J. R. PARKS.

PROCESS OF TREATING ORES.

APPLICATION FILED NOV. 23, 1906.

940,821.

Patented Nov. 23, 1909.

3 SHEETS—SHEET 1.

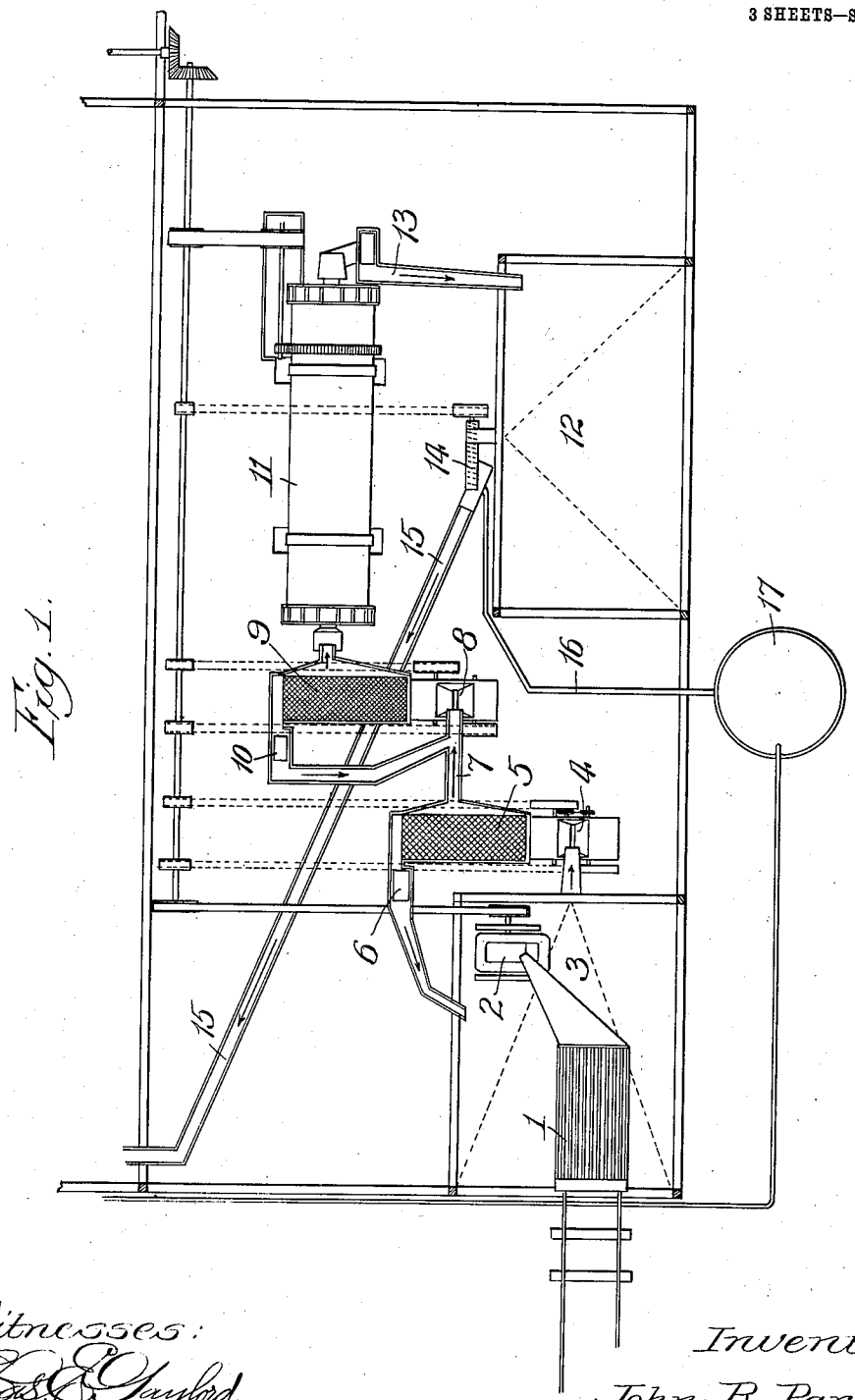

Fig. 1.

