

UNITED STATES PATENT OFFICE.

CARRIE J. EVERSON, OF CHICAGO, ILLINOIS.

PROCESS OF CONCENTRATING ORES.

SPECIFICATION forming part of Letters Patent No. 348,157, dated August 24, 1886.

Application filed August 29, 1885. Serial No. 175,665. (Specimens.)

To all whom it may concern:

Be it known that I, CARRIE J. EVERSON, of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes of Concentrating Ores; and I do hereby declare that the following is a full, clear, and exact description thereof.

The discovery which forms the basis of my invention is that metals and metallic substances in a comminuted state will unite with compounds of fats or oils and acids, and that such compounds will not unite with comminuted quartz or other rocky gangue. The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral, or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil, or any constituent of a mineral oil, together with an acid, either mineral or vegetable, or a soluble neutral or acid salt, for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed material, whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing or other suitable means.

The invention is more specially applicable to the treatment of ores in which the metal or metallic portion is mixed with quartz or other rock as distinguished from the mixture of mineral with clay, though it is applicable to ores containing alumina, together with quartz or other rock, to the extent of permitting the removal of the silica or sand.

The operation of concentration as a whole, or in its practical form as applied to the separation of rocky mineral ores, involves the reduction of the quartz or other rock containing the mineral to a powder, the addition thereto of the fat or oil and acid or salt, and the subsequent removal of the gangue.

If my invention is inapplicable to any particular rocky ores or class or classes of rocky ores, or to the concentration of any particular metal, such limitations are not now known to me. Its commercial value, however, will probably be restricted to its use in connection with ores bearing the precious metals, such as gold, silver, and copper.

Among the ores upon which I have operated

successfully by means of my invention are the following: Ores containing native gold and silver, kerargyrite, argentite, argentiferous galena, and a variety of double and otherwise compound sulphides of silver, with copper, antimony, arsenic, and other base-metal sulphides. I have also operated successfully upon pyritic ores, white, yellow, green, and intermediate shades, having variable constituents of iron, copper, arsenic, and sulphur, and mostly auriferous, and having variable proportions of such constituents. I have also operated successfully upon ores containing tellurides of gold, silver, and lead, and others containing the oxides and carbonates of copper and the carbonate of lead. All the metals or metallic mineral portions of these ores are acted upon by the admixture described, in such manner as to permit the rocky gangue to be removed by a washing process, after which the several metals may be separated by the usual means.

In putting my invention into practice any fat or oil, and any acid, either mineral or vegetable, or any soluble neutral or acid salt, or any compound of fats and oils with appropriate acids, may probably be successfully employed, at least such is the case with all of these agents with which I have so far experimented. I have used petroleum and one of its several constituents—namely, paraffine-oils—also tallow, (melted,) lard, lard-oil, red-oil, (impure oleic acid,) cotton-seed oil, castor-oil, sperm-oil, and linseed-oil, and some combinations of these with each other. The acids which I have employed are sulphuric, hydrochloric, nitric, phosphoric, acetic, oxalic, tannic, and gallic. I have also used the following salts, to wit: the sulphates and chlorides of sodium, zinc, and copper, and the double sulphate of potash and alumina. The selection of the appropriate agents will, however, be largely determined in the practical working of my invention by the consideration of economy, which will obviously exclude the greater number of those above enumerated. A reasonably cheap and practicable use of my invention will be as follows, the quantity named being suitable for laboratory use and the character of the ore specified, being substantially that of an ore upon which I have successfully operated by the preparation and in the manner hereinafter-described.

Take an ore assaying twelve ounces per ton in silver and containing forty-eight per cent. silica, 6.3 per cent. zinc, 1.5 per cent. copper, fifteen per cent. iron and aluminium, 6.5 per cent. lead, 14.18 per cent. sulphur, 7.19 per cent. arsenic. Of this ore take four (4) ounces by weight in pulverulent form, prepare a mixture containing sulphuric acid, cotton-seed oil, and water, in all about twelve fluid drams, of which ten drams are of water and about two drams are acid and oil in the proportions of fifteen parts of the oil and two parts of the acid by measure. In making this fluid mixture the acid and oil are first mixed with each other, the acid being added to the oil very gradually, so that the temperature will not rise above 120° Fahrenheit. The stirring in of the acid should be thorough, as it tends at first to gravitate to the bottom. After a few hours, in a summer temperature, the mixture will be ready for use, and, preferably, in such a temperature should not be prepared long before using, though if it should have stood long enough to solidify it should be gently heated before adding the water thereto. In winter or in air-tight vessels it may be kept for a number of weeks or even longer, and then rendered fit for mixing with water by heating gently when required for use. The water may be advantageously added in installments of about three equal parts, and the mixture stirred after each addition of water until it stiffens. After stirring in the entire quantity of water the compound is added to the ore, the proportions of ore and compound being chosen with a view to producing a stiff mass after the materials have been incorporated, such proportions being therefore variable in different cases with this end in view. The stirring or incorporation of the ore with the liquid should of course be thorough for the purpose of bringing the mineral into contact with the oil and acid as completely as possible, and after such incorporation the mass is then in condition for the washing out of the quartz by the action of water which will be applied to the mass in sufficient quantities for this purpose. The washing should promptly follow the mixing, and in this operation the mass be opened out or broken up and thoroughly stirred in the water, in order that the sand or quartz may be freed and carried away. In treating so small a bulk as above specified the mass may be squeezed repeatedly in the hand in a basin of water, the substance so manipulated being expressed between the fingers each time it is squeezed, and thus made to expose new surfaces to the water from which the sand will be detached, so as to fall to the bottom of the basin. In practice upon large masses any vessel having an outlet or outlets at its bottom for the escape of the water and sand will be suitable for this operation of washing, and mechanical means will of course be employed to break up the mass. The concentrated mineral will accumulate in a pasty mass or lump or lumps and will contain the metallic portion

