A. H. RICHARDS.

PROCESS OF SINTERING ORES.

APPLICATION FILED OCT. 27, 1915. RENEWED MAY 10, 1918.

1,292,059. Patented Jan. 21, 1919.

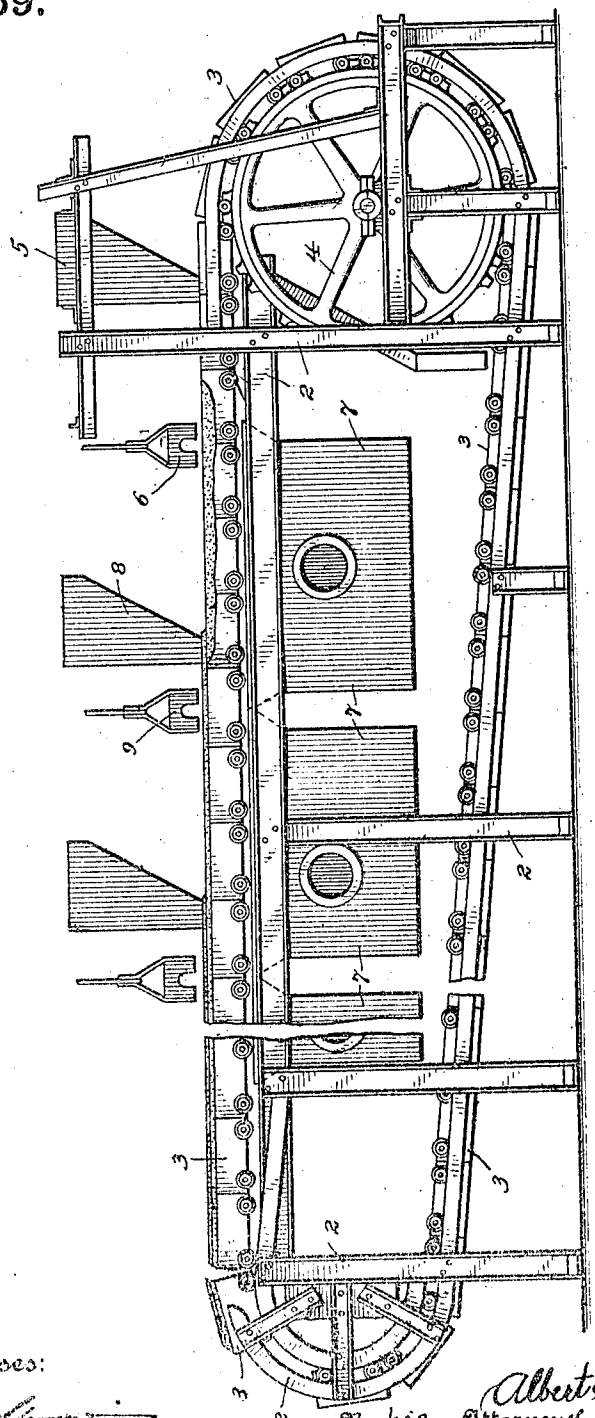


Fig. 1.

Witnesses:

Albert H. Richards Inventor

By his Attorneys

Messmer and Austin

UNITED STATES PATENT OFFICE.

ADELBERT H. RICHARDS, OF SALT LAKE CITY, UTAH, ASSIGNOR TO AMERICAN SMELTING & REFINING CO., A CORPORATION OF NEW JERSEY.

PROCESS OF SINTERING ORES.

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To all whom it may concern:

Be it known that I, ADELBERT H. RICHARDS, a citizen of the United States, and resident of Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Processes of Sintering Ores, of which the following is a specification.

My invention relates to an improvement in the process of roasting and sintering metalliferous ores and the primary object of the invention is to produce, economically, a more perfectly sintered product than is produced by present methods.

Ores are sintered and roasted at present by igniting the top layer of a charge and supporting the combustion by drawing air down through the charge until the zone of combustion has reached the bottom of the layer. This is usually accomplished by depositing a layer of the ore to be treated on an endless belt of traveling grates, which carry the layer of ore under an ignition flame and over one or more vacuum boxes. Ores so treated have been found on analysis to contain some sulfur and other combustible products showing that the sintering and roasting is not complete and efforts to re-ignite the charge to burn out the products have not, so far, proven successful.

