

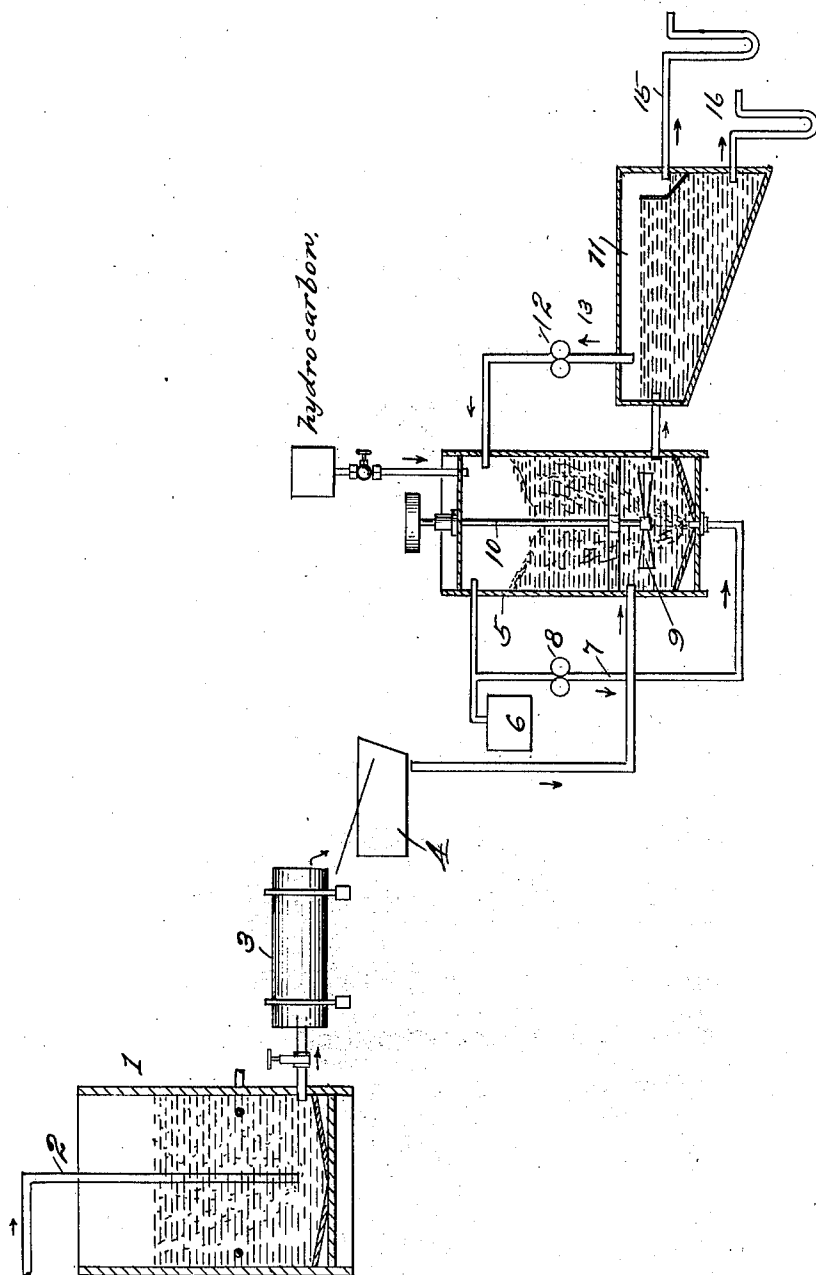
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METHOD OF ORE TREATMENT

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WITNESSES:

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METHOD OF ORE TREATMENT.

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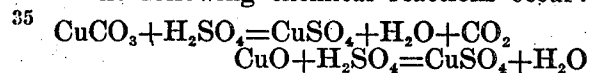
This invention relates to improvements in methods of ore treatment and has for its object the extraction, concentration and recovery of metalliferous constituents not readily susceptible to concentration; and to provide a process transforming such constituents rendering them amenable to gravity and flotation methods of recovery, and consists in treating pulverized ores with a solvent of certain metalliferous constituents and precipitating the dissolved metals within the pulp and recovering the precipitated and other metalliferous constituents by concentration.

