

UNITED STATES PATENT OFFICE.

JOACHIM H. BURFEIND, OF SALT LAKE CITY, UTAH, ASSIGNOR OF ONE-HALF TO WINFIELD S. KEYES, OF BUTTE, MONTANA.

METHOD OF TREATMENT OF AMALGAM CONTAINING COPPER OR PRECIOUS METALS.

SPECIFICATION forming part of Letters Patent No. 671,988, dated April 16, 1901.

Application filed April 28, 1900. Serial No. 14,745. (No specimens.)

To all whom it may concern:

Be it known that I, JOACHIM H. BURFEIND, a citizen of the United States, and a resident of Salt Lake City, in the county of Salt Lake and State of Utah, have discovered a new and useful Method for the Treatment of Amalgam Containing Copper or Precious Metals, of which the following is an exact and clear description, which will enable any one familiar with metallurgy to use it.

The amalgam as it comes from the mill is put into a vessel provided with a stirring apparatus—say into the “clean-up pan.” It is then freed from adhering water. The amount of copper in it is ascertained in the usual manner. Sufficient finely-pulverized sulfur to convert the copper present into copper sulfid (Cu_2S) is then weighed off. The stirrer is set into rapid motion and a portion of the sulfur is added to the cold dry amalgam. After a short time the sulfur will disappear and the amalgam, which is quite bright again, will be quite warm. After this more sulfur is added in the above manner until the total amount of sulfur has been added. Stirring is then continued for a short time to insure contact of all the sulfur with the copper present. The motion of the stirrer is then slowed down to a very low speed and water is added, preferably boiling water, which is kept at or near that temperature. The copper, which is now present as copper sulfid (Cu_2S) in the amalgam, rises at once to the surface of the amalgam, forming a black cover over it under the water. Stirring slowly is now continued until a sample taken of the amalgam from under the copper shows it to be free, or nearly so, from copper. The stirrer is then stopped, and the now very liquid amalgam is drawn off from beneath the copper sulfid. It is then strained, and the quicksilver so strained off is ready for mill use at once. The amalgam remaining on the strainer is retorted and treated as usual. The copper sulfid will yet contain small globules of amalgam, from which it is freed by washing or otherwise in the usual way. The bullion (gold and silver) resulting from the so-treated amalgam will be sufficiently free from copper, so that it can be at once parted by any of the well-known methods without any

preliminary treatment, such as is needed for all methods of parting if the bullion contains over five per cent. of copper.

In the practice used hitherto, bullion containing, say, up to seventy-five per cent. of copper and twenty-five per cent. gold and silver is most difficult to sample, and in order to obtain a correct sample several meltings are required. Such bullion has to be sent to refiners by express. The refiners will make an extra charge to separate the copper first from the gold and silver and will then add the regular charge for parting gold and silver.

The bullion with the above amount of copper or any other proportion will require a large apparatus for retorting, and the amount of fuel needed for this is large. Melting the retorted bullion requires large crucibles or furnaces and, again, costly fuel. The extra labor required for retorting and melting will far exceed the cost of the small amount of sulfur needed to remove the copper directly from the amalgam according to my method. Thus it will be seen that the copper in the bullion is a source of loss if handled in the usual way. If my method is used, the copper is obtained as copper sulfid, (Cu_2S), which can as such be shipped by freight to copper-smelting works, or it may be treated in the usual manner for the production of copper sulfate, or disposed of in any other suitable way. The bullion of gold and silver, or either, obtained by my method will only be subject to parting charges.

In explanation of the chemical reaction taking place in my process I would state that copper has the largest affinity for sulfur of all the heavy metals. If in a finely-divided state it comes into contact with finely-divided sulfur, both combine at ordinary temperature. This reaction is so energetic that if large lots are brought together at once the heat generated is large, in consequence of which, as shown above, the sulfur must be added in small portions to the amalgam, as otherwise the temperature will be so high as to evaporate quicksilver, causing a loss and endangering the operator. Silver sulfid (Ag_2S) cannot form in the presence of metallic quicksilver. Gold does not combine with sulfur under the conditions obtaining in my process.

The action of the water used in my process is to keep the mixture of amalgam and copper sulfid in a condition suitable for the ready separation of the copper sulfid. While cold
5 water may be used, hot water shortens the time of treatment. After the sulfur has been incorporated into the amalgam and has combined with the copper present to copper sulfid, the latter is so intimately mixed with
10 the amalgam that it can hardly be seen with the naked eye, the amalgam being perfectly bright, as before the addition of the sulfur and the conversion of the metallic copper to copper sulfid, but somewhat more solid. To
15 separate the finely-divided and intimately-mixed copper sulfid from the metallic quicksilver and the metallic gold and silver, it is necessary to keep the mixture as liquid as possible, and this I do by keeping it hot by
20 keeping it under hot water. In this condition I stir it slowly, and the copper sulfid, having a much smaller specific gravity than the metallic quicksilver, silver, or gold, rises continuously to the surface of the metallic ele-
25 ments—viz., amalgam containing silver and gold, or either. If cold water is used, the amalgam remains stiffer and the separation is slower. If no water is added, all the stirring that can be done will cause no perfect separation of the copper sulfid from the amalgam.
30

I desire it to be understood that wherever the term "amalgam" occurs in this specification and in the claims I refer to mercury amalgams.

Having thus described my new and useful 35 method, I desire to secure by Letters Patent—

1. The method of treating amalgams containing copper and precious metals, which consists in adding sulfur to the amalgam at a temperature not exceeding the boiling-point 40 of water, and separating from the amalgam the copper sulfid formed.

2. The method of treating amalgams containing copper and precious metals, which consists in adding sulfur to the amalgam, 45 then adding water, and finally separating the copper sulfid formed.

3. The method of treating amalgams containing copper and precious metals, which consists in adding sulfur to the amalgam, 50 then adding water under the influence of heat, and finally separating the copper sulfid formed.

In testimony whereof I have signed my name to this specification in the presence of 55 two subscribing witnesses.

JOACHIM H. BURFEIND.

Witnesses:

JOHN W. COTTER,
W. C. WREN.