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Inventor:
John R. Parks,
By Thomas F. Sheridan,
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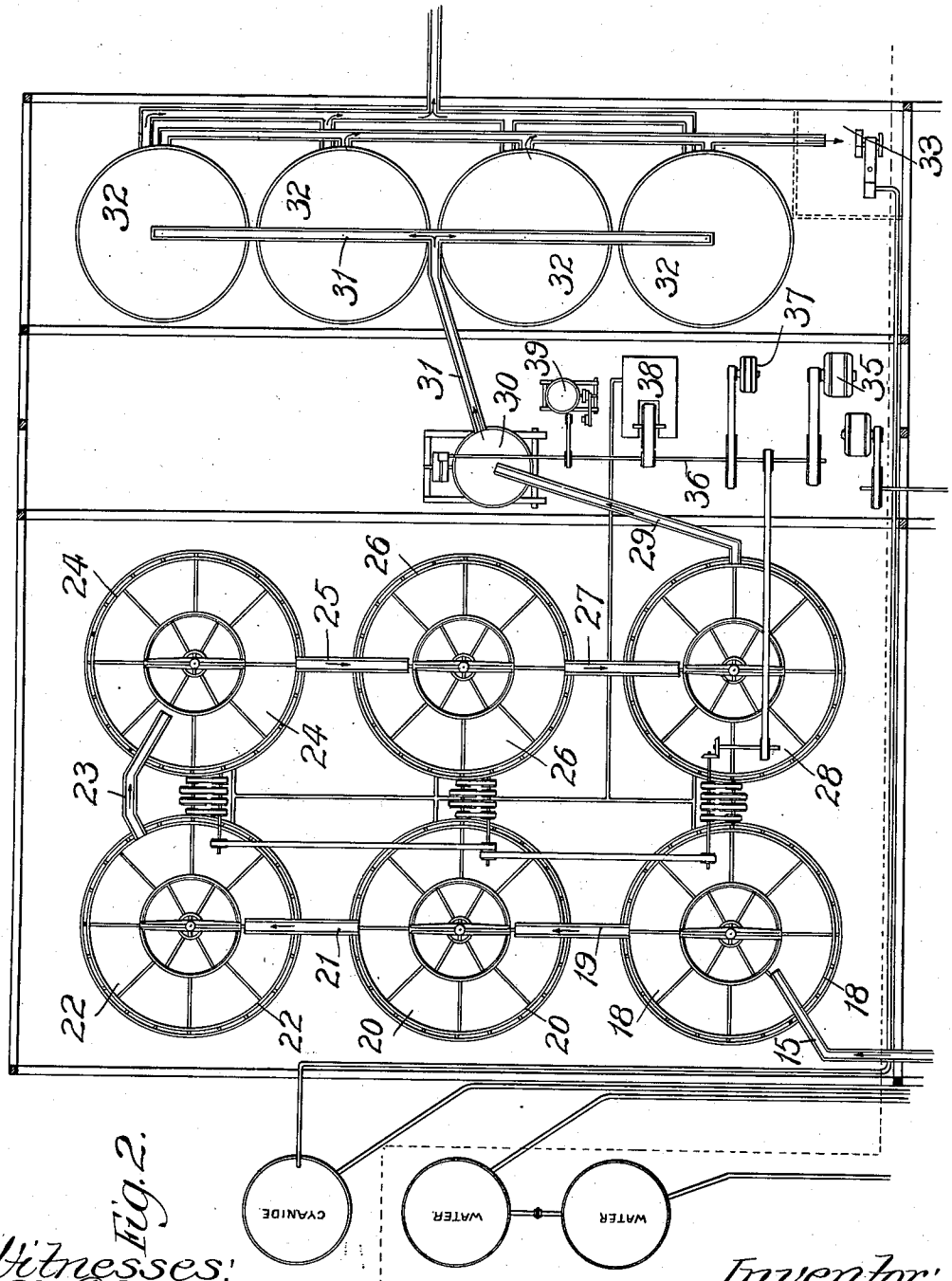

Fig. 2.