It is noted that as the zone of combustion is drawn down through the charge the burnt portion of the layer becomes somewhat porous which allows a larger amount of air to pass through the layer than when the charge is raw or unsintered. There is thus produced a tendency toward drawing a greater amount of air through the partly finished charge than is drawn through the freshly ignited charge. As the machines now used have a uniform vacuum under all portions of the charge, it is obvious that these sintering machines are not working at their maximum efficiency along all portions of their length.

Endeavors have been made to remedy this condition by providing different vacuums in the several wind boxes and this has been partially successful but different charges, and even different portions of the same charge, vary in their combustible constituents so that it is difficult to so regulate the intensities of the several vacuums to produce just the proper degrees of roasting and sintering under all conditions.

Accordingly an object of my invention is to obtain a well roasted and sintered product independent, or substantially independent, of the character of the ore under treatment.

Another object of my invention is to increase the capacity of known types of sintering machines by utilizing draft creating portions thereof, which, under present methods, are assisting but little in the sintering of the ores.

One means by which these objects may be attained without seriously modifying the present types of sintering machines is to deposit a charge of the ore on the traveling grates of the present machine, ignite the same and subjecting the ignited mass to the action of a current of air directed downwardly therethrough, as is usual with known sintering processes. Before the charge has been completely sintered, however, a second charge in the form of a layer of less depth than the preceded layer is deposited on the top of the first layer and ignited. Both layers are then subjected to the action of a downwardly directed current of air passing therethrough and for this purpose the succeeding vacuum boxes now present in these machines may be utilized. Another layer may be imposed upon the preceding lower layer and in fact, any number of layers may be superimposed upon each other. However, the number of layers and the thickness of each layer which goes to make up the charge that can be treated at the least cost per unit of mass depends upon the capacity of the machine and the character of ore under treatment.

The best sintering results are obtained apparently by a slow burning process and this is satisfactorily obtained during the initial portion of the operation. The gradually increasing portions of the burnt out charge, however, permit of a rapid increase in the amount of air supplied to the burning zone of the charge and accordingly accelerates the operation. The addition of the fresh charge may be timed to intercept this accelerated action at a point where the action is about to progress too rapidly but it is within the scope of this invention to deepen the charges progressively at the rate of movement of the combustion zone through the charge.

This process has been carried out with ad-

vantage by means of a sintering machine of the conveyer type, such as is illustrated in the accompanying drawings in which:

The figure is a side elevation of a modified form of Dwight and Lloyd sintering machine.

The machine illustrated is a straight line sintering machine which when used with the method herein disclosed, may be made much longer than the conventional type of such machines and thus provide for a large tonnage over any machine now known with a resulting decrease in cost per ton of roasting. With any present size sintering machine a larger tonnage is realized due to the increased number of layers which are sintering at a given time. In this machine a frame 2 supports an endless chain of grates 3 passing about and actuated by some suitable driving means, such as a sprocket wheel 4. A feed hopper 5 is positioned to direct a continuous stream of the ore to be treated onto the upper line of grates and to spread the same evenly in a layer of uniform thickness. The most satisfactory working thickness of this layer is dependent obviously upon the capacity of the machine, the rate of travel of the grates and the character of the ore under treatment, but in general, working with a layer of from four to six inches in depth has given the most satisfactory results.

An igniting device preferably in the form of a muffler 6 is disposed above the layer in position to ignite the upper surface of the spread layer. The ignited layer is passed over one or more vacuum or wind boxes 7 designed to cause a downwardly directed draft to pass through the layer. A second discharge hopper 8 and coöperating igniting device 9 are positioned beyond the hopper 5 and spaced therefrom a distance dependent upon the point in the travel of the grates at which it is described to introduce the superimposed charge. The particular location of this second hopper depends, among other factors upon the rate of travel of the grates, upon the rate of travel of the combustion zone through the ore and upon the point at which it is desired to retard the acceleration of the rate of travel of the combustion zone through the charge. In its practical operation it has been found desirable to so design this second hopper that a smaller amount of ore is fed than was deposited by the preceding hopper and a layer of about one inch in depth has given the most perfectly sintered resulting product.

