

UNITED STATES PATENT OFFICE.

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PROCESS OF SEPARATING ORES.

1,043,850.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, ALFRED ARTHUR LOCKWOOD, a subject of the King of Great Britain, residing at Baltic House, 27 Leadenhall street, in the city of London, England, have invented new and useful Processes of Separating Ores, of which the following is a specification.

It has been discovered that the behavior of an oily liquid, under which term it is intended to include a magnetic paint, (which usually consists of a mixture of magnetite with an oily liquid,) toward the constituents of an ore, (under which term it is intended to include magnetite,) can be greatly modified by the employment of a silicate of an alkali metal. Thus the addition of such silicate before or simultaneously with an oily liquid or a magnetic paint allows the metallic particles of one or more metals to be magnetically prepared in preference to the metalliferous particles of another metal or metals, or enables the gangue to be oiled or magnetically prepared, with the employment of a suitable oil, to the exclusion of the metalliferous particles of one or more metals. Again ores whose metallic constituents consist wholly or partially of oxides or carbonates are easily and cheaply oiled or prepared with magnetite to the exclusion of the gangue by adding such silicate at some stage of the process.

As will be seen by the examples a larger quantity of silicate is required for preparing the metalliferous constituents of an oxidized ore than for hindering the magnetic preparation or oiling of one or more of the metals in an ore containing a plurality of metals while a still larger quantity of silicate is required to magnetically prepare or oil a gangue to the exclusion of the metalliferous particles. It may therefore be preferable when treating oxidized ores to add the silicate after agitation with the paint or oil when the ore to be treated contains a plurality of metals one of which is differentially affected by the silicate. If when treating an oxidized ore of which it is desired to magnetically prepare or oil the metalliferous particles, the distinction between this process and that of magnetically preparing or oiling the gangue alone is not sufficiently sharply divided with any ore, it may be advisable to employ for this former purpose exclusively oils which do not easily

coat the gangue or to add the silicate after agitation with the paint or oil.

Example I: 500 lbs. of a sulfid ore in a silica gangue assaying 13.7% lead, 16.35% zinc and 13 oz. of silver per ton are agitated for twenty minutes with silicate of soda, equivalent in amount to 20 oz. of a 5° Baumé solution, 800 lbs. of water and 20 lbs. of a magnetic paint composed of two parts by weight of magnetite to one of a residuum oil. This charge is then treated in a preferably wet magnetic separator with the result that the major portion of the lead and the silver are attracted and thus separated from the major portion of the zinc and the remaining silver.

Example II: 300 lbs. of a sulfid ore in a calcite baryta gangue containing considerable quantities of iron pyrites and assaying 13.65% lead and 21.5% of zinc is agitated for twenty minutes with 96 oz. of a 5° Baumé silicate of soda solution, 480 lbs. of water and 9 lbs. of magnetic paint. After treatment in a magnetic separator it will be found that the major portion of the lead is attracted and thus separated from the zinc, gangue and iron pyrites.

Example III: 100 lbs. of a sulfid ore in a baryta gangue and assaying 12% lead and 30% zinc and containing iron pyrites is agitated for thirty minutes with 1.5 lbs. of a preferably alkaline 5° Baumé silicate of soda solution, 100 lbs. of water and 4½ lbs. of magnetic paint. In many cases it is necessary when it is desired to extract the gangue to employ some saponifiable oil or olein in the magnetic paint; thus in the magnetic paint referred to in Example I 5% of the residuum oil is in the present example replaced with a saponifiable oil such as whale oil or olive oil, or olein. On treating in a magnetic separator the baryta is extracted leaving the zinc, iron pyrites and lead as a concentrate.

In Examples I and II the zinc sulfid is separated from the gangue and iron pyrites in any convenient manner and this may take place by means of a second magnetic preparation process in which case it will be found necessary first to slightly acidify the mixture of zinc sulfid and gangue. In many cases it will be found that after acidification the iron pyrites will follow the gangue and not the zinc.

In Example III the lead may afterward

be separated from the zinc and iron as described in the preceding examples, after if necessary partial neutralization of the silicate.

- 5 Example IV: 100 lbs. of a very much oxidized copper glance ore in a schistose gangue assaying 3% copper was agitated for about thirty minutes with 100 lbs. of a 5° Baumé silicate of soda solution and a
10 paint consisting of a mixture of 1.6 lbs. Texas residuum oil and 3.2 lbs. of magnetite. When passed through a wet magnetic separator an extraction of 86% copper was obtained. As magnetite is really an example
15 of an oxidized ore (and is intended to be included in such term) this invention enables magnetite which has been previously wetted with water by the aid of the silicates to be easily incorporated with oil. Mag-
20 netite as recovered in present practice from the metalliferous particles to which it is attached is admixed with water and hitherto it has been necessary to evaporate the occluded water. It can now be incorporated
25 with an oil as follows:—

Example V: To the magnetite and water is added 1 oz. to 5 oz. of silicate of soda for every 100 lbs. of water. By adding oil and agitating a magnetic paint can be made.

- 30 In all these examples it is to be understood that the water employed is a neutral water.

Although it is usual to form the magnetic paint by mixing dry magnetite with oil and
35 such as has been described in the examples it follows from the result of Example V that when treating an ore, whether sulfid or other, it is not necessary previously to mix the magnetite with the oil, but the mag-
40 netite while wetted with water may be agitated together with the ore and the oil.

- Example VI: 50 lbs. of an oxid and carbonate of copper ore in a quartzite gangue, assaying 4.2% copper, were agitated with
45 1% of oil made up of 3 parts mineral residuum oil and 1 part cotton seed oil, together with 3 lbs. silicate of soda in 54 lbs. water. This was then subjected to the

ordinary hot acid water flotation process, an extraction of 75% copper being obtained 50 without taking into account the copper dissolved.

What I claim is:—

1. In the treatment of an ore the process which consists in treating the ore with an 55 oily liquid, water and with a silicate of an alkali metal to modify the behavior of the oil toward the constituents in the ore and separating the oiled constituents from the un-
60 oiled constituents.

2. In the treatment of an ore the process which consists in treating an ore containing a plurality of metals with an oily liquid, water and with a silicate of an alkali metal to hinder the oiling of the particles of one 65 or more of the metals in such ore and separating the oiled constituents from the un-
oiled constituents.

3. In the treatment of an ore the process which consists in treating an oxidized ore 70 with an oily liquid and with a silicate of an alkali metal to aid the oiling of the metalliferous constituents of the ore and separating the oiled constituents from the un-
75 oiled constituents.

4. In the treatment of an ore the process which consists in treating the ore and magnetite while mixed with water, with an oily liquid in the presence of a silicate of an alkali metal and magnetically separating 80 the mixture.

5. The process of treating an ore containing a plurality of metals, which consists in oiling the metalliferous particles of one of said metals by the aid of a silicate of an 85 alkali metal, separating the oiled metalliferous particles from the un-
oiled metalliferous particles, adding an acid, and afterward oiling the un-
oiled metalliferous particles without the aid of a silicate and then 90 separating the remaining metalliferous particles from the gangue.

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Witnesses:

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