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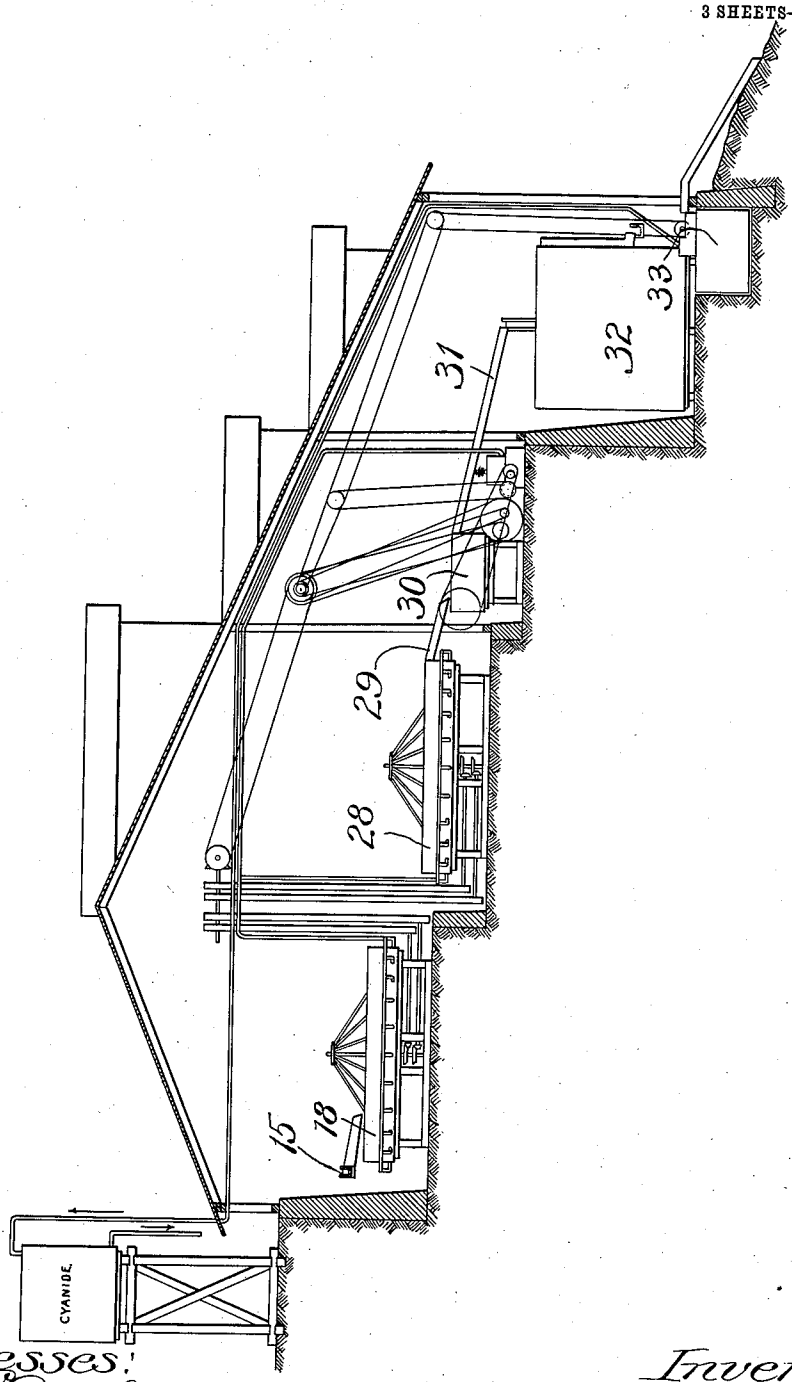

Fig. 3.

Witnesses:
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UNITED STATES PATENT OFFICE.

JOHN R. PARKS, OF SPOKANE, WASHINGTON.

PROCESS OF TREATING ORES.

940,821. Specification of Letters Patent. Patented Nov. 23, 1909.

Application filed November 23, 1906. Serial No. 344,777.

To all whom it may concern:

Be it known that I, JOHN R. PARKS, a citizen of the United States, residing at Spokane, county of Spokane, and State of Washington, have invented certain new and useful Improvements in Processes of Treating Ores, of which the following is a specification.

This invention relates to improvements in processes for electro-chemical reduction of precious metal ores, and is in particular an improvement upon the process as disclosed in my former patent No. 796,754, dated August 8, 1905.

My present improvements provide for the continuous operation of the mill, and produce what I prefer to term "a continuous electro-cyanid amalgamation process."

In the following description particular stress is only given to that portion of the process which relates to the ore which is susceptible to economic treatment by cyanid of potassium, and it is to be understood that the ores may be prepared for this portion of the treatment either as hereinafter described, or as described in my former patent, or in any other way according to the composition and condition of the mineral ore—it being understood that ores of certain gangue composition may be successfully treated by pulverizing them in their original or mined form, while others must have the basic metals and portions not amenable to the cyanid treatment removed before entering into that part of the process which forms the invention herein described.

In the accompanying drawings forming a part of this specification—Figure 1 is a plan view of a portion of my mill adapted for grinding ores such as may be wholly economically treated by my improved process; Fig. 2 is a plan of that portion of the mill containing the tandem cyanid pans; and Fig. 3 is an elevation of the mill taken upon the line 3—3 of Fig. 2 showing the difference of elevation of the cyanid pans.

