UNITED STATES PATENT OFFICE.

MARK BIRMINGHAM, OF CLIFTON, NEW YORK.

PROCESS OF SEPARATING METALS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 342,422, dated May 25, 1886.

Application filed July 14, 1885. Serial No. 171,617. (No specimens.)

To all whom it may concern:

Be it known that I, MARK BIRMINGHAM, a citizen of the United States, residing at Clifton, in the county of Richmond and State of New York, have invented new and useful Improvements in Processes of Separating Metals from their Ores, of which the following is a specification.

My invention relates to the mechanical and chemical combination, with the ore during amalgamation, of sulphate of ammonia, or of a salt of ammonia, or any form of ammonia and a salt of alum or any form of alum. These salts may be used separately or combined with common salt, sulphate of copper, or any other chemical, combined or separately, according to the ore under treatment. The effect of the ammonia and alum is to assist to eat and destroy the chemical bases and residue still remaining in the ores that may reattach themselves to the precious metals.

In amalgamation it should be the object to mechanically diffuse the mercury in fine particles all through the ore as much as possible, while keeping the mercury at the same time free from taking up bases, and to bring it in physical and chemical contact, through the mass of pulp, into the minerals. The alum properties have more or less the same decomposing effect on the base metals as ammonia, and especially in gathering the particles of floured mercury and amalgam, and eating out and freeing the mercury and amalgam from the bases that sicken it and prevent its amalgamating affinity, thus assisting in keeping the precious metal and mercury bright, and assisting in coating the metal with mercury.

The manner of working is to take the pulverized ore, preferably after having been treated in the manner as described in Letters Patent No. 283,461, dated August 21, 1883, in a quantity of about a ton, with a suitable amalgamating-pan, preferably a pan with steam-bottom, and with a certain amount of quicksilver. The pulp is kept as thick as advisable, according to the ore under treatment, and then a sufficient amount of sulphate of ammonia is mingled with the pulp, and, if necessary, a sufficient quantity of the sulphate of copper, common salt, or other well-known reagents are added and then intermixed and amalgamated from two to four hours, as the ore requires. During this operation small quantities of alum may be put in, to act, with or without combination, with the other chemicals, according to the ore. It is preferable to add the alum properties about one hour or more before commencing to thin the pulp for discharging into the settler. The alum has a special effect of bringing the small particles of amalgam together, making the mercury active and cohesive. In other words, while the ammonia and alum properties assist, with or without combination with the other known chemicals, to free the metals from base affinities and sulphide coatings, the alum acts more especially to gather the amalgam in single cohesive bulk.

In the usual process or manipulation of ores, when the amalgamation is made more or less complete in the pan, the pulp is thinned with water and the slimes discharged into a settler for final settling, which leaves a great amount of fine infinitesimal particles of amalgam floating, and which it is almost impossible to settle and save without some mode of treatment. Thus much valuable amalgam of gold and silver is lost by floating away.

My treatment with ammonia and alum intermingled with the thick pulp in the pan before thinning the mass with water will amalgamate and gather the fine amalgam into a cohesive bulk, and, in fact, performs a mechanical and chemical precipitation into globular settling condition, so that while the pulp is thinned for discharging into the settler the amalgam readily settles to the bottom of the settler in bulk, leaving the slimes to pass off, thus making an effective amalgamation and effecting more or less settling and collecting of amalgam in the pan before the slimes are discharged into the settler.

I am aware that alum has been used in preparing ores for amalgamation, by mingling it with the pulverized ores and roasting the combination; but heating and roasting alum changes its nature before it reaches the amalgamating-pan, so that all its properties as alum have passed off in gaseous fumes, the sulphuric acid separated and combined with other substances, and leaving only the small

residue of alumina-ash, which is left by the roast in an insoluble condition and harmless for good or evil, for amalgamation. I use alum, however, only during amalgamation mingled with the mercury and without previous roasting, it being thus in a form capable of exerting its chemical effects.

I am also aware that it has been proposed to employ ammonia combined with muriatic acid or muriate-of-ammonia solution to saturate ores, which are then mixed with mercury and placed into an iron cylinder with a wood plug, of about one inch or more in size, in its bottom, resting on a receiver holding the bottom of the cylinder, then applying pressure to the mass to force the quicksilver and amalgam through the pores or fiber of the wooden plug.

Another method has been proposed, which consists in first roasting the ores and subsequently pickling the calcined ore in acid solutions for some hours, to prepare them for amalgamation. After this treatment, and prior to amalgamation, the ores have been washed in a solution of ammonia, which would have the effect, however, of counteracting the acid in the mixture. Then the mass was passed over mercury, or plates coated with mercury, and a hair-cloth or coarse substance was made to scratch the surface of the mercury, to assist it in taking up the fine metal. These processes, however, I do not claim, and my invention differs therefrom, in that I first feed the fine ore into a pan amalgamator with mercury intermingled. The mass is then heated by steam, when I introduce ammonia, using it in the mass for four hours and more to the charge, thus giving it ample opportunity for eating out the base constituents, which takes time, while the mere wetting or washing of the ore could not effect this object.

Others have used the ammonia solution for washing the ore before it comes in contact with mercury, while I use it for a different object, namely: to eat up and convert the base material that attaches to the mercury, and subsequently to complete the amalgamation.

I use, in combination with the ammonia salts, the alum to assist and continue to add to the destruction of the base sulphides that may attach to the mercury and prevent the gathering of the amalgam.

Having thus described my invention, what I claim is—

1. In the separation of gold and silver from their ores, the process herein described, consisting in using in amalgamation ammonia and alum, or equivalents, substantially as described.

2. The herein-described process of separating gold and silver from their ores, which consists in the addition of an ammonia and alum salt, or equivalents, to the amalgamated pulp, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

MARK BIRMINGHAM.

Witnesses:

H. A. HAVEN,

THOS. B. ATKINSON.