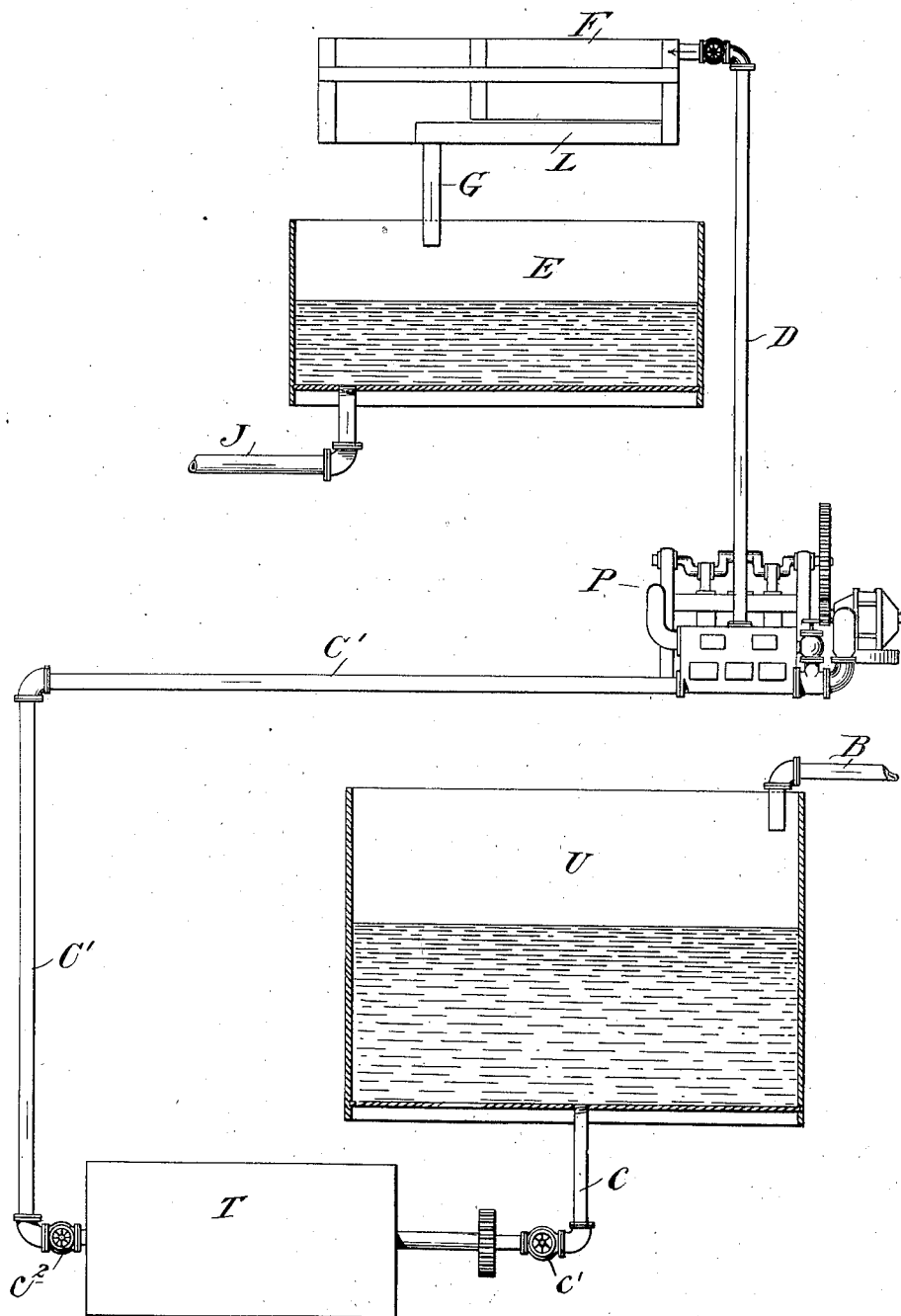


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 PROCESS OF PRECIPITATION OF MATERIAL FROM CYANID SOLUTIONS.
 APPLICATION FILED JULY 15, 1911.

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Patented June 3, 1913.



