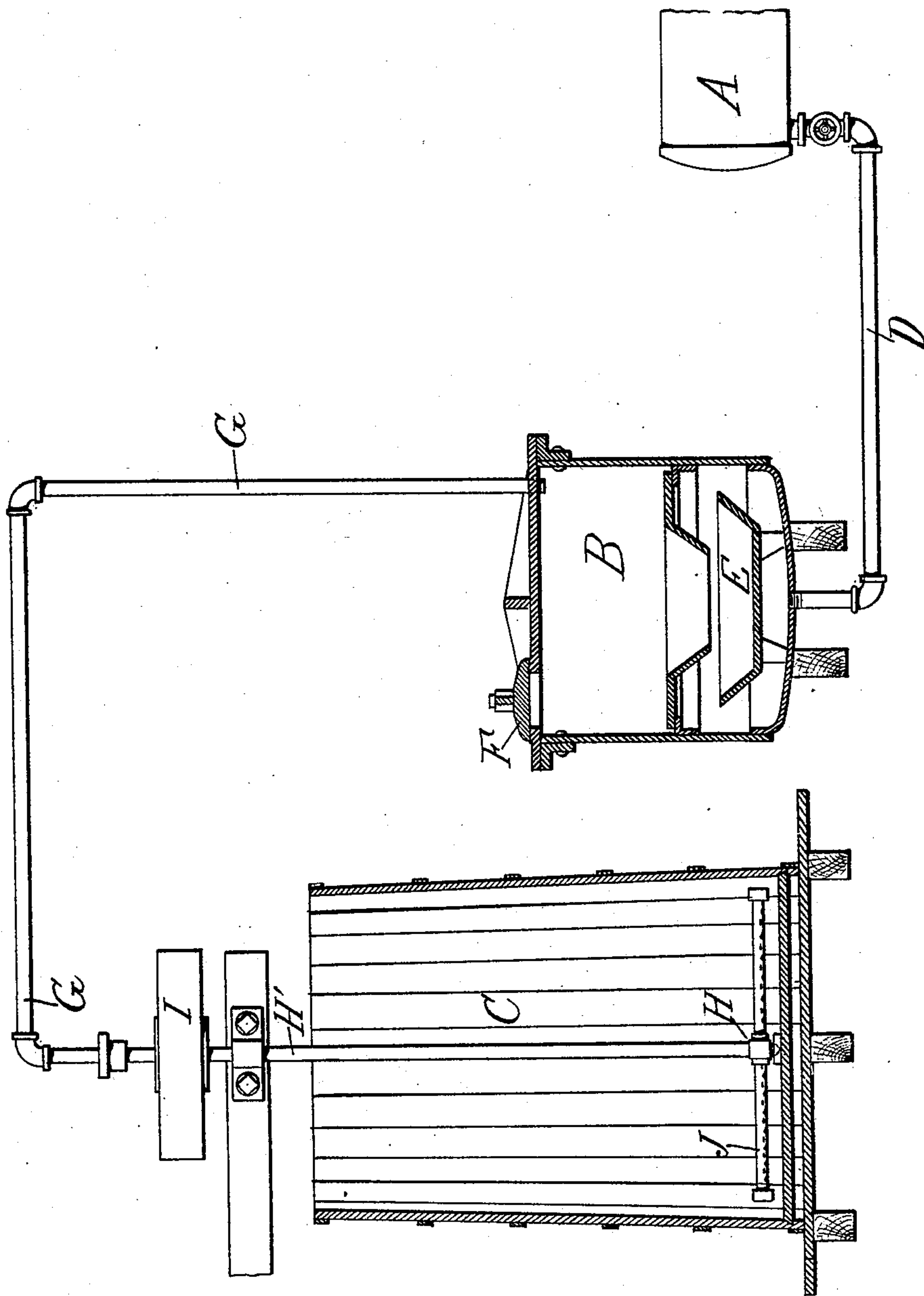


(No Model.)

J. H. BURFEIND.
TREATMENT OF GOLD AND SILVER ORES.

No. 587,179.

Patented July 27, 1897.



WITNESSES:
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JOACHIM H. BURFEIND, OF SALT LAKE CITY, UTAH.

TREATMENT OF GOLD AND SILVER ORES.

SPECIFICATION forming part of Letters Patent No. 587,179, dated July 27, 1897.

Application filed July 16, 1896. Serial No. 599,370. (No specimens.)

To all whom it may concern:

Be it known that I, JOACHIM H. BURFEIND, of Salt Lake City, in the county of Salt Lake and State of Utah, have invented a new and
5 useful Improvement in the Treatment of Gold and Silver Ores, of which the following is a full, clear, and exact description.

My invention relates to an improved treatment of the product, residue, or precipitate
10 obtained at works where gold and silver ores are treated by the well-known MacArthur & Forrest cyanid process. This product contains all the gold and some of silver extracted from the ores by the cyanid solution and subsequently precipitated by zinc, besides various
15 quantities of zinc, lime, silica, sulfur, arsenic, mercury, cyanogen, &c. The constituents of course vary as the ores from which it is produced vary. Zinc, lime, and
20 cyanogen are always present and frequently constitute fully eighty per cent. of the entire product. The usual method of treating this product is to dry it and then melt it in crucibles with suitable fluxes, which requires a
25 large amount of labor, crucibles, and fluxes, and in melting this impure product there is a great loss of gold and silver through volatilization, and the resulting bullion is seldom over six hundred fine and requires additional
30 refining. Very impure products cannot be treated in this way and are therefore shipped at a great expense to refining-works.

