

UNITED STATES PATENT OFFICE.

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METHOD OF SEPARATING METALS FROM WET-PROCESS LIQUORS.

972,584.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that we, JOHN HERBERT THWAITES, M. Sc., chemical engineer, and STEPHEN JAMIESON RALPH, technical chemist, both subjects of the King of Great Britain, and both residing at Market Chambers, Peterborough, in the county of Northampton, England, have invented a certain new and useful Improved Method of Separating Metals from Wet-Process Liquors, of which the following is a specification.

This invention relates to an improved method of separating copper and other metals from liquors obtained by any known wet process from roasted or unroasted ores, pyrites cinder, residues, ashes, scrap or other like sources, for instance the liquor obtained in the wet copper process or from mines. Such liquors usually contain iron in addition to the copper and frequently also cobalt, nickel and small quantities of other metals.

The object of the invention is to obtain copper compounds substantially free from iron and from other metals commonly occurring in such liquors. In attempting to attain this object by using a known precipitant for copper, namely sulfur dioxide alone or an alkali sulfite, we have found that either the proportion of copper compounds precipitated is insignificant or the copper compounds precipitated are never free from the other metals even when the precipitation is fractional. We have discovered, on the other hand, that the greater part of the copper can be precipitated in a form substantially free from other metals by using the sulfite of an alkaline earth metal in which term we include magnesia. Sulfur dioxide passed into the liquor to which an alkaline earth metal has been added is of course equivalent to the previously prepared sulfite.

In the case of magnesium sulfite care must be taken to add the reagent in deficiency of the proportion necessary to precipitate the whole of the copper, but in the case of the sulfites of calcium, barium and strontium far greater latitude is permissible. According to the invention, therefore, the liquor, which preferably contains only a small percentage of free acid, is treated with one of the aforesaid sulfites, to precipitate copper compounds substantially free from iron. If calcium sulfite is used, calcium sulfate is liable to accompany the copper compounds in the precipitate when sulfates are present in the liquor.

The sulfite may be added to the liquor as such or may be formed in the liquor, such as by mixing a suitable base with the liquor and passing in about sufficient sulfur dioxide to convert the base into normal sulfite assuming that this reaction occurred, and its quantity should be such that the greater part of the copper is precipitated. In the case of many liquors the proportion of copper precipitated is greater per unit weight of sulfite if the liquor is heated with the sulfite and afterward cooled, this being usually the best practice; or if the precipitation is effected without heating and the precipitate is removed, such as by filtration, a further quantity of copper may be precipitated by heating and cooling the filtered liquor; or again, if precipitation and filtration are effected while the liquor is hot, more copper will be precipitated from the filtered liquor when this is cooled. In any case the precipitate is removed from the liquor and is utilized in any suitable manner, for instance it may be smelted to metal. As, however, according to the invention this precipitate of copper compounds is obtained substantially free from iron, it is a feature of the invention that the copper compounds or the greater part thereof in the precipitate can be converted rapidly into copper sulfate by treatment with dilute sulfuric acid and oxidation with air, thus providing a manufacture of copper sulfate substantially free from iron, which is cheaper and more rapid than the dissolution of the pure metal in sulfuric acid. Should the precipitate contain cuprous chlorid, which is generally the case when the liquor contains chlorids, it may be necessary to crystallize fractionally the copper sulfate from the liquor obtained by treatment with sulfuric acid.

If the remainder of the copper is to be recovered independently of the other metals, the liquor from which the precipitate has been removed is treated with a precipitant which will throw out the copper alone, scrap iron or zinc sulfid being examples of suitable precipitants. When the precipitate containing the copper has been removed the iron and cobalt may be precipitated by adding a suitable sulfid or sulfite, such as those of the alkalis or alkaline earths.

Instead of recovering the remainder of the copper first, the liquor from which the precipitate of copper compounds has been removed may be treated with an alkali sulfite,

either added as such or formed in the liquor and after the precipitate of iron and cobalt compounds has been removed the copper may be precipitated by any suitable means, such as by scrap iron. If, however, it is not desired to recover the remainder of the copper independently of the iron and cobalt from the liquor, but by subsequent separation, these metals can all be precipitated together, for example by the addition of an alkali sulfid or an alkaline earth sulfid and the precipitate worked up in known manner.

When iron and cobalt are precipitated together as sulfids, they are easily separated by treating the precipitate with dilute acid which dissolves the iron, leaving the cobalt sulfid as an insoluble residue which may be filtered from the solution of iron salts.

If zinc is present in the liquor, it will be precipitated together with the cobalt whenever the latter is precipitated by any of the above means and may be separated in known manner.

We claim—

1. The method of separating copper from liquors obtained from any wet metallurgical process, which consists in treating the liquor with a sulfite of an alkaline earth metal, substantially as described.
2. The treatment of liquors obtained from any wet metallurgical process for the purpose of obtaining copper sulfate substantially free from iron, which consists in precipitating the copper by means of a sulfite of an alkaline earth metal and treating the precipitate with sulfuric acid and oxidizing with air, whereby copper compounds in the precipitate are converted into copper sulfate; substantially as described.
3. A treatment of liquors obtained from any wet metallurgical process for separating copper and other metals therefrom, consisting in first precipitating the greater part of the copper by means of a sulfite of an alkaline earth metal, then removing the precipitate, then treating the liquor with an agent which will precipitate copper but not iron

or cobalt, then removing the precipitate, and finally treating the liquor with a substance capable of precipitating iron and cobalt together; substantially as described.

4. A treatment of liquors obtained from any wet metallurgical process for separating copper and other metals therefrom, consisting in first precipitating the greater part of the copper by means of a sulfite of an alkaline earth metal, then removing the precipitate, then treating the liquor with an agent which will precipitate copper but not iron or cobalt, then removing the precipitate, and finally treating the liquor with a sulfid to precipitate iron and cobalt together; substantially as described.

5. A treatment of liquors obtained from any wet metallurgical process for separating copper and other metals therefrom, consisting in first precipitating the greater part of the copper by means of a sulfite of an alkaline earth metal, then removing the precipitate, then treating the liquor with scrap iron to precipitate the remainder of the copper, then removing the precipitate and finally treating the liquor with a sulfid to precipitate iron and cobalt together; substantially as described.

6. A treatment of liquors obtained from any wet metallurgical process for separating copper and other metals therefrom, consisting in first precipitating the greater part of the copper by means of a sulfite of an alkaline earth metal, then removing the precipitate and then treating the liquor with an alkali sulfid to precipitate the remainder of the copper, iron and cobalt together; substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN H. THWAITES.
S. JAMIESON RALPH.

Witnesses:

JOSEPH MILLARD,
WALTER J. SKERTEN.