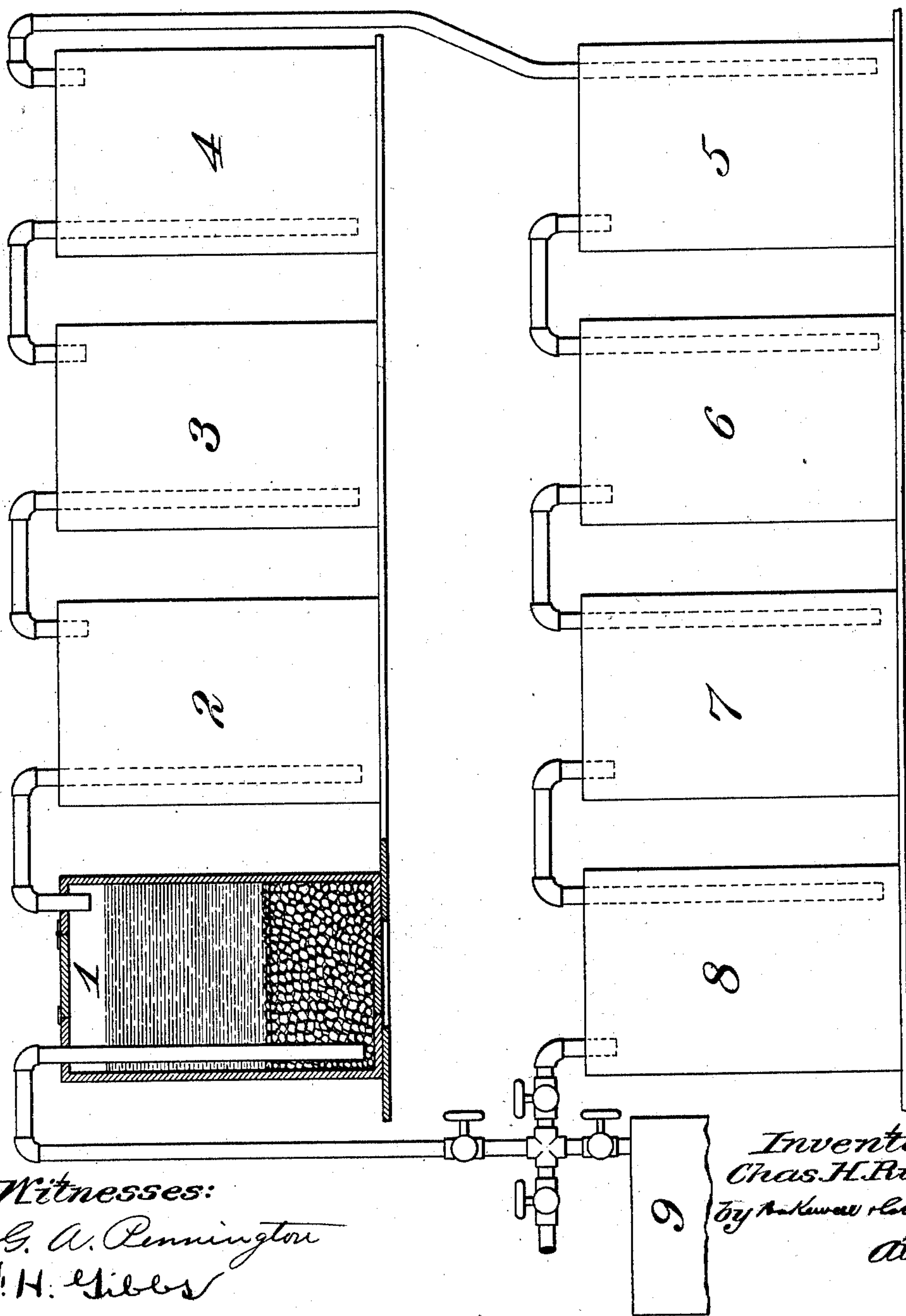


No. 759,191.

PATENTED MAY 3, 1904.

C. H. RIDER.
PROCESS OF TREATING COPPER ORES.
APPLICATION FILED MAR. 19, 1903.

NO MODEL.



Witnesses:

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UNITED STATES PATENT OFFICE.

CHARLES H. RIDER, OF ST. LOUIS, MISSOURI.

PROCESS OF TREATING COPPER ORES.

SPECIFICATION forming part of Letters Patent No. 759,191, dated May 3, 1904.

Original application filed May 22, 1902, Serial No. 108,519. Divided and this application filed March 19, 1903. Serial No. 148,569. (No specimens.)

To all whom it may concern:

Be it known that I, CHARLES H. RIDER, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Processes of Treating Copper Ores, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, forming part of this specification.

This application is a division from an application filed by me May 22, 1902, Serial No. 108,519, for process of treating ores.

This invention relates to a new and useful process of extracting metals from ores, the object being to extract copper in metallic state.

Another object of the process is to recover the extracting and precipitating agents in the form of by-products for repeated use in carrying on the improved process.

In the drawing I have shown an apparatus for working my improved process, the same in this instance consisting of eight tanks numbered, respectively, from 1 to 8, inclusive, said tanks being connected by pipes running from the top of one of them down into the bottom of the next adjacent tank of higher order. These tanks are constructed of wood and made so as to be preferably air-tight by the use of rubber placed under a removable cover so arranged in the top wall thereof and a dumping-door being arranged in the bottom thereof. Openings are also provided whereby the resultant liquid in the tanks may be racked or drawn off.

