

# UNITED STATES PATENT OFFICE.

DAVID W. BIRMINGHAM, OF CLIFTON, NEW YORK.

PROCESS OF ROASTING AND DISINTEGRATING GOLD AND SILVER ORES.

SPECIFICATION forming part of Letters Patent No. 283,461, dated August 21, 1883.

Application filed July 25, 1883. (No specimens.)

*To all whom it may concern:*

Be it known that I, DAVID W. BIRMINGHAM, a citizen of the United States, residing at Clifton, Richmond county, New York, have  
5 invented new and useful Improvements in Processes of Roasting and Disintegrating Gold and Silver Ores, of which the following is a specification.

My invention relates to the manipulation  
10 and treatment of ores of the precious metals, especially those having refractory bases, the object being to obtain a more thorough, speedy, and convenient desulphurization of such ores without fluxing or slagging the same, and to  
15 prepare the ores for a more perfect and effectual amalgamation, whereby I obtain a higher percentage of value from a given quantity of ore than is otherwise possible.

To this end my invention consists in mechanically combining the broken ores with a  
20 bulk of broken charcoal of any required size and any salt of lime, preferably the hydrate, and artificially roasting the said ores so combined in any reverberatory or other furnace  
25 suitable for the purpose, and subsequently subjecting the charge to a bath of salt, cyanide of potassium, and sulphate of copper.

In carrying out my invention I first break the ores by any suitable crushing mechanism  
30 to any suitable degree—say to a size, preferably, of gravel, or finer, according to the refractory bases of the ores. With the crushed ore is then mingled broken charcoal or other carbonaceous material and lime, in the proportion, say, of about one bushel (more or less) of  
35 each to one ton of the ore. While I may use any salt of lime for this purpose, the hydrate is to be preferred, and although the proportions of the lime to the charcoal mentioned  
40 may be taken as the standard, it should be noted that this is subject to variation, according to the fusible character of the ore under treatment, the fusion of which it is desired to prevent.

45 The art or principle of manipulation is as follows: The ores, mechanically crushed in the above manner and in bulk of about half a ton, are then admitted through a suitable aperture into the upper end of a reverberatory furnace  
50 having an inclined hearth, or in any suitable furnace adapted to the purpose, and then subjected to a gradual roast by impinging upon

the mass the heat or flame derived from a wood fire contained in the fire-pit of said furnace, the important feature being to gradually  
55 raise the temperature of the ore as high as possible without matting or slagging the same. The charge at the upper end of the furnace, being most remote from the fire, receives during the roast the least degree of heat, which  
60 is from time to time increased, as the treatment of the ores under manipulation and their character may suggest, by approaching the same nearer to the fire located at the other end of the furnace, and is accomplished by rakes or  
65 other tools made and used for that purpose. At each periodical movement down or removal of said ores to a mean approach to said fire, after a discharge of similar quantity of roasted  
70 ores, another charge of similar bulk is admitted, as before, and this plan is pursued until the gases, fumes, and refractory bases are eliminated, when, by an exit in the hearth of the furnace, constructed for the purpose, they  
75 are discharged at a white heat into a bath, as hereinafter more fully set forth.

The presence of lime and charcoal gives to the mass a light, puffy, and buoyant consistency, holding the ore, as it were, in suspension, and giving an even and equally-distributed heat throughout the same, the lime being  
80 herein used and applied in the management of the roast as a prevention to slagging the ores, and, like the charcoal, and in conjunction therewith, acts as an absorbent and decomposer  
85 of the rebellious bases.

It should be also noted that while I may use the combination of lime and charcoal, as specified, I am not to be restricted to their combined use with all classes of ores in the manner  
90 referred to; but I may defer using either of these materials when they or their equivalents are found in natural combination with the ores themselves—that is to say, for instance, when ores contain sufficient lime in themselves,  
95 I may simply use the charcoal therewith, and when ores require less heat I may use the lime alone with the ore.

Now, when I have prepared the ores by a thorough roast in the manner before described,  
100 after their desulphurization, and the ore at proper temperature of heat, I at once discharge them into a bath composed of an aqueous solution of salt, cyanide of potassium, and



sulphate of copper, prepared in the following manner: Within a vat or ear made of suitable dimension, and used for receiving the discharge, I form a solution of common salt, sulphate of copper, and cyanide of potassium with water, the proportions being about one pound (more or less) of each of the substances named to a sufficient volume of water to cover the bulk of ore roasted at a single operation, salt being added to the point of saturation. While I use this combination as a whole, I may also use them separately or in following quantities, to wit: say, one pound of the cyanide of potassium to a sufficient quantity of water to cover the ore, salt being added to saturation, or, say, one pound of the sulphate of copper to a like quantity of water, with salt added to saturation, the different combinations being used according to the requirements of the ore to be treated. The action of the roast and this bath upon the heated ores effects their disintegration, leaving them in a friable condition, in which they are readily crumbled or pulverized, thereby effecting a separation of the bases, setting free the precious metals, and leaving the ores in condition for amalgamation.

In the treatment of ores for the separation

of gold and silver my invention secures great economy as compared with previous methods. 30

What I claim is—

1. In the separation of gold and silver from their ores, the process herein described of preparing said ores for amalgamation, consisting in mechanically combining therewith lime and charcoal and roasting the mixture in a suitable furnace, and subsequently plunging the hot ore into a suitable bath, substantially as described. 35

2. The process described for preparing gold and silver ores for amalgamation, said process consisting in combining lime and charcoal or their equivalents with said ores, roasting them in conjunction with said substances, and plunging the hot ore after roasting into a bath composed of an aqueous solution of salt, cyanide of potassium, and sulphate of copper, or their equivalents, substantially as described. 40 45

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses. 50

DAVID W. BIRMINGHAM.

Witnesses:

JAMES L. NORRIS,

J. A. RUTHERFORD.