Witnesses:
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 By his Attorney
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UNITED STATES PATENT OFFICE.

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PROCESS OF PRECIPITATION OF MATERIAL FROM CYANID SOLUTIONS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES W. MERRILL, a citizen of the United States of America, and resident of Berkeley, Alameda county, State of California, have invented new and useful Improvements in Processes of Precipitation of Material from Cyanid Solutions, of which the following is a specification.

In practice zinc threads or shavings if necessary and zinc fume or dust have heretofore been used in order to precipitate precious metals from cyanid solutions. The objections to the use of threads or shavings of zinc are first, the cost of preparing them, second, that even when tightly packed, a number of boxes must be placed in tandem in order to insure each particle of solution to be treated coming in contact with the zinc, which results in an unnecessarily large consumption of zinc and cyanid; third, the zinc becomes rapidly polarized and coated and must be moved and washed frequently to insure good precipitation; fourth, this frequent handling offers opportunity for theft. Hence the use of zinc dust has overcome many of these objections, largely superseding the use of threads or shavings, but it too has defects which have developed in its use, and some of which are as follows: First, it contains a widely varying proportion of oxid and other impurities, many of which are not only useless as precipitating media, but destructive of cyanid, or difficult to eliminate in the subsequent refining of the precipitate. Second, the increase in the use of the zinc fume in this art has resulted in an advance in the cost of this material until it now exceeds that of spelter. Third, the transportation and storage of the fume is attended with danger and abnormal expense on account of its inflammable and explosive nature. Fourth, unless hermetically sealed, it oxidizes rapidly, particularly in hydrometallurgical plants where the atmosphere is humid, thus resulting in a serious deterioration of its precipitating efficiency. Furthermore, owing to its well-known property of malleability, zinc itself is comminuted with great difficulty by the friction of one zinc surface upon another, and attempts to so produce a pulverulent precipitate for cyanid solutions have not found successful use in the art.

Now, I have discovered that if cyanid solutions containing the precious metals be

passed through a grinding apparatus, one at least of the grinding surfaces of which is composed of zinc, aluminum, or other metal or alloy, which will precipitate the desired metals from their cyanid solutions, and preferably such alloys as are more brittle than metallic zinc, and the mixture of solution, precipitate and precipitant conducted to a collector or a filter, an economic, easily regulated and metallurgically efficient process results, which is free from the defects enumerated in the zinc thread and zinc fume processes, and one in which the precipitant can be easily comminuted.

The method of conducting the process will be best understood by reference to the accompanying sheet of drawings forming a part of this specification, which shows one of many arrangements of plant, in which the process forming the subject of the present invention can be carried out; but the apparatus itself and the arrangement of the same form no part of the invention, and may be varied both in the arrangement and number of the parts and of the entire system from time to time, as may be found necessary, according to the conditions under which the process is applied in practice.

In the drawing, U is a receiver for the unprecipitated solution; B, an inlet pipe, C is a discharge pipe, T is a revolving tube mill containing rollers or balls, composed wholly or in part of a precipitant, and preferably lined with the same material and driven from any convenient source of power.

C¹ is a suction of a pump P, and D is a discharge pipe of the same.

C¹ and C² are inlet and outlet valves of the grinding apparatus.

F is a filter press, shown in this case with the discharge pipe D from the pump forming the feed inlet at the top and with open delivery into a launder L which discharges the precipitated solution into the receiver E.

The generally preferable method of operation is as follows: The receiver U having been filled with solution to be treated, the appropriate valves of the tube mill are opened, the tube mill revolved, the pump P is started and the solution allowed to enter the mill, whereupon it is subjected to the grinding action of the same. From the mill T, the solution is drawn through the pipe C¹ to the pump P, thence forced through the pipe D to the filter press F,

and thence through the filter F, which not only retains the precipitate and precipitant, but which also effects the precipitation of more of the metallic contents of the solution and permits the solution to pass into the launder L and thence to the receiver E.

