UNITED STATES PATENT OFFICE.

JOHN C. MONTGOMERIE, OF DALMORE, STAIR, SCOTLAND.

EXTRACTION OF GOLD AND SILVER FROM ORES.

SPECIFICATION forming part of Letters Patent No. 549,736, dated November 12, 1895.

Application filed March 20, 1894. Serial No. 504,443. (No specimens.) Patented in England October 27, 1893, No. 20,343; in New Zealand October 27, 1893, No. 6,775; in Cape Colony March 29, 1894, No. 913; in India March 29, 1894, No. 106; in South Australia April 9, 1894, No. 2,663; in West Australia April 10, 1894, No. 502; in Victoria April 10, 1894, No. 11,265; in Transvaal April 10, 1894, No. 620; in New South Wales April 12, 1894, No. 4,972; in Tasmania April 14, 1894, No. 1,261; in Canada July 20, 1894, No. 46,630, and in Austria-Hungary July 24, 1894, No. 172 and No. 6,627.

To all whom it may concern:

Be it known that I, JOHN CUNINGHAME MONTGOMERIE, a subject of the Queen of Great Britain, residing at Dalmore, Stair, in the county of Ayr, Scotland, have invented certain new and useful Improvements in the Extraction of Gold and Silver from Ores or Compounds Containing the Same, (for which I have received the following Letters Patent: in Great Britain, dated October 27, 1893, No. 20,343; in Austria-Hungary, dated July 24, 1894, No. 172 and No. 6,627; in Canada, dated July 20, 1894, No. 46,630; in Cape Colony, dated March 29, 1894, No. 913; in Transvaal, dated April 10, 1894, No. 620; in India, dated March 29, 1894, No. 106; in South Australia, dated April 9, 1894, No. 2,663; in West Australia, dated April 10, 1894, No. 502; in Victoria, dated April 10, 1894, No. 11,265; in New South Wales, dated April 12, 1894, No. 4,972; in New Zealand, dated October 27, 1893, No. 6,775, and in Tasmania, dated April 14, 1894, No. 1,261,) of which the following is a specification.

This invention relates to the treatment of auriferous and argentiferous ores or compounds for the purpose of separating and collecting the gold or silver or gold and silver contained therein and to means for rendering the solution, after undergoing filtration, comparatively free from muddy particles.

According to my invention I treat in a vessel containing water the ore with a cyanide, an alkaline oxide, a nitrate or a nitrite, and an oxidizing agent—such as an alkaline dioxide or air, oxygenated air, or oxygen.

In applying my improvements to the treatment of ores containing gold or silver or gold and silver I crush or grind the ore sufficiently fine to admit of its passing through a sieve of from forty to ninety meshes to the lineal inch, according to the nature of the ore. Preferably I then add to the ore, while in a solid state, from one-half pound to two pounds or more, as circumstances demand, of sodium dioxide or other alkaline dioxide and charge the same into a barrel containing water and close the inlet. The pulverized ore mixed with the dioxide is treated in the barrel or vessel, along with the water, which is in sufficient quantity to render the mixture of the consistency of cream or very thin mud, with the following chemicals: (*a*) a cyanide, such as cyanide of potassium or of sodium or of other such cyanide or mixture of cyanides; (*b*) an alkaline oxide, such as sodium oxide or its hydrate (caustic soda) or other alkaline oxide or a hydrate of an alkaline oxide, and (*c*) a nitrate or nitrite, such as nitrate of soda or of potash or of ammonia or other suitable or equivalent nitrate or nitrite. The barrel, containing the ore, the dioxide, and the other chemicals above referred to, is then revolved for a short time in order to thoroughly mix its contents. The barrel is then charged with air or oxygenated air or (when sodium dioxide is not used) with oxygen to a pressure of from fifty to one hundred pounds per square inch. When oxygen is used, sodium is not required.

With some ores when sodium dioxide is employed, air or oxygen under pressure is not needed. In such case the ore may be treated in tanks, with or without agitation.

When there is no agitation, it is preferable to allow the solvent liquid to percolate through the mass of ore repeatedly, the liquid as it passes away being fed back to the surface of the ore until the precious metals are sufficiently dissolved. Under such procedure the sodium dioxide, instead of being mixed with the ore, may be dissolved in the solvent solution in very small quantities at a time, so as to prevent any violent action or great loss of oxygen occurring. By way of example, a refractory ore of a muddy character containing eight ounces of gold and fifty ounces of silver per ton may be treated with ten pounds of cyanide of potassium, ten pounds of caustic soda, and seven pounds of nitrate of soda, with one and one-half pounds of sodium dioxide added to the ore. These proportions should, however, be varied considerably with different descriptions of ore, the most suitable proportions being readily determined by experiment. Should the other chemicals mentioned be employed, the same proportions may

be used. The barrel is then again revolved, and maintained in motion until the precious metals are dissolved, with average ores the time occupied being from four to six hours. The barrel is thereupon emptied, the contents filtered and washed, and the solution treated in any known manner for the separation of the precious metals.

An important advantage resulting from the use of a nitrate or nitrite, as hereinbefore described, is that the liquid filtered from the tailings is tolerably free from muddy particles, any matter left in suspension settling quickly, so that charcoal, if and when employed as a precipitant, is not liable to become choked by sediment.

I have found with many ores that when cyanide alone is used the liquid is very muddy and takes weeks or even months to settle, whereas a solvent solution containing a nitrate or nitrite becomes fairly clear in a day or so after filtration from the tailings.

In treating the liquid received from the filters and containing the precious metals in solution, as also the unused solvent and other chemical agents employed, I prefer to pass the said liquid through a filter containing charcoal, preferably wood-charcoal, or through a series of such filters.

I wish it understood that I claim as within the scope of my invention the chemical equivalents of the substances herein specifically mentioned, and when I specify in the claims the use of a nitrate I mean to also include a nitrite. When I specify the use of oxygen, I include also the use of oxygenated air or air, and when an alkaline oxide is mentioned it should be understood that its hydrate may be substituted. "Sodium dioxide" must be understood to include its equivalent alkaline dioxide.

I claim as my invention—

1. The improved process of extracting gold and silver from ores or compounds containing the same, substantially as herein described, consisting in treating the ore in a vessel containing water, with a cyanide, an alkaline oxide, a nitrate and an oxidizing agent.

2. The improved process of extracting gold and silver from ores or compounds containing the same, substantially as herein described, consisting in mixing with the pulverized ore or compound, an alkaline dioxide, such as sodium dioxide, and treating this mixture in a vessel containing water holding in solution a cyanide, such as cyanide of potassium, an alkaline oxide, such as sodium oxide and a nitrate, such as sodium nitrate, allowing the chemicals to act on the ore until the precious metals are sufficiently dissolved.

3. The improved process of extracting gold and silver from ores or compounds containing the same, substantially as herein described, consisting in mixing with the pulverized ore or compound, an alkaline dioxide, such as sodium dioxide, charging the mixture into a barrel or vessel containing water, holding in solution a cyanide, such as potassium cyanide, an alkaline oxide, such as sodium oxide, and a nitrate, such as sodium nitrate, closing the barrel or vessel and forcing in an oxidizing agent, such as air, the contents being then agitated until the precious metals are sufficiently dissolved.

JOHN C. MONTGOMERIE.

Witnesses:
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