Several methods have been tried for the purpose of reducing the cost of this treatment
35 and to avoid the large loss of gold, but as far as I know all have failed. I have discovered that by treating the above-described product with sulfurous acid I can cheaply and quickly remove most impurities, especially zinc, lime,
40 and soluble cyanids, and that the insoluble residue containing the precious metals settles quickly from the salts in solution of the sulfurous acid.

In carrying out my invention I may employ
45 any suitable apparatus.

The accompanying drawing is an elevation, with parts in section, of a plant for producing sulfurous-acid gas and treating the cyanid
50 product therewith. This drawing illustrates only one way of performing my improved process, and I desire it to be distinctly un-

derstood that my invention is not limited to the use of this specific apparatus.

The apparatus shown in the drawing comprises three parts—viz, an air-compressor or
55 air-pump A, a sulfurous-acid generator B, and a vat or other vessel C, adapted to receive the cyanid product. The air-pump may be of any approved construction, and its delivery-port is connected by means of a pipe D
60 to the bottom of the generator B. Said generator contains an iron pan E, adapted to hold the necessary sulfur. A manhole or hand-hole is provided in the top of the generator or at any other suitable place thereof,
65 said hole being normally closed by a cover F. When it is desired to start the operation, the cover F is removed, so as to enable the attendant to light the sulfur on the pan E. Then the hand-hole is closed and the pump
70 is worked to supply air to the generator. The sulfurous-acid gas thus generated, together with the excess of air, passes out through a lateral opening in the top of the generator and is conveyed through a pipe G to the hollow
75 shaft H' of the stirrer H, located in the vat C. A suitable swivel-joint is provided between the pipe G and the shaft H'. I is a pulley for rotating the stirrer. Arms J are secured to the lower end of the shaft H', said arms
80 being hollow and communicating with the interior of the shaft. The arms are further perforated, so that the mixture of sulfurous-acid gas and air forced into the stirrer by the pump will escape from the arms J in a
85 great number of small jets, thus coming in close contact with the liquid and solid matter in the vat C.

My method of treatment is as follows: The product above described, either wet and slimy,
90 as it is taken out of the precipitating-boxes, or dry, is put into the vat C together with a suitable amount of water. The contents of the said vat, barrel, or other suitable vessel are
95 constantly stirred, and sulfurous-acid gas is passed into it in sufficient quantity to have always an excess of the acid in the mixture, which is indicated by the smell. That an excess of sulfurous acid should always be
100 present is an important point, as many salts formed are only soluble in that menstruum, while other salts formed will dissolve some

of the precious metals, which is not possible as long as free sulfurous acid is present. After stirring and passing sulfurous-acid gas into the mixture for, say, ten hours, if one
5 thousand pounds or more of the product are treated, all the contents in the product soluble in sulfurous acid will be dissolved, especially free zinc, zinc oxid, lime, and also the soluble cyanids. The stirrer is now removed
10 and the mixture is left to settle for about twelve hours. The supernatant liquor can then be drawn off, and the residue, containing all precious metals with some impurities left, is now mixed with strong sulfuric acid
15 and evaporated until heavy fumes of sulfuric acid have come off for some time. Most impurities insoluble in sulfurous acid are now decomposed. Water is now added and the mixture is boiled for a short time, so as
20 to dissolve any anhydrous salts formed. The residue, containing now all the gold and some of the silver with a few insoluble impurities, settles quickly. The supernatant clear solution is drawn off, the residue is dried and
25 melted in the usual way, which can now be done at a minimum cost, and there is no loss of gold and silver in melting except that which is always incurred when remelting pure silver and gold. If the method has been carefully
30 manipulated, the bullion obtained will be about nine hundred and fifty fine, but if a finer bullion is wanted chlorine gas can be passed into the molten metal before it is poured into molds for a few minutes, and the
35 resulting bullion will be nine hundred and ninety to nine hundred and ninety-four fine, requiring no further refining.

Sulfurous acid can be produced from sulfur, pyrites, &c. Pyrites can usually be

bought at very low prices in mining camps, 40 and especially if they carry gold and silver, the residue of them after they have furnished the sulfurous acid will bring such prices as will leave the cost of sulfurous acid next to nothing. By the use of sulfurous acid I have 45 reduced the cost of producing fine gold bars from the above-described product to a few cents per ounce of gold produced, and in particular I avoid the loss of precious metals by volatilization entirely. Local circumstances 50 will be the guides as to the mechanical arrangements, the mode of producing sulfurous acid and the mode of application.

By "cyanid product" I mean the precipitate or residue obtained by treating the ore with 55 a cyanid solution and subsequently using zinc or its equivalent to precipitate the gold. As hereinbefore explained, said cyanid product contains various other metals besides gold, also impurities in the form of com- 60 pounds practically insoluble in water. It will be understood that the composition of the above-defined cyanid product may vary considerably, according to the composition of the ore. 65

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

As an improvement in the extraction of precious metals from their ores, the treatment 70 of the cyanid product or precipitate containing said metals, preparatory to melting the said product with sulfurous acid, substantially as described.

JOACHIM H. BURFEIND.

Witnesses:

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