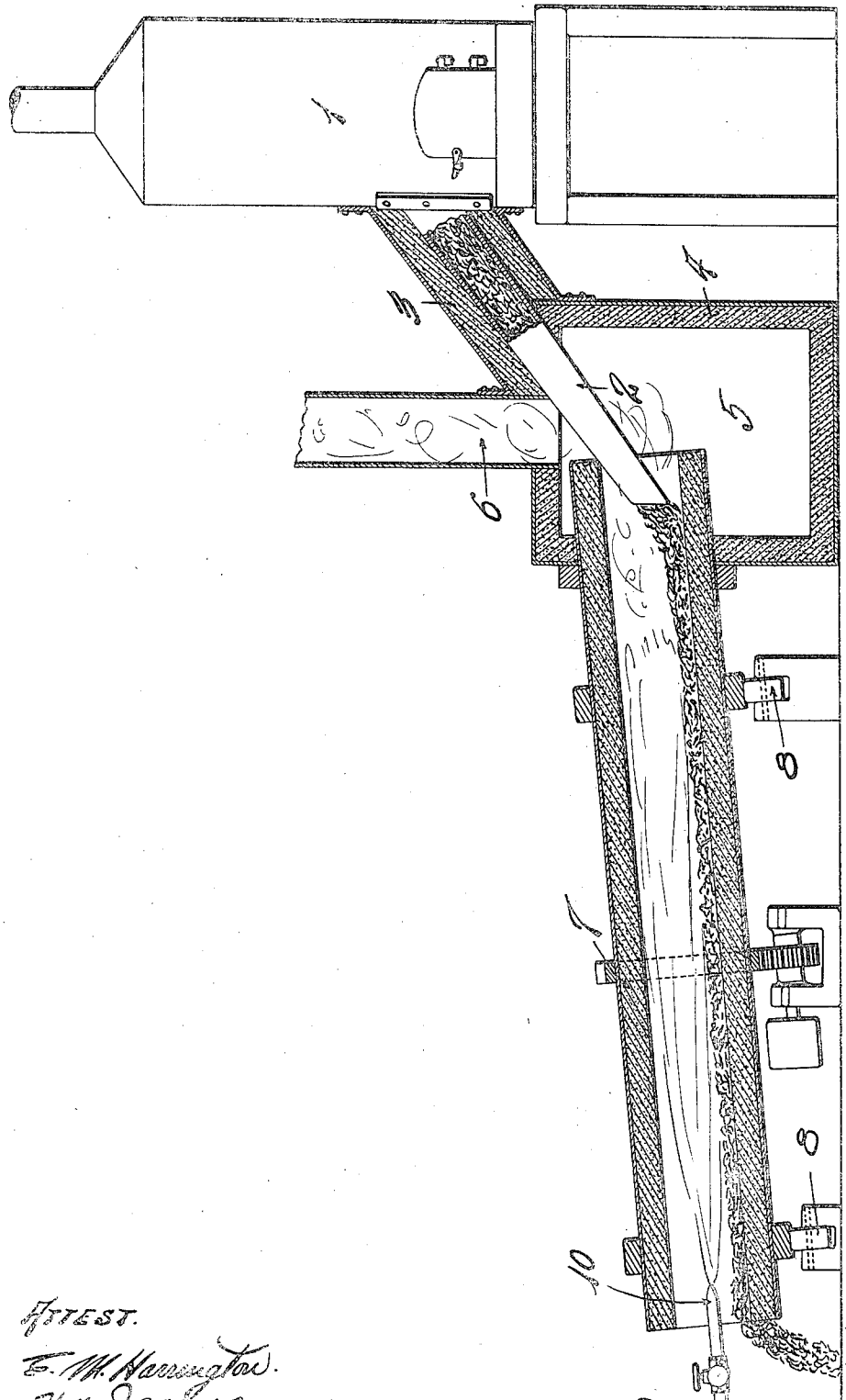
H. H. HUGHES.

METHOD OF PRODUCING ZINC OXID.

APPLICATION FILED MAY 27, 1911.