I do not confine myself to special reagents nor apparatus.

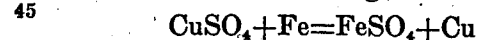
The drawing illustrates one form of apparatus, with which the process can be carried out.

One way of carrying out my invention in the treatment of ores containing copper carbonate or oxide is to treat the pulverized ore with a solvent such as dilute sulphuric acid in tank 1, by agitation produced by air under pressure through pipe 2. I prefer to have the ore pulverized to pass a forty mesh sieve, or finer; and find an acid solution from two to five per cent efficient depending on the value and character of the ore. This agitation may be performed with or without the aid of heat preferably introduced by steam under pressure.

The following chemical reactions occur:



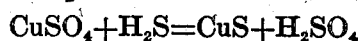
The pulp is transferred to a revolvable drum or other suitable apparatus 3, in which is an element, elements or reagent capable of precipitating the copper in a form susceptible to concentration. This precipitant may be a metallic element such as iron and the following reaction occurs:



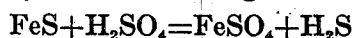
The pulp is next subjected to concentration on a suitable machine, such as a Deister slime table 4, where a portion of the copper is separated and removed from the gangue.

The pulp is then treated to the action

of hydrogen-sulphide gas in tank 5, and the remaining dissolved copper precipitated as a sulphide.



This hydrogen sulphide gas may be produced by the chemical reaction between ferrous sulphide and dilute sulphonic acid preferably in an external generator 6:



or by other suitable means.

The pulp is agitated in this tank by circulating the gas through pipe 7 and blower 8, and a propeller 9 on revoluble shaft 10. A small amount of suitable hydro-carbon is added and thoroughly disseminated through the pulp by the agitation and readily films and collects the precipitated copper sulphide, precipitated metallic copper and natural sulphides.

The amount and character of the hydro-carbon depends on the ore under treatment, and I do not limit myself to its use, but have found less than one per cent oil of tar and crude oil satisfactory.

The pulp is then subjected to a partial vacuum in apparatus 11, maintained by suction pump 12, through pipe 13, which returns the hydrogen sulphide gas to tank 5. In this apparatus the hydro-carbon coated or filmed metalliferous constituents separate and, assisted by the partial vacuum, float upon the surface of the pulp and overflow baffle 14, discharging at 15, the gangue residues discharging at 16.

In treating certain ores of copper I first subject them to heat in a suitable furnace to render the copper soluble.

The process described may be continuous or intermittent, and may be performed in any suitable manner, the essential features of which are the solution and precipitation of metalliferous constituents in ores and recovering the precipitated metalliferous constituents from the pulp by concentration.

It is understood that some solvents will affect certain constituents and not others as copper carbonate will be dissolved by dilute sulphuric acid while iron pyrite will

not, and, therefore, that I will utilize such solvents as will effect the solution of the desired metal.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. The process of treating oxidized ores which comprises dissolving certain metal-liferous constituents with a suitable solvent, precipitating such dissolved constituents in elemental form back into the pulp, and concentrating the resulting pulp by a settling treatment.

2. The process of treating oxidized ores which comprises dissolving certain metal-liferous constituents with a suitable solvent, precipitating such dissolved constituents in elemental form back into the pulp, and concentrating the resulting pulp in part by a settling treatment and in part by an oil flotation process.

3. The process of treating oxidized ores which comprises dissolving certain metal-liferous constituents with a suitable solvent, precipitating part of such dissolved constituents back into the pulp in elemental form, concentrating the pulp by a settling treatment, precipitating the rest of such constituents in the form of sulfides, and then concentrating by an oil flotation process.