In general operation the ore after being finely pulverized is placed in tanks 1 to 4, inclusive, and the dissolving solution added through the opening in the top, said opening being subsequently closed. The action of the chemicals on the pulverized ore causes a steady and rapid flow of gas from the top of one tank to the bottom of the next adjacent tank of higher order, which results in keeping the ore constantly in motion until all the soluble matter is decomposed, which is effected usually in from ten to twelve hours. This agitation of the ore effects a quicker decomposition

than would be possible if the ore was permitted to lie in a quiescent state in the bottoms of the several tanks. After the decomposition referred to sufficient time is allowed for the solid matter to settle, and the clear fluid is drawn off and placed in tanks 5 to 8. The residue in tanks 1 to 4 is preferably washed with clear water and allowed to settle, after which the water is transferred to the clear fluid. The residue in tanks 1 to 4 in the form of sulfur silica or earthy matter is discharged through the openings in the bottoms of the respective tanks. For the sake of description I will term tanks 5 to 8 the "precipitating-tanks," into which the clear solution from tanks 1 to 4 is placed in following the first step of my process. The second step consists in recharging the first four tanks and repeating the operation above described, the resultant gases produced thereby being carried through the precipitating-tanks for the purpose of agitating the fluid after the proper precipitating reagent has been added thereto. This agitation of the contents in the precipitating-tanks hastens this operation, and in most cases the gases coming over from the decomposing-tanks supply some necessary element or elements required. In this manner the process of manufacturing carbonates, hydrates, &c., is cheapened.

In order to illustrate my improved process as used in the production of copper, the ore is ground to pass through a twenty to forty mesh screen. A charge of five hundred pounds is added to each of the tanks 1 to 4. To this is added in each tank a solution composed of fifty gallons of saturated solution of sodium chlorid, fifteen gallons of commercial nitric acid, and one hundred gallons of water. The covers of tanks 1 to 4 should be closed tightly upon the introduction of this solution, as chlorine gas is generated immediately, and in passing over into the next tank the contents are kept in constant motion until the metallic elements are completely dissolved. During this first operation tanks 5 to 8, inclusive, should be partly filled with water, and the pipe leading from the end of tank 8 should connect with a gas-receiver 9. During the operation

of dissolving the ore the stop-cocks at the left should be adjusted so as to permit all the gas passing out of tank 8 to enter the gas-receiver 9. In copper ore the metallic elements are usually completely dissolved in from one to three hours. After the above operation the water from tanks 5 to 8 should be removed to a proper receptacle. This water is to be used in making the solution of sodium chlorid. With a siphon draw off from tanks 1 to 4 the clear solution containing the metallic elements and place in tanks 5 to 8. Add to the residue in tanks 1 to 4 about ten gallons of pure water to each tank. After this solution has become clear remove by siphon and add to corresponding tanks 5 to 8, wherein the copper is precipitated by using in said tanks smooth iron. (Any old iron will answer the purpose if freed from rust.)

In extracting copper it is best to use ten or more tanks, using two or more tanks following the ore-tanks, said last-mentioned tanks being partly filled with water. This will take up the gases from the ore-tanks, forming an acid, usually hydrochloric acid, to be used again in the next charge, in which case less acid may be used than before. Solutions from the precipitating-tanks may be profitably used again on copper ores. The tanks 1 to 4 may be again charged with ore, as previously described, and a small quantity of the acid solution may be added as required. Adjust the gas-pipe to the gas-receiver 9, as previously described. As soon as the fluids in the tanks have become quiet allow to settle for from two to three hours or until such time as the solution becomes clear, which may be ascertained by carefully closing the pipe leading to the gas-receiver and opening tank 8. I have found by actual working of the process that by confinement of all the elements in a solid, liquid, or gaseous state during the chemical changes the power of the chemical action in dissolving and precipitating the various metals is increased fully five hundred per cent. This, together with the reproduction of a number of compounds and the saving in fuel, labor, &c., and avoiding all danger of escaping gases which tend to destroy life, especially in the processes at present employed, is a great advantage.

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

1. The herein-described process of extracting copper from its ores comprising the following steps; viz., crushing the ore, charging a series of connected receptacles therewith,

adding thereto a solvent comprising sodium chlorid, nitric acid and water, closing said receptacles, and permitting the gases generated therein to circulate through the said several receptacles and through a second series of receptacles, connected thereto, containing water, removing the water from the second series and charging the same with the metal-impregnated fluid from the first series of receptacles and precipitating the copper therein; substantially as described.

2. The herein-described process of extracting copper comprising the following steps; viz., charging a series of receptacles with a mixture of copper ore and a dissolving solution, causing circulation of the generated gases therefrom through the several receptacles of the series, removing the resultant ore-impregnated fluid to a second series of gas-connected receptacles and precipitating the copper therein by means of a precipitating reagent and aiding such precipitation by agitation resulting from the passage of gas there-through which gas is generated in the first series of receptacles; substantially as hereinbefore described.

3. The herein-described process of extracting copper comprising the following steps; viz., charging a series of receptacles with a mixture of copper ore and a dissolving solution, causing circulation of the generated gases therefrom through the several receptacles of the series, removing the resultant ore-impregnated fluid to a second series of gas-connected receptacles and precipitating the copper therein by means of metallic iron and aiding such precipitation by agitation resulting from the passage of gas therethrough which gas is generated in the first series of receptacles; substantially as hereinbefore described.

4. The herein described process of treating copper-bearing ores, the same consisting in placing a charge of finely-ground ore in a tank, adding a solution of nitric acid and chlorid of sodium, then placing the clear solution in a second tank, adding iron to precipitate the copper, then recharging the first-mentioned tank, and finally passing the gases generated therein through the precipitating-tank; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 2d day of March, 1903.

CHARLES H. RIDER.

Witnesses:

F. H. GIBBS,

GEORGE BAKEWELL.