of the ore, together with the hydrated oil and acid, which latter may be removed by heating and afterward roasting, or by other suitable means. The use of petroleum or of a constituent thereof, either by itself or in combination with tallow, (heated,) cotton-seed oil, or other fat or oil, will be even less expensive.

When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid or a soluble neutral or acid salt, the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass. In the case of petroleum or its constituent, paraffine-oil, one or two fluid drams of acid to one gallon of water is sufficient for this purpose. The petroleum which I have used was 30° Baumé, and I have found three fluid drams of oil abundant for properly moistening two ounces of heavy ore, or in the ratio of about a barrel of oil to the ton of ore, the amount being, of course, variable with the relative bulkiness of the ore.

In the use of petroleum, or of a liquid constituent thereof, like paraffine-oil, the condition of the concentrated mass is more liquid than when a vegetable or an animal oil or a fatty constituent thereof is used, and a somewhat different means or method should be employed for removing the sand. In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off. Devices and methods now well known in wet separation of ores will be suited to this part of the operation, bearing in mind that the sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil, and acid. A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores. After removing the quartz or rock by washing or any suitable means the mineral may be roasted, in which operation the water, if present, will be dispelled, the oil will burn out, and the acid will be decomposed and eliminated, in the case of sulphuric acid, which will commonly be used, by conversion into sulphurous acid gas, which passes off. In case fixed oils are used the mass may be allowed to stand until the water has run off. To hasten the operation of removing the water the mass may be heated, say, to about 212° Fahrenheit or less, whereupon the water will generally be promptly freed and may be poured off or it may be evaporated. The operation of smelting is facilitated by the presence of the fat acting simply as a fuel.

The disposition made of the mineral or metal after concentration, whether by roasting and subsequent smelting or by smelting without previous roasting, or otherwise, belongs to the

after treatment and is not material to my present invention.

The proportions in which the acids or salts are added to the oils or fats may vary according to the kind of acid or oil employed, and also according to the kind of ore to be treated; and the manipulation of the substances employed may be varied from that above set forth in either formula given. These matters may be determined in individual cases by the operator; and I do not, therefore, restrict myself to any particular proportions of the substances employed, though I have above indicated proportions of certain acids and oils by one of the other of which practical results may be obtained upon almost all varieties of ores.

It is also not essential to my invention that the acid or salt employed with a vegetable oil be added to the oil before the incorporation of the oil with the ore, as it is entirely practicable, at least in most, and possibly in all, cases, to first mix such oil with the ore and thereafter add the acid, as set forth in the use of petrolem.

I am aware that it has been proposed in a patent to Tunbridge, No. 228,004, dated May 25, 1880, to recover finely comminuted metal held in suspension in water by the use of soap or a saponaceous compound formed by a partial or imperfect blending of an alkali or an alkaline salt with a fat or an oil. The action of the soap or saponaceous compound when diffused through hard water containing the metal in suspension is to form with the lime salt in the water a coagulum in which the particles of metal are enveloped and by which they are held during a subsequent removal of the water. When the water is soft a lime salt must be added to form the coagulum. I disclaim the use of any substance in connection with the fats and oils capable of saponifying them. I also disclaim the method set forth in said Tunbridge patent as being entirely dissimilar to that herein claimed. Said

Tunbridge method is stated in said patent to consist "in first depriving the water of as much earthy non-metallic matter as possible," this being effected by any of the ordinary methods in use for that purpose, such as letting it stand until the earthy matter precipitates. My invention, on the other hand, has reference solely to the separation of metal or metallic mineral from earthy non-metallic matter, (rocky gangue,) and not to its subsequent separation from water. In the practice of my method, moreover, the metal or mineral and non-metallic matter (rocky gangue) are together and in the first instance mixed with the fat or oil, and the non-metallic matter is afterward separated from the metal or mineral by the peculiar action of the acid or soluble neutral or acid salt operating in the presence of water to detach the gangue from the mass.

With the understanding that I am not restricted in the matters mentioned, I claim, broadly—

1. In the separation of pulverulent ores containing rocky gangue, the method of treatment herein described, which consists in mixing with such pulverulent ore a fat or an oil or a constituent thereof, an acid or soluble neutral or acid salt, and water, finally breaking up the mass to allow the sand to separate therefrom.

2. The method, substantially as described, of separating metals or metallic minerals from rocky gangues, which consists in mixing a fat or an oil or a constituent thereof with pulverized ore and washing out the gangue with water containing an acid or a soluble neutral or acid salt.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

CARRIE J. EVERSON.

Witnesses:

M. E. DAYTON,
G. F. LANAGHEN.