UNITED STATES PATENT OFFICE.

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PROCESS OF SILVER EXTRACTION.

No. 828,287. Specification of Letters Patent. Patented Aug. 7, 1906.

Original application filed July 18, 1905, Serial No. 270,300. Divided and this application filed December 20, 1905. Serial No. 292,554.

To all whom it may concern:

Be it known that I, FRANCIS J. HOBSON, a citizen of the United States, residing at Guanajuato, in the Republic of Mexico, have invented certain new and useful Improvements in Processes of Silver Extraction, of which the following is a specification.

My present invention consists of an improved process for extracting silver from its ores, and particularly from ores in which the silver is present in combination with sulfur, sulfur being present in almost all silver ores. The improved process is of very general application.

Briefly outlined the process consists of treating the ores after such preliminary sizing as may be desired with a solution containing a mercurous potassic cyanid. This salt, the characteristics of which are described in my previous application, Serial No. 270,300, filed July 18, 1905, of which the present case is a division, has a selective affinity for silver in combination with sulfur. This selective affinity I have demonstrated experimentally a great many times. The formula of the salt is $KHgCy_2$. It forms with silver when in combination with sulfur a double salt, the cyanid of silver and potassium, which is freely soluble in water, and also the sulfid of mercury, which is substantially insoluble in water, and passes off with the tailings. The reaction to which I here refer is expressed verbally as follows: silver sulfid + mercurous potassic cyanid = cyanid of silver and potassium + sulfid of mercury, and in chemical symbols the reaction is expressed thus:

$$AgS + KHgCy_2 = KAgCy_2 + HgS.$$

The solvent which I employ in my improved process does not attack gold in any of the forms in which it appears to exist in ore, and although it forms the same salt of silver and potassium in solution as cyanid of potassium when the latter dissolves silver it does not do so in the same way, since potassium cyanid dissolves silver by the well-known Elsner's equation, stated verbally as follows: silver + cyanid of potassium + oxygen + water = cyanid of potassium and silver + potassium hydrate or caustic potash. This equation in chemical symbols is stated thus:

$$2Ag + 4KCy + O + H_2O = 2KAgCy_2 + 2KOH.$$

The same equation applies to the solution of gold, gold replacing silver in it.

Free oxygen in solution is necessary to dissolve silver or gold and form the double salt of potassium and silver or gold with cyanogen.

I may produce the mercurous potassic cyanid in any desired way, since the particular method of its production does not seem to affect the results. I may, for example, add mercurous chlorid (Hg_2Cl_2) to a solution of potassium cyanid, (KCy.) Another method which I may use is to add mercuric chlorid (corrosive sublimate, $HgCl_2$) to the ordinary mill cyanid solutions containing ferrocyanid of potassium, in which case the reaction may be stated verbally thus: ferrocyanid of potassium + mercuric chlorid = ferrocyanid of mercury + chlorid of potassium. This reaction may be expressed in chemical symbols as follows:

$$KFeCy_6 + 2HgCl_2 = Hg_2FeCy_6 + 4KCl.$$

This is succeeded by the following reaction: Ferrocyanid of mercury + cyanid of potassium = ferrocyanid of mercury and potassium + mercurous potassic cyanid. This reaction may be expressed in chemical symbols as follows:

$$Hg_2FeCy_6 + 2KCy = KHgFeCy_6 + KHgCy_2.$$

The most suitable strength of the solution is to some extent dependent upon the silver content of the ore and the form in which the metal is present. I have obtained good results with solutions varying from .05 to .50 per cent. The metal may be separated from the solution in any of the approved methods commonly employed in cyanid processes, such as precipitation by zinc dust or shavings or electrolysis.

The solution should be kept alkaline, and this my be effected by the addition of any suitable alkali, such as caustic potash or soda, although in most cases lime will be found to be not only the cheapest but the best alkali.

I do not in this case claim specifically the formation of the mercurous potassic cyanid by the addition of mercuric chlorid in a solution containing a ferrocyanid, since that is covered by my pending application, Serial No. 292,555, filed December 20, 1905, a division of my original application hereinbefore referred to.

Having thus described my invention, what I claim, and wish to protect by Letters Patent of the United States, is—

1. The process of extracting silver from its ores, which consists in subjecting the ores to the dissolving action of a solution of a mercurous salt of cyanogen and an alkaline metal.

2. The process of extracting silver from its ores, which consists in subjecting the ores to the dissolving action of an alkaline solution of a mercurous salt of cyanogen and an alkaline metal.

3. The process of extracting silver from its ores, which consists of subjecting the ores to the dissolving action of a solution of potassium cyanid to which has been added mercurous chlorid.

4. The process of extracting silver from ores in which it is present in combination with sulfur, which consists in treating the ores with a solution of a mercurous salt of cyanogen and an alkaline metal, thereby forming a solution of cyanids of silver and the alkaline metal and precipitating the sulfid salt of mercury.

5. The process of extracting silver from ores in which it is present in combination with sulfur, which consists in treating the ores with an alkaline solution of potassium cyanid and mercurous chlorid, thereby forming a solution of the double cyanid of silver and potassium and precipitating the sulfid salt of mercury, and then separating the silver from the solution.

6. The process of extracting silver from ores in which it is present in combination with sulfur, which consists in treating the ores with an alkaline solution of mercurous potassic cyanid, thereby forming in solution the double cyanid of silver and potassium and precipitating the sulfid salt of mercury, and then separating the silver from the solution.

7. The process of extracting silver from ores in which it is present in combination with sulfur, which consists in treating the ores with an alkaline solution of mercurous potassic cyanid of strength between .05 and .50 per centum, thereby forming in solution the double cyanid of silver and potassium and precipitating the sulfid salt of mercury, and then separating the silver from the solution.

FRANCIS J. HOBSON.

Witnesses:
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