1,014,062. Patented Jan. 9, 1912.



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METHOD OF PRODUCING ZINC OXID.

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Application filed May 27, 1911. Serial No. 629,912.

To all whom it may concern:

Be it known that I, HARRY H. HUGHES, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Methods of Producing Zinc Oxid, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

The figure is a longitudinal section taken vertically through the center of a simple form of apparatus particularly designed for practicing my improved method.

This invention relates to improvements in the method of treating sulfid and other ores of zinc for the production of zinc oxid or what is commercially known as zinc white.

The principal object of my invention is the provision of a simple, easily practiced continuous method of treating sulfid and other ores of zinc so as to rapidly produce at little cost a zinc oxid, or zinc white.

Among the important features of my improved method is, first, the somple and economical elimination in a marketable form of the zinc contained in complex ores, which besides carrying zinc carry iron, copper, lead, silver, gold and other metals; second, the feature of the continuous mechanical treatment of the ore; third, the feature of obtaining complete combustion of all the carbon used for heating and reduction in the furnace itself; and fourth, the conservation of the heat of the ore, as it passes from the roasting furnace into the rotary reduction cylinder, for by taking the heated ore direct from the roasting furnace and delivering said ore into the reduction cylinder it is a comparatively easy and inexpensive matter to obtain the degree of heat necessary within the reduction chamber to bring about the oxidation necessary to produce zinc oxid.

Other features and objects of my invention will be apparent from the following detailed description, wherein my improved method as practiced with the apparatus shown is fully set forth. It will be understood, however, that other forms of apparatus than the one herein shown and described may be advantageously utilized for treating zinc ores for the production of zinc oxid.

In the particular form of apparatus illustrated, 1 designates an ordinary ore roasting furnace, and leading directly therefrom is a chute or spout 2, which is preferably inclosed by a layer 3 of non-heat conducting material.

4 designates a housing of fire brick or analogous material, which incloses a chamber 5, and leading therefrom is a stack or outlet pipe 6. This outlet pipe or stack leads to suitable collecting chambers or bag houses of ordinary design and used for collecting zinc oxid.

7 designates an elongated cylinder preferably lined with fire brick, which cylinder is mounted for rotation on suitable roller bearings 8, and said cylinder is slightly inclined so that material entering the upper end will gradually gravitate and discharge from the lower end as said cylinder is slowly rotated. The upper end of this cylinder 7 extends through one of the walls of the housing 4 and receives the discharge end of the spout or chute 2. The lower end of the cylinder is preferably open as shown, although suitable means may be provided for partially closing said lower end to regulate the air supply into said cylinder.

9 designates a hydro-carbon supply pipe, the nozzle 10 of which is positioned in the open lower end of the cylinder 7, and thus the flame resulting from the ignition of the liquid or gaseous hydro-carbon as it discharges from said nozzle is projected through the cylinder 7, thereby impinging directly upon the stream of ore passing through the cylinder.

In the treatment of sulfid ore carrying zinc, said ore is first roasted in the furnace 1 in order to drive off the sulfur in the usual manner and to accomplish this result it is necessary to develop a temperature of approximately 900° C. within the furnace 1. The ores freed from the sulfur gases pass into and through the spout or chute 2 and discharge therefrom into the upper end of the cylinder 7, which during the practicing of my improved method is slowly rotated. The upper portion of the chute or tube 2 is insulated against the radiation of heat,

and therefore, the ore discharging into the upper end of the cylinder 7 maintains approximately the same degree of heat that it was subjected to in the roasting furnace, viz: 900° C. The ignition of the hydro-carbon discharging from the nozzle 10 in the lower end of the cylinder 7 brings the temperature up to approximately 1300° C. within the cylinder 7, which heat is necessary for the proper reduction of the ore to produce zinc white. This hydro-carbon flame acts as a reduction material and the air drawn into the cylinder by the suction produced by the hydro-carbon flame together with the carbon dioxid produced from the combustion of the oil or gas causes a re-oxidation of the ore, thereby producing zinc oxid or zinc white. Thus it will be seen that the zinc oxid or zinc white is produced without the necessity of adding to the ore any carbon as a reducing agent, which is the practice in present methods. Any iron or other metals in the ore are left in the residue which discharges from the lower end of the cylinder 7, and these metals and residue can be treated as desired.

