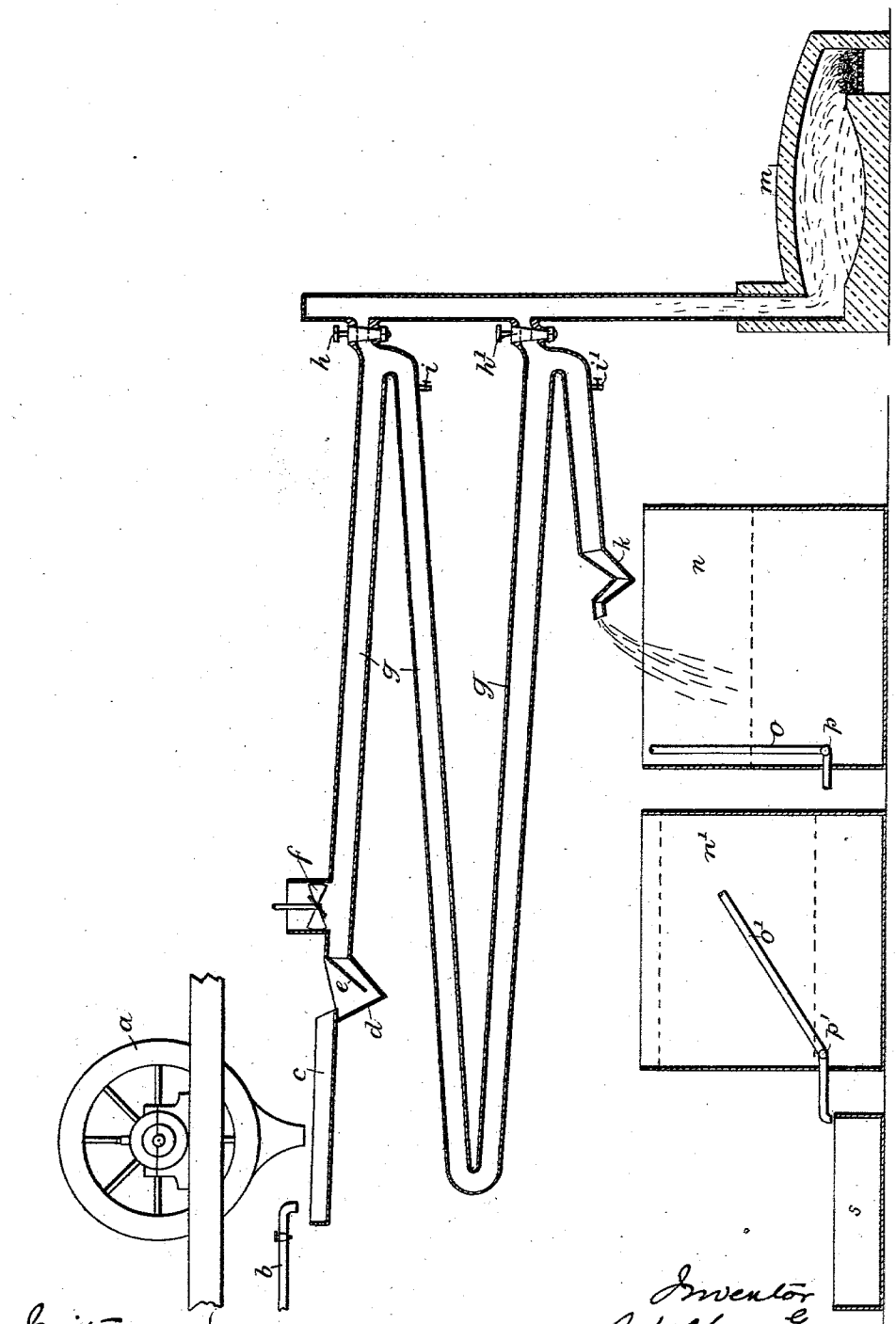
No. 717,565. PATENTED JAN. 6, 1903.

A. VON GERNET.

PROCESS OF EXTRACTING COPPER FROM ITS ORES.

APPLICATION FILED JULY 16, 1901.

NO MODEL.



Witnessed
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ADOLF VON GERNET, OF LONDON, ENGLAND.

PROCESS OF EXTRACTING COPPER FROM ITS ORES.

SPECIFICATION forming part of Letters Patent No. 717,565, dated January 6, 1903.

Application filed July 16, 1901. Serial No. 68,508. (No specimens.)

To all whom it may concern:

Be it known that I, ADOLF VON GERNET, a subject of the Emperor of Russia, residing at London, England, have invented a certain new and useful Improved Process of Extracting Copper from its Ore, of which the following is a specification.

My invention relates to an improved process for extracting copper from its ore.

According to this invention a low-grade ore can be continuously and commercially utilized, and this end is attained by continuously dissolving the flowing copper oxids or carbonates in an aqueous solution of sulfurous acid, so as to convert them into a cuprous-sulfite (Cu_2SO_3) solution, from which the solid sulfite may be obtained in any of the known methods. If it be desired to treat a sulfid ore, it may be done by first oxidizing it and utilizing the sulfur driven off for the production of the sulfurous acid, (SO_2,) or such acid may be produced by burning sulfur or by roasting pyritic ore, as is well known. As the solubility of cuprous sulfite, even in water containing free sulfurous acid, is very limited, a considerable amount of water is necessary; but the water may be used over and over again after the solid cuprous sulfite has been removed.