I prefer to use a suitable alloy for a grinding surface because of the increased precipitating efficiency caused by the galvanic couple, and I also prefer to use an alloy more brittle than zinc because of the greater ease with which such an alloy may be comminuted, a tube mill for the grinding apparatus containing rollers or balls of said alloy; and I also prefer to conduct the precipitation without such retardation as will permit of the settlement of the pulverulent precipitant and without exposure of the precipitant and precipitate to the influence of oxidation, from the grinding apparatus to the filter or collector, but I do not limit myself to these special features.

In the practical operation of the process it may be desirable to so adjust the flow of the solution through the grinding apparatus as to attain a proper proportion between the comminuted precipitant and the amount of solution, and this may, of course, be accomplished by the valves c^1 and c^2 .

I also do not limit myself to the precise form of grinding apparatus described above, nor to the precise arrangement of the plant nor the aggregation of component parts shown. But I employ any form of grinding apparatus, whether closed or open, and any arrangement or disposition of plant which may be found desirable according to conditions, or I may re-arrange or eliminate any desired parts from time to time, and may substitute for the filter press any equivalent apparatus or any apparatus which will accomplish the mechanical separation of the valuable suspended material from the solution, either by filtration, settlement or other method of separation or concentration.

In cases where the attritive action is insufficient to liberate an adequate amount of precipitant, or where it is desired to reinforce the precipitation by an increased amount of precipitant, I may add an additional amount of precipitant or alloy, such as zinc fumes, zinc shavings, or an alloy in the form of granules, either to the collecting tank, to the grinding apparatus, to the filter, or to the solution, wherever convenient between its discharge from the container, where the precious metals are dissolved from the ore and the discharge of the solution from the apparatus in which the precipitate and precipitant are collected, the result of which is to form a precipitate and a precipitant which would pass into the grinding apparatus and thus partially precipitate the solution before it comes in contact with the precipitant incorporated in the

grinding surface of the comminuting apparatus.

I claim as my invention:

1. The hereinbefore described process of precipitation of metals from their solutions, which consists in causing the said solutions to pass through a comminuting apparatus, in which they are brought in contact with a metallic precipitant of said metals, with which has been incorporated a substance capable of intensifying the comminution of said precipitant.

2. The hereinbefore described process of precipitation of metals from their solutions, which consists in causing the said solutions to pass through a comminuting apparatus in which they are brought in contact with a metallic precipitant of said metals, with which has been incorporated a metallic substance capable of intensifying the comminution of said precipitant.

3. The hereinbefore described process of precipitation of metals from their solutions, which consists in causing said solutions to pass through a comminuting apparatus in which they are brought in contact with a brittle alloy containing a metallic precipitant of said metals.

4. The hereinbefore described process of precipitating metals from cyanid solutions, which consists in passing the solution, which has already been partially precipitated, together with such a partial precipitate and precipitant through a comminuting apparatus.

5. The hereinbefore described process of precipitating metals from cyanid solutions, which consists in passing the solution, which has already been partially precipitated, together with such a partial precipitate and precipitant, through a comminuting apparatus in which they come in contact with a precipitant.

6. The hereinbefore described process of precipitating metals from cyanid solutions, which consists in passing a solution which has already been partially precipitated, together with such partial precipitate and precipitant, through a revolving tube mill, in which they are brought in contact with a brittle alloy containing a metallic precipitant of said metals.

7. The hereinbefore described process of precipitating metals from cyanid solutions, which consists in passing the said solutions which have already been partially precipitated, together with such partial precipitate and precipitant through a revolving tube mill in which they are brought in contact with a metallic precipitant of said metal, alloyed with a metal capable of producing a galvanic couple favorable to the precipitation of the desired metals from their solutions.

8. The hereinbefore described process of precipitating metals from cyanid solutions,

which consists in passing a solution which has already been partially precipitated, together with such partial precipitate and precipitant, through a revolving tube mill, in which they are brought in contact with a precipitant alloyed with a metal capable of producing a galvanic couple, favorable to the precipitation of the desired metals from their solutions.

In testimony, that I claim the foregoing 10 as my invention, I have signed my name in presence of two witnesses, this thirtieth day of June, 1911.

CHARLES W. MERRILL.

Witnesses:

LOUIS D. MILLS,
C. C. BROADWATER.