The zinc white fumes produced within the cylinder 7 pass rearwardly therethrough and discharge therefrom into the chamber 5, and pass from thence into and through the stack or outlet 6 into suitable collecting chambers or bag houses wherein the zinc white is collected in the usual manner. The chute or spout 2 is kept full of ore, and thus the zinc white fumes are prevented from passing upwardly through the chute or spout and into the roasting furnace 1.

By my improved method of substituting the hydro-carbon flame for the solid carbon ordinarily used as a reducing agent, and the practically complete combustion of the gases within the rotating cylinder, the zinc oxid or zinc white escapes from the rotating cylinder and passes through the stack 6 to the collecting chamber uncontaminated by carbon, and therefore, said zinc oxid can be produced clean and white and practically pure.

Where zinc white is produced by my improved method from oxid ore, silicates or carbonates the roasting furnace 1 can be dispensed with, inasmuch as it is not necessary to roast the oxid ores, silicates or carbonates. In some instances, with certain grades of ore it may be found advisable to mix a small amount of carbon with the ore, and which carbon acts as a reduction material.

By slightly inclining the cylinder and slowly rotating the same the material fed into the cylinder is continuously agitated as it passes therethrough, and by the time said material passes from one end of the cylinder to the other practically all of the metallic vapors have passed off to be oxidized and converted into zinc oxid or zinc white, which as heretofore described passes through the stack 6 to the collecting chambers or bag houses, thus making a continuous process. The combustion of carbon is complete in the furnace as distinct from other oxid furnaces.

My improved method is particularly designed for the purposes herein set forth, and for the elimination of zinc in the form of oxid from complex ores usually carrying gold, silver, iron, copper, lead and other metals, so as to render such complex ores available in the ordinary treatment for blast furnaces, or such treatment as is usually given to this class of ores. The hydro-carbon flame from the burner in the lower end of the cylinder impinges directly upon the stream of roasted or oxidized ore as it passes downward through the rotating cylinder, and by the regulation of the air supply into the lower end of the cylinder and regulating the burner, the flame can be so manipulated as to burn the carbon in the oil or gas (according to the form of fuel used) to carbon monoxid, CO. This CO is an excellent reducer for zinc oxid and by taking up another atom of oxygen from the ZnO of the roasted ore the carbon completes combustion by burning to carbon dioxid CO_2. At the same time the ZnO in the ore is reduced to metallic zinc, which is immediately volatilized and reoxidized by CO_2 to ZnO, or zinc white.

I claim:

1. The herein described continuous method of producing zinc oxid from sulfid and other sulfur bearing ore consisting in roasting the ore to eliminate practically all of the sulfur in the form of fumes, delivering the roasted ore while still in a heated condition into a rotary reduction furnace, the interior of which is heated solely by the combustion of liquid or gaseous hydrocarbon within said furnace, causing the heated ore to pass through the furnace, and introducing air into said furnace to reduce the zinc vapor to an oxid.

2. The herein described continuous method of producing zinc oxid, consisting in initially applying heat to the zinc ore under treatment to eliminate practically all of the sulfur from said ore, then delivering said ore to and passing it through a chamber heated solely by the combustion of hydro-carbon within the chamber, continuously agitating the ore while in the chamber, and introducing air into said chamber to reduce the zinc vapors to an oxid.

3. The herein described continuous method of producing zinc oxid from zinc ore from which the sulfur has been eliminated, con-

sisting in passing the heated zinc ore through a chamber heated solely by the combustion of hydrocarbon within said chamber, continuously agitating said ore while passing through the chamber, and introducing air into said chamber to reduce the zinc vapors to an oxid.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this 25th day of May, 1911.

HARRY H. HUGHES.

Witnesses:
M. P. SMITH,
B. S. REID.