4. The process of treating copper containing oxidized ores which comprises dissolving the copper with a suitable solvent, precipitating the copper back into the pulp in elemental form, and concentrating the resulting pulp by a settling treatment.

5. The process of treating copper-containing oxidized ores which comprises dissolving the copper with a suitable solvent, precipitating the copper in elemental form back into the pulp and concentrating the resulting pulp in part by a settling treatment and in part by an oil flotation process.

6. The process of treating copper-containing ores which comprises dissolving the copper with a suitable solvent, precipitating part of the copper back into the pulp in elemental form, subjecting the pulp to a settling treatment, precipitating the rest of the copper in the form of an insoluble compound, and then concentrating by an oil flotation process.

7. The process of treating copper-containing oxidized ores which comprises dissolving the copper with a suitable solvent, precipitating part of the copper back into the pulp in elemental form, subjecting the pulp to a settling treatment, precipitating the rest of the copper in the form of the sulphide, and then concentrating by an oil flotation process.

8. The process of treating copper-containing oxidized ores which comprises dissolving the copper with a suitable solvent, precipitating the copper back into the pulp

by treatment with metallic iron, and concentrating the resulting pulp by a settling treatment.

9. The process of treating copper-containing oxidized ores which comprises dissolving the copper with a suitable solvent, precipitating part of the copper back into the pulp in metallic form by treatment with metallic iron, subjecting the pulp to a settling treatment, precipitating the rest of the copper as sulphide and then concentrating by an oil flotation process.

10. The process of treating copper-containing oxidized ores which comprises dissolving the copper with dilute sulphuric acid, precipitating the copper in elemental form back into the pulp and concentrating the resulting pulp by a settling treatment.

11. In a process of the class described, the following steps: subjecting a pulp containing copper oxide ore to the action of a solvent for copper oxide; thereafter precipitating dissolved copper from the solution back on the pulp in elemental form; thereafter concentrating the pulp mixture by a flotation process.

12. In a process of treating ore containing copper oxide and copper sulphide, the following steps: comminuting the ore and forming a pulp thereof; subjecting the pulp to the action of a solvent of copper oxide; precipitating dissolved copper from the solution in elemental form; subjecting the pulp mixture to a flotation process.

13. In a process of treating metalliferous ore, the following steps: comminuting the ore and forming a pulp thereof; subjecting such pulp to the action of a solvent of certain metalliferous constituents of the ore; precipitating the metal of such dissolved constituents from the solution in elemental form; concentrating the pulp mixture by flotation.

14. In a process for the treatment of ore containing copper oxide, the following steps: comminuting the ore and forming a pulp thereof; subjecting such pulp to the action of a solvent, as sulphuric acid, for copper oxide; precipitating dissolved copper from the solution in elemental form; concentrating the pulp mixture by a flotation process.

15. In a process for the treatment of ore containing copper oxide, the following steps: comminuting the ore and forming a pulp thereof; subjecting such pulp to the action of a solvent, as sulphuric acid, of copper oxide; precipitating dissolved copper from the solution in elemental form by the addition of iron; and concentrating the pulp mixture by a flotation process.

16. A process for the treatment of ore containing oxide copper, consisting in comminuting the ore and forming a pulp thereof, subjecting such ore to the action of a solvent to dissolve the oxide copper, there-

after precipitating dissolved copper from the solution in elemental form back on the pulp and subjecting the pulp mixture to concentration to recover the precipitated
5 copper from the gangue.

17. A process for the treatment of ore containing oxide copper, consisting in comminuting the ore and forming a pulp thereof, subjecting such ore to the action of a
10 solvent to dissolve the oxide copper, there-

after precipitating dissolved copper from the solution in elemental form back on the pulp and subjecting the pulp mixture to concentration to recover the precipitated copper and naturally occurring copper sul- 15 phide from the gangue.

In testimony whereof I have hereunto set my hand.

JOSEPH T. TERRY, JR.