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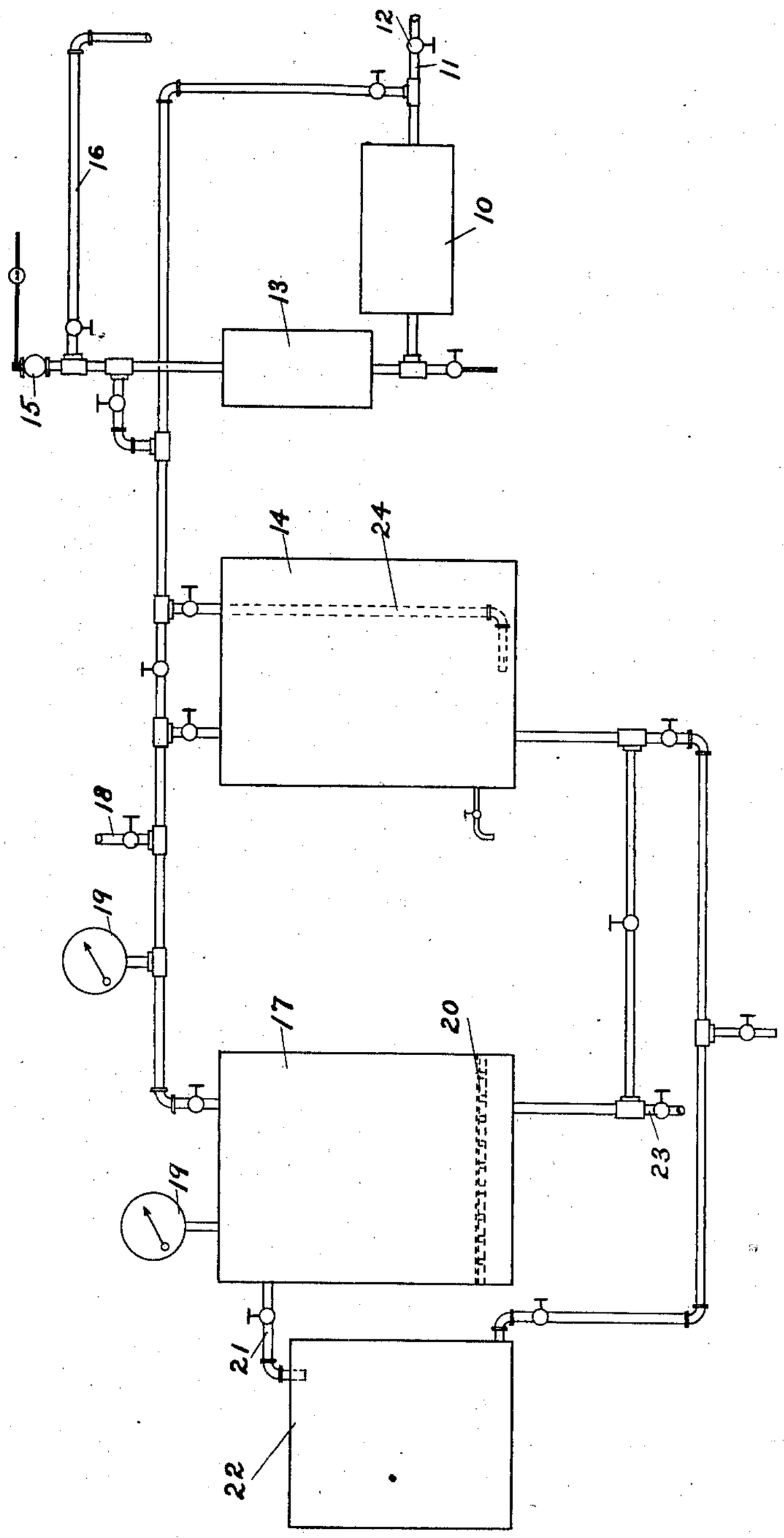
H. B. GOETSCHIUS.

CYANID PROCESS.

APPLICATION FILED MAR. 28, 1906.



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CYANID PROCESS.

No. 840,840 Specification of Letters Patent. Patented Jan. 8, 1907.

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To all whom it may concern

Be it known that I, HOWARD B. GOETSCHIUS, a citizen of the United States, and a resident of Dumont, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Cyanid Extraction Processes, of which the following is a specification.

My invention relates to the so-called "cyanid extraction process" for gold and silver; and it has for its object the more complete extraction of said metals by the cyanid solution, as well as greater rapidity of extraction and the ability to handle coarser grades of ore.

For this purpose my invention consists, essentially, in thoroughly oxygenating the cyanid solution while under pressure and prior to the treatment of the ore therewith, then forcing this solution through the ore against a back pressure, then releasing said pressure, whereby, due to the simultaneous disengagement of gas because of the release of pressure, the ore is agitated throughout, and finally increasing the pressure slightly above the initial degree in order to redissolve the remaining disengaged gas, together with any films or bubbles adhering to the particles of ore.