The mill herein illustrated consists of a "grizzly" 1 arranged to receive the ore as it is brought from the mine. The coarse portions of the ore which are too large to pass through the meshes in the "grizzly" 1 pass through the crusher 2, and fall into the bin 3 where they mix with the portions which have passed through the first screen. From bin 3 the crushed ore is fed to the coarse rolls 4 by means of an automatic feeder of any known type such as the Tullock or Hendy. From rolls 4 it passes into the revolving screen 5, that portion not yet crushed fine enough to pass through the screen being returned to bin 3 by means of an elevator 6, while that portion which passes through the screen passes down the chute 7 through the fine rolls 8 to the fine screen 9. Likewise the portion of the ore too large to pass through the fine screen is returned by elevator 10 to the chute 7, while that portion which passes through the fine screen to the automatic feed and discharge tube mill 11, which may be of the well known Abbe type, is therein pulverized to an almost microscopic fineness and then delivered into the storage bin 12 by elevator 13. From this storage bin the finely powdered ore is delivered by a screw-conveyer or worm 14 to launder 15, where it meets the cyanid and prepared chemical solution passing through pipe 16 from the standardizing tank 17 at the top of the mill, and is conducted through the launder 15 into the first electro-cyanid pan 18 of the series of tandem pans 18, 20, 22, 24, 26 and 28. These tandem pans are of substantially the construction disclosed in my Patent No. 796,753, and are arranged upon gradually decreasing levels, so that the contents of each pan will overflow into the next succeeding pan through one of the series of connecting launders 19, 21, 23, 25 and 27.

From cyanid pan 28 the launder 29 conducts the ejected pulp to the settler or amalgam trap 30, from which, through the launder 31, the cleansed ore passes to the series of settling tanks 32, from which the supernatant cyanid solution is drained off to the cleansing tank 33, where it is allowed to stand until it sufficiently clears up before pumping it back to the storage tank at the top of the mill.

In practicing my improved process—the character of the ore having been determined—I allow, according to the composition of the ore, from one-half to twenty pounds of cyanid of potassium, five to seven pounds of common salt, one to three pounds of lime, and one ton of water to pass into the first cyanid pan with each dry ton of powdered ore. To this is added from three ounces to five hundred ounces of quicksilver. I have found in practice that with

my tandem pan arrangement I may deliver to the first pan of the tandem series from two to two and one-half tons of prepared ore per hour, and that ore fed at this rate will be subjected to the treatment a sufficient length of time to obtain the maximum precious metal extraction.

After the crushed or powdered ore enters the first pan of the tandem series, each pan holding approximately from five tons to seven and one-half tons of dry ore, it passes from pan to pan of the series, every portion of it undergoing treatment for an average time of from eight to twelve hours, according to the rate of feed into the first pan.

The treatment of the ore within the electro-cyanid pans having been fully described in my former patent, it is only deemed necessary to describe herein such treatment as is specifically covered by this improvement.

Each of the tandem pans is provided with a horizontally revolving disk formed of two or more annular sections and mounted upon insulated bearings, whereby the disk—which is preferably of cast-iron—may be used as the anode of an electro-plating or decomposing battery. Immediately below the lower face of this revolving disk is a copper plate, which forms the cathode upon which is deposited the free metal from the solution, which may be extracted by a strong electric current passed between the two electrodes. Upon this cathode plate is also deposited all of the amalgam metal which forms within the mixture, and which, owing to the circulation of the pulped ore, may come into contact with the copper plate. To aid in the chemical action a strong current of compressed air is admitted into the pulped mass as it is forced outward between the two electrodes by paddles upon the revolving disks. This current of air furnishes free oxygen to the solution, as well as assisting greatly in the agitation.

In practicing my improved process, the electrolytic pans illustrated and described in my prior patent No. 796,754, may be conveniently used, and as such plans are clearly illustrated, especially in Figs. 7 and 8 of such prior patent, it is deemed unnecessary to illustrate such pans in the drawings forming part of my present application. In these electro-cyanid pans the ore undergoes treatment of oxidation by compressed air and mechanical agitation; solution and chemical action through the agencies of the cyanid of potassium, salt and lime; amalgamation by contact with the mercury upon the copper or cathode plates; and electro-chemical solution and precipitation from the solution onto the amalgam of the copper plate simultaneously causing the deposition of the precious metals of the ore as amalgam upon the copper cathode plate.