It is understood that any number of these discharge hoppers and coacting igniting devices may be disposed along the travel of the ore and very satisfactory results have been obtained by disposing a plurality of wind boxes along the length of the machine and carrying the vacuum therein higher as each additional charge is added. This vacuum is regulated by suitable controlling dampers which are adjusted whenever necessary to insure the proper treatment of the ores passing through the machine.

By means of a device of this character two or more separate layers are roasting and sintering at the same time so that a cross-section of the charge would show layers of burning zones separated by layers of porous roasted sinter. This not only provides for an increase in capacity of the machine but results in an improvement in the resulting product.

The new layers of charge gradually sinter and fuse into the lower layers so as to form a solid porous product with no distinctive dividing line between the layers and uniformly sintered throughout the mass.

Considered commercially the process is valuable in that it permits of an enlargement in capacity of the present types of sintering machine without materially increasing the cost of operation of the unit thus reducing the cost per ton of ore roasted and sintered.

At the same time high vacuums are maintained in the wind boxes and this high vacuum is utilized. While the rate of travel of the combustion zone through the material is reduced over the former methods still the fact that there are several zones burning simultaneously permits the grates to travel at the old speed and thus insures as rapid a roasting and sintering as was possible with the single layer machines.

Further this multiple layer process is valuable in that the finished product is more thoroughly sintered than by the one layer process, and is produced at a lesser cost per ton of charge roasted.

Having thus described my invention, I claim:

1. In the art of sintering metalliferous ores, the process which consists in subjecting an ignited charge of ore to the action of a downwardly directed current of air passed through the charge, said charge offering a resistance to the passage of the air which resistance gradually decreases as the charge is sintered, adding a fresh charge of ore to the top of the next adjacent lower burning charge when the air resistance through this lower charge has reached a desired value, igniting said fresh charge and subjecting both charges to the action of a current of downwardly directed air passed therethrough.

2. In the art of sintering metalliferous ore, the process which consists in causing a layer of ignited ore to travel in one direction, subjecting said layer to the action of a downwardly directed current of air passed therethrough, depositing a second layer on top of said first named layer after the same

has been subjected to the action of said air current for a definite time, igniting said second layer and causing both layers to be subjected to the action of a downwardly directed current of air passed therethrough.

3. In the art of sintering metalliferous ores, the process which consists in subjecting a layer of ignited ore to the action of a current of air passed therethrough, and gradually increasing the depth of said layer thereby to cause the air supplied to any portion thereof to become less active as this portion approaches its completely sintered state.

4. In the art of sintering metalliferous ores, the process which consists in subjecting a burning layer of the ore to the action of an air current passed therethrough to sinter the same, replenishing said ore with fresh quantities thereof during the progress of the sintering action and igniting said added ore.

5. In the art of sintering metalliferous ores, the process which consists in successively adding layer after layer of ore upon each preceding layer, separately igniting each layer as deposited and simultaneously subjecting all layers to the action of a current of air passed therethrough.

6. In the art of treating metalliferous ores, the process which consists in causing a current of air to pass through a layer of ignited ore to support the combustion necessary to sinter the ore and increasing the depth of said layer as portions of the same approach their completely sintered state.

7. In the art of sintering a layer of metalliferous ores, the process which consists in subjecting the layer of the ignited ore to the action of a relatively rapid moving body of air and then positioning masses of semi-porous materials on said sintering layer thereby progressively subjecting the layer to the actions of successively less active bodies of air as the layer of unsintered ore is decreased.

8. In the art of sintering ore, the process which consists in forming a layer of ore, igniting the top surface of said ore, causing a draft to pass downwardly through said layer to carry a burning zone gradually through the layer and depositing a second layer of ore on said first layer when the burning zone has penetrated the first layer for a definite distance.

Signed at Salt Lake City, in the county of Salt Lake and State of Utah, this 7th day of October, A. D. 1915.

ADELBERT H. RICHARDS.