In the present practice of cyaniding ores containing precious metals two methods are most commonly employed—viz., simple percolation of the fluid through the ore or mechanical agitation with the cyanid solution. In both of these methods it has been found necessary to supply oxygen to the cyanid solution or to the ore and solution in order to insure an efficient extraction of the contained metals. When simple percolation is resorted to, the solution is aerated or oxygenated as thoroughly as possible and then permitted to percolate through the ore in the various cycles anywhere from fifteen to thirty days. By this long treatment the oxygenated solution is finally conveyed throughout the mass to all the particles of the ore and a good extraction is obtained in the case of the gold; but many compounds of silver are imperfectly acted upon by the dissolving fluids. If the ore to be percolated is crushed fine by the dry process, the cost of the operation is much increased and also the difficulty of percolating, and there is considerable loss in the fine dust carried away. If wet crushed, some of these difficulties are removed; but other mechanical ones are substituted. In all cases of percolation the gentleness of movement of the liquid causes no disturbance of the grains of ore, and so the contact becomes very imperfect after a time. When agitation is used, it is necessary to handle much fluid in proportion to the amount of ore, because each particle must be in a partial state of flotation if the agitation is to take place, and although the oxygen required may be more readily conveyed to the mass than by ordinary percolation it will be found that the grains of ore become covered with bubbles, thus protecting the ore from intimate contact with the cyanids. The apparatus required is also much more complicated and expensive.

The nature of my invention will be best understood in connection with the accompanying drawing, which illustrates diagrammatically the general arrangement of the apparatus employed.

10 represents an air-compressor taking air through an inlet-pipe 11, provided with a valve 12.

13 is a reservoir for the air, from which air is delivered into the solution-tank 14. A safety-valve 15 is provided in connection with said reservoir for the air, also a relief or blow-off pipe 16. Connections are also provided whereby the said reservoir may be placed in communication with the ore-tank 17. A relief-valve 18 is provided between the two tanks 14 and 17. Pressure-gages 19 are placed at the desired points to permit the observation of the pressure existing in the two said tanks. Provision is made whereby the solution-tank 14 may be placed in communication with the ore-tank 17 both at the top and bottom. The ore-tank 17 contains a false bottom 20, upon which the ore is held, and is provided with an outlet 21, adapted to deliver the metal-saturated solution into a zinc extraction-box 22 or the like. This box or tank 22 is arranged to be placed in communication with the solution-tank 14 when desired. A drain 23 for the ore-tank 17 is also provided.

In carrying out my invention I first sufficiently aerate the cyanid solution in the closed solution-tank 14 with air or oxygen under pressure by forcing it into said solution through a perforated pipe 24 or any of the usual apparatus for finely dividing the stream of gas and set in such a manner as to stir the liquid while the gas is passing into it. The tank or chamber 14 in which this aeration

takes place is connected with a relief-valve 18, through which the unabsorbed excess of gases is allowed to pass off, and the safety-valve 15 is set at a pressure proportionate to the degree of oxygenation required for the subsequent treatment of the ore and, other things being equal, sufficiently high to keep in liquid form any cyanogen which may be liberated. The cyanid solution is thus saturated with the required gas and is "still," no gas being evolved so long as the initial pressure upon the liquid is maintained. In another closed tank 17 or, if desired, in another compartment of the tank in which the cyanid solution is aerated is placed the ore on a false bottom 20, covered with duck or some other suitable fabric. The ore may be dry crushed and as coarse as twenty-four mesh, including the siftings of finer mesh. Into this mass of ore I force the aerated cyanid solution, a suitable back pressure being maintained at the proper point in said ore-tank by means of the safety-valve 15. The cyanid solution therefor passes entirely through the ore without disturbing or channeling it. It is allowed to flow through the ore in this fashion for some time, discharging to the zinc-boxes 22, the pressure in the tank being kept up to the initial degree while this part of the operation is going on. After a time the flow of cyanid solution both to and from said ore-tank is stopped. The pressure in the ore-tank is then partly released through the relief-valve 18, causing a simultaneous disengagement of the contained gases throughout the entire mass of ore. By this means the whole mass of ore is thoroughly agitated and oxygenated, each particle being disturbed in its relation to its neighbor and the gases entrapped in the interstices of the ore released with a tendency to fracture the particles containing them. By thus releasing the pressure upon said mass of ore a very convenient and thorough agitation of the ore is obtained, allowing of the agitation of a mass of material much larger than could be handled by mechanical means and with a minimum expenditure of labor and power. The release of pressure having taken place, the forcing of cyanid solution from the aerating-tank through the ore to the zinc-boxes is resumed, the safety-valve being set to obtain a pressure somewhat higher than the initial pressure, so as to cause a complete reabsorption of all gases remaining, whether in the liquid or entrapped in the crevices of the ore or adhering as films to the particles of ore. By thus dissolving away any adhering gas films or any gas entrapped in the interstices the solution comes into contact with each of the particles of ore and removes therefrom the contained gold and silver. Where air is blown through such a mass of ore, as is sometimes practiced, this is not accomplished, for the particles become surrounded by an adherent film or bubble of gas which prevents the solution from coming into perfect contact with them.

