

UNITED STATES PATENT OFFICE

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METHOD OF TREATING ORES

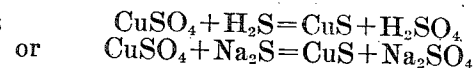
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In the flotation treatment of mixed ores, or ores containing both sulphide and non-sulphide minerals, it is well known that extreme losses of non-sulphide minerals occur and, to a lesser extent, of the sulphide minerals; the latter loss being due to the fact that a part of the sulphide minerals is filmed with oxide or other non-sulphide mineral which renders it refractory to the flotation process.

It is well known that the addition of soluble sulphide such as sodium sulphide, hydrogen sulphide and other soluble sulphides, assist in reducing the above mentioned losses. These soluble sulphides have been used in the past, in this connection, in a variety of ways, but their use has not been attended with signal success.

It is an object of this invention to provide a simple, efficient and economical method or process of recovering copper from ores by subjecting the ore to a treatment to obtain a definite range of hydrogen ion concentration and then bringing the ore into contact with a sulphidizing agent, such as sodium sulphide, hydrogen sulphide, calcium polysulphide or other suitable sulphidizing agents, thereby converting the tarnished sulphide mineral surfaces and the non-sulphide mineral surfaces of sulphide surfaces, or particles, and precipitating any copper in solution as sulphide and subjecting the mass to a flotation process to recover a concentrate.

It is well known that in sulphidizing practice it is not necessary to convert the entire mass of non-sulphide particles to a sulphide, but that it is sufficient to form a surface coating of sulphide on these particles. In the case of any copper sulphate, however, which may be contained in solution in the pulp, this is converted into sulphide by the action of the soluble sulphide used in accordance with the following reaction:



Our invention relates to a process of treating mixed ores and especially ores containing sulphide minerals and ores containing sulphide minerals associated with minerals

other than sulphide minerals; for example:— as in the case of copper minerals our invention relates to a process for treating mixed copper ores and especially ores containing copper sulphide minerals associated with copper minerals other than copper sulphide minerals, such as copper carbonates, copper oxides, etc., whether with or without other metallic minerals.

We have discovered and have proved by actual operation on a large scale that the yield when a soluble sulphidizing agent is used in the recovery of sulphide and non-sulphide metallic minerals from ores is surprisingly increased when the solution in which the ore is contained as a pulp preceding and during sulphidizing treatment has a hydrogen ion concentration of from about 0.00001584786 to about 0.00000031645 grams of ionized hydrogen per liter. In other words, the pulp solution must have from about $10^{-4.8}$ to about $10^{-6.5}$ grams of ionized hydrogen per liter, or as commonly expressed, as about pH 4.8 to about pH 6.5, and will hereinafter be expressed in a like manner.

We have also discovered that when soluble sulphides are applied to a pulp, the solution hydrogen ion concentration of which is either substantially above or substantially below the limits specified, the recovery of sulphide and non-sulphide minerals is very appreciably decreased, to an extent which causes it to fall below the recovery which is made by standard non-sulphidizing flotation practice.

Our invention consists of the steps of the process hereinafter described and claimed. In the accompanying drawing we have shown diagrammatically an apparatus suitable for carrying out our process.

Referring to the drawing, 1 represents a grinding mill (either in closed circuit with some suitable classifying mechanism, or in open circuit) suitable for crushing the ore to the required degree of fineness having a discharge outlet 2 through which the finely ground pulp may be discharged to a trough or launder 3 for conveyance to a conditioning tank or tanks 4 provided with suitable agitating mechanism 5. A conditioning