In the accompanying drawing is diagrammatically illustrated a convenient apparatus for carrying the invention into practical use.

In said drawing the ore crushed to a fineness which will enable it to pass through a sieve having twenty to eighty holes per lineal inch passes from the crushing-mill or other source of supply *a* to a launder or trough *c*, in which it meets with water flowing in from *b* and generally of five to ten times its weight. The pulp thus formed flows into a trap *d*, provided with a plate *e* or other means to prevent the outflow of sulfurous-acid gas drawn up from a furnace *m* through closed inclined trough *g* and regulating-valves *h* by fan or exhauster *f*. Taps *i* may also be provided at suitable points to enable samples of the pulp to be taken, and the fully-treated pulp is discharged through trap *k* into settling-tanks *n n*, which may be connected by pivotally-mounted decanting or draw-off pipes *o*, delivering eventually into precipitation-boxes *s* or electrolyzing or other baths.

The continuous motion of the ore through the troughs *g* tends to prevent any insoluble salts of lime from adhering to the sulfite formed or to the oxids or carbonates of the ore, while an excess of atmospheric oxygen and free sulfurous acid in the solution will tend to prevent the sulfite forming an insoluble basic salt, even if iron-salts be present in the solution.

The time required for the treatment will vary with the nature of the ore treated, and it will be generally necessary to experimentally determine for each ore the rate of flow and length of covered trough necessary. In some cases a flow through twelve yards' length of covered trough inclined at an angle to give about one-half a yard fall will be sufficient, and in other cases a much longer trough and even a slower flow may be essential, or the pulp and water may be pumped up from the settling-tanks *n n* and caused to flow again through the troughs, meeting fresh quantities of sulfurous acid, until the eventual point of saturation of the cuprous sulfite is reached, which may be roughly taken at about one-half of one per cent. For successful treatment it is necessary to use such a quantity of sulfurous acid as will not only produce the sulfite, but will also leave a certain amount of the acid in the water.

The solution eventually drawn off should be of a clear green color, and this may be heated to drive off free SO_2, or the sulfite and sulfate may be precipitated by adding iron, which will also precipitate metallic copper from any sulfate-of-copper solution which has been formed by the oxygen of the air carried in with the sulfurous-acid gas acting on the sulfite solution, and in practice it will generally be found that the precipitate consists of all three substances—namely, metallic copper, sulfite of copper, and sulfid thereof. In either case the cuprous sulfite will come down as a bright-red crystalline powder. If electrolysis be employed, it will generally be preferable to employ peroxid-of-lead anodes and copper cathodes, in which case the copper will be rapidly precipitated, partly as cuprous sulfite and partly as cuprous sulfid, as with precipitation by iron if sulfate-of-copper solution be present then metallic copper will be deposited therefrom; but the action of

the electric current on the solution disengages sulfureted hydrogen which chemically reacts on the cuprous sulfite and precipitates it chemically in the form of a powder.

To obtain metallic copper, the precipitate may be roasted to drive off the contained sulfur, after which it may be smelted in the ordinary way.

The pulp remaining in the settling-tanks is washed with water to remove any copper solution contained therein, and this wash-water may be employed as a first solution with a fresh lot of ore.

It is of course known to scientists that sulfurous acid is a solvent for copper oxids and carbonates, and it is also known that metal held in solution may be precipitated by adding another metal having a greater affinity for the solvent, and it is of course known that metallic solutions can be electrolyzed; but, so far as I am aware, no process has heretofore been devised for treating copper ores with sulfurous acid by a continuous process in which there is constantly present an excess of free sulfurous acid in the solution and in which all mechanical agitation of the pulp is avoided.

I declare that what I claim is—

1. The process substantially as herein described of extracting copper from its ore, which consists in slowly passing the ore in the form of pulp through a current of sulfurous acid passed in a direction opposite to that of the travel of the pulp.

2. The process substantially as herein described of extracting copper from its ore which consists in passing the ore continuously in the form of pulp through a trough inclined at such an angle to the horizontal that the pulp will travel slowly down the trough, and at the same time passing a current of sulfurous acid through the trough in a direction opposite to its travel.

3. The process substantially as herein described of extracting copper from its ore which consists in continually passing oxids and carbonates of the ore in the form of pulp through a trough inclined at such an angle to the horizontal that the pulp will travel slowly down the trough, and at the same time passing through said trough an aqueous solution of sulfurous acid containing sufficient SO_2 and water to form the copper-salt and to cause the same to go into solution therein, and then extracting the contained salt and the metallic copper therefrom.

4. The process substantially as herein described of extracting copper from its ore which consists in continually passing oxids and carbonates of the ore in the form of pulp through a trough inclined at such an angle to the horizontal that the pulp will travel slowly down the trough and at the same time passing a current of sulfurous acid and air through said trough thereby producing a soluble sulfite of copper, and preventing formation of insoluble basic salts.

5. The process substantially as herein described of extracting copper from its ore which consists in continually passing oxids and carbonates of the ore in the form of pulp through a trapped inlet to a covered launder inclined at such an angle to the horizontal that the pulp will travel slowly down the launder, providing said inclined launder with trapped outlets and gas inlet and exhaust valves, and continuously passing through the valves and launder a current of sulfurous acid, and discharging the resultant sulfite-of-copper solution into settling-tanks.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ADOLF VON GERNET.

Witnesses:
L. PALMER,
E. OEHM.