Because of the simultaneous and complete gaseous agitation and because of the complete penetration of the ore and its particles by solution carrying a sufficiently large quantity of oxygen I am able to deal with a coarser product containing a large or small quantity of fine material entirely by percolation and without rehandling the whole or part in other apparatus, such as slime-separators, agitation-tanks, filter-presses, &c. The tendency to separate the coarse from the fine portions of the ore is also reduced to a minimum, so that the washing out of the imperfectly-extracted fine material (which takes place when the air is blown through) is prevented.

In handling large quantities of ore I may arrange a number of ore-tanks in series and pass the cyanid solution through said series if the values per tank are not too great for the dissolving powers of the cyanid solution, due provision being made between each tank for redissolving the gases, or I may work a number of tanks independently from a central tank containing the said cyanid solution under pressure.

After the solution of cyanids containing a certain proportion of the precious metals has passed from the tank 17 containing the ore it is run into the zinc-box or tube-mill 22 and passed over the zinc or other materials used to separate the gold and silver from said solution and when deprived of them is drawn back into the tank or compartment 14 for aeration of the solutions, reaerated, and then again passed through the ore. This is repeated as many times as may be necessary to complete the extraction, the solution being strengthened with new cyanid when a test shows this to be necessary. The precious metals having been extracted, a certain amount of liquid remains, and air under pressure is now supplied above the ore, by which means a quantity of the liquid is forced out, and this is followed by a washing with water forced through either from top or bottom until the escaping liquid is found to be as free of anything of value as may be required. The last of the water is finally forced out of the ore in the same manner as the cyanid solution already referred to, and this wash-water is brought up to the proper strength with new cyanid and used to replace solutions that have become worthless by use and to standardize those which have become weak.

In this way the exhausted ore is delivered in a much drier condition than by percolating in open tanks, and because of this and the minimum amount of fluid required in a cycle of the operation and also because the operation is carried on in closed tanks and evaporation thereby prevented a great saving of

water is made, which is a matter of importance in hot and dry climates. The process is worked to the best advantage at the pressure required to maintain cyanogen gas a liquid, and where necessary the ore is kept alkaline by the usual means to correct the acidity of the ore and to absorb any released cyanogen or hydrocyanic acid that may have been produced. I have found that usually a pressure of from sixty to ninety pounds per square inch gives satisfactory results for oxygenating the cyanid solution for percolation, &c.

Where the ores contain refractory combinations of the precious metals, and especially in the case of silver, the ore is given a preliminary treatment with a watery solution of chlorin, bromin, or hypochlorites aerated with oxygen or air in the same manner as hereinbefore described and in which the production and release of pressure is allowed to take place as already described in order to wholly or in part break up the said refractory combinations, agitate the body of ore, dissolve the adhering gases, and prepare the material for the more ready action of the solution of the cyanids.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The herein-described cyanid extraction process, consisting in: first aerating the cyanid solution under pressure greater than atmospheric pressure; then forcing the aerated solution under said pressure through the ore to be treated and against a suitable back pressure.

2. The herein-described cyanid extraction process, consisting in: first aerating the cyanid solution under pressure; then forcing said aerated solution under the initial pressure through the ore to be treated and against a suitable back pressure; and then releasing the pressure upon the mixture.

3. The herein-described cyanid extraction process, consisting in: first aerating the cyanid solution under pressure; then forcing said aerated solution under the initial pressure through the ore to be treated and against a suitable back pressure; releasing the pressure upon the mixture; and finally increasing the pressure upon said mixture slightly above the initial pressure.

4. The herein-described cyanid extraction process, consisting in: treating the ore with an aerated cyanid solution under pressure, and alternately releasing and increasing the pressure to mechanically stir the mass of ore and redissolve the remaining released gases.

5. The herein-described cyanid extraction process, consisting in treating the ore in a closed vessel with an aerated cyanid solution under pressure; then releasing the pressure to mechanically stir the mass of ore; and finally increasing the pressure slightly above the initial pressure to dissolve the remaining disengaged gas and any gas films or bubbles adhering to the particles of ore.

6. The herein-described cyanid extraction process, consisting in: a preliminary treatment of the ore with a watery solution of chlorin or the like aerated with oxygen or air under pressure and with an alternate release and increase of said pressure; then finally treating the ore with cyanid solution under pressure as set forth.

7. The herein-described cyanid extraction process, consisting in: a preliminary treatment of the ore with a watery solution of chlorin or the like aerated with oxygen or air under pressure as set forth; then treating the ore with cyanid solution under pressure; and finally releasing the pressure upon the mixture.

8. The herein-described cyanid-extraction process, consisting in: a preliminary treatment of the ore with a watery solution of chlorin or the like aerated with oxygen or air under pressure as set forth; and then treating the ore with cyanid solution under pressure, alternately releasing and increasing said pressure upon the mixture.

Signed at New York, in the county of New York and State of New York, this 26th day of March, A. D. 1906.

HOWARD B. GOETSCHIUS.

Witnesses:

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