No. 788,247. Patented April 25, 1905.

UNITED STATES PATENT OFFICE.

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ORE CONCENTRATION.

SPECIFICATION forming part of Letters Patent No. 788,247, dated April 25, 1905.

Application filed March 29, 1904. Serial No. 200,649.

To all whom it may concern:

Be it known that we, ARTHUR EDWARD CATTERMOLE, HENRY LIVINGSTONE SULMAN, and HUGH FITZALIS KIRKPATRICK-PICARD, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in Ore Concentration, of which the following is a specification.

Our process has for its object the separation of minerals from the silicious or earthy matters of ores by means of soaps or similar compounds, and is dependent upon the superior physical attraction exhibited by minerals for fatty or resin acids or for certain other aromatic derivatives—such as cresols, phenols, &c.—which form soluble salts or compounds with alkaline hydrates, as compared with earthy or silicious substances.

The process described in this application relates to a process somewhat similar to the process described and claimed in a copending application filed by us of even date with this application and serially numbered 200,650.

In general the soluble compounds we employ are typified by ordinary soaps, from which the fatty or resin acids are liberated by the addition of a suitable mineral acid and which fatty or resin acids are again rendered completely soluble by the addition of an equivalent of caustic alkali.

In carrying out our invention the suitably-crushed ore is suspended in water, and to the mixture an addition of a small quantity of soap solution is made. A small amount of mineral acid is then added, which decomposes the soluble soap or other similar compound by uniting with the alkaline base thereof, thus liberating in a state of chemical subdivision the fatty or resin acid or other compound, such as cresol, &c., in intimate contact with the suspended ore particles. It is found that the liberated acids, &c., which may even be solid under ordinary conditions are precipitated and adhere to the sulfureted minerals or to sulfur, graphite, or free metals present in the ore, leaving the gangue or earthy particles preferentially wetted by water and free from adhesions of fatty acid and the like. The fatty acid and the like used for the purpose of adhering to the mineral particles is thus produced *in situ* throughout the suspended ore mass in the most intimate contact or admixture therewith. The mineral particles now attached to or more or less coated or inclosed by films of fatty or resin acids and the like are capable of being separated from the gangue or earthy particles by various methods dependent upon this altered physical condition. For example, the coated mineral particles may be removed by generating gaseous bubbles in the mixture which preferentially attach themselves to the fatty or similar acid-coated particles and raise them to the surface of the pulp, whence they may be removed by skimming or the like. If the ore contains a carbonate, any small excess of the acid used to decompose the soap or similar alkaline compound will also liberate bubbles of carbonic acid, which will attach themselves to the fatty acid-coated mineral particles and float them to the surface, or a suitable carbonate (or other substance capable of liberating a gas on the addition of a suitable acid, such as an easily decomposable sulfid, &c.) may be initially added to the ore mass for such purpose, or the mineral particles may be caused to adhere to metallic or other suitable surfaces coated with similar fatty acids, or, finally, the coated mineral particles may be caused to adhere to wood, sawdust, or other suitable material lighter than water coated with similar fatty acids, &c., which can then be removed by flotation, in each case leaving the mineral-free gangue particles capable of rejection. After separation of the coated mineral particles by any of the methods before mentioned the recovered mineral concentrate is subjected to the action of a suitable amount of caustic or carbonated alkali, whereby the fatty or resin acid, &c., recombines completely with the alkali, forming a readily soluble soap or alkaline compound. After draining this off, and washing with water, if necessary, the mineral particles are left clean and free from soap. The resulting solution thus contains all the soap or equivalent compound originally used

in a state ready for immediate employment in the separation of mineral from fresh quantities of ore, and the process becomes completely cyclic with regard to the soap employed.

Throughout the operation the same soap or similar compound is used, the constituent whereof may be quite solid under ordinary conditions, the only additions required being small quantities of mineral acid and alkali for the decomposition and recomposition of this agent during the cycle of operations.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The herein-described process of concentrating ores which consists in mixing a freely-flowing ore pulp with a soap solution and a mineral acid so as to liberate the organic acid from the soap throughout the suspended ore mass in intimate contact therewith, whereby the organic acid coats the desired mineral particles and not the gangue, and thereafter separating the coated mineral matter from the non-coated gangue.

2. The herein-described process of concentrating ores which consists in mixing the ore pulp with a soap solution and a mineral acid which liberates the organic acid from the soap, separating the coated mineral matter from the non-coated gangue and adding alkali to the coated mineral matter to reproduce the soluble soap.

3. The herein-described process of concentrating ores which consists in mixing a freely-flowing ore pulp with a soap solution and a mineral acid so as to liberate the organic acid from the soap throughout the suspended ore mass in intimate contact therewith, bringing the liquor into intimate contact with a gas which will adhere to the coated particles and separating out the coated mineral matter which floats.

4. The herein-described process of concentrating ores which consists in mixing the ore pulp with a soap solution and a mineral acid which liberates the organic acid from the soap, bringing the liquor into intimate contact with a gas, separating out the coated mineral matter which floats and adding thereto an alkali which reproduces the soluble soap.

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

ARTHUR EDWARD CATTERMOLE.
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Witnesses:
T. B. Buss,
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