When a sufficient amount of amalgam has been deposited upon a copper plate to warrant a "clean up", the pan to be cleaned is bridged over by a temporary launder, so that the operation of the mill may continue uninterrupted while the electro-cyanid pan is emptied and the amalgam removed from the copper plate.

It will be seen in making a complete clean up of the whole series of tandem pans that it is not necessary to interfere with the continuous operation of the mill, since by the use of a bridging launder to carry the pulp past the pan being cleaned, five of the pans may be constantly in operation. It is this feature of my invention which gives to the process the preferred designation of a "continuous electro-cyanid amalgamation process." It may readily be seen that the conditions may be so governed, that, as the pulp passes from one pan to another, different degrees of agitation and different densities of electric current flow may be applied to the solution whereby every available precaution will have been taken to extract the maximum mineral value from the ore.

After the ore, relieved of its precious metal burden, leaves the last of the series of the electro-cyanid pans, it is conducted by means of gravity through a launder to the settler or amalgam trap 30, where the pulp is slightly agitated so that the particles of heavy amalgam, which have been carried in suspension throughout the entire train of tanks, may here have an opportunity of settling. From the upper part of this tank the waste pulp flows through launder 31, as formerly described, to the settling tanks 32 from the base of which it is drawn off and allowed to run outside of the mill as waste product.

The driving means for the mill may be of any desired character, but it is here shown as an electric motor 35, which, through its connection with the line shafting 36 drives the electrolysis dynamo 37, air compressor 38, clean up pan 39, for cleansing the amalgam from the amalgam trap before it is retorted, and the rotatable anodes of the electro-cyanid pans.

By the foregoing process I have found in practice that I am able to extract from gold ores, silver ores, and gold and silver ores, ranging in values from four ounces to one hundred and twenty ounces of silver per ton and in gold from one-fifth of an ounce to one and a quarter ounces per ton. I have extracted and saved from 60 to 90 per cent. of the silver values and from 80 to 97.5 per cent. of the gold values in the ores, with a total loss of cyanid, including that portion destroyed by chemical action on impurities in the ores and that portion which remains in solution in the moisture of the settled tailings, varying from 0.55 of a pound for

ordinary ores to 7.2 pounds for the high grade refractory silver ores, for each ton of ore treated.

While I have herein described my process in combination with a specific form of cyanid pan and have gone somewhat into the details of my improvements in order to more clearly disclose the advantages secured thereby, I do not wish to be unduly limited thereto, it being evident that certain variations may be made from the process herein specified without departing from the spirit or scope of my invention.

I claim:—

1. The process of treating ores, which consists in intermixing pulverized ore, cyanid of potassium and an electrolyte and simultaneously passing a current of air and a current of electricity through the mixture, passing such mixture through each of a series of electro-cyanid pans, and excluding any one of said pans from the series while the mixture continues to pass through the other pans.

2. The process of treating ores, which consists in intermixing pulverized ore with an electrolyte and passing the mixture through a series of electrolytic extraction pans in tandem, simultaneously subjecting the mixture to a current of electricity, and excluding any one of said pans from the series while the mixture continues to pass through the other pans.

3. The process of treating ores, which consists in intermixing pulverized ore, cyanid of potassium, mercury and an electrolyte, agitating such mixture successively in each of the pans of a series in tandem arrangement, subjecting the mass while in the pans to an electric current, and excluding any one of said pans from the series while the mixture continues to pass through the other pans.

4. The process of treating ores, which consists in intermixing pulverized ore, cyanid of potassium, lime, salt and water, and subjecting the mixture to agitation in each of a series of electrolytic pans, passing compressed air through the mixture in each pan, and excluding any one of said pans from the series while the mixture continues to pass through the other pans.

5. The process of treating ores, which consists in intermixing pulverized ore with a sufficient quantity of liquid to make a mobile mixture, passing such mixture through a series of electrolytic pans in tandem, excluding any one of said pans from the series while the other pans continue with the operation.

6. The process of treating ores, which consists in carrying the finely powdered ore in suspension within a liquid through a series of electrolytic pans arranged in tandem and in which the precious metal values from the ore are deposited, and removing the deposited metal from each of the series of tandem pans individually without interfering with the operation of the other tandem pans.

7. The process of extracting precious metals, which consists in passing a fluid containing precious metals in solution and in suspension, through a series of electrolytic extraction pans, thereby simultaneously extracting the precious metals from the solution thereof by electrical deposition and by amalgamation from suspended particles thereof and from compounds thereof, and removing the deposited metal from each of the series of pans individually without interfering with the operation of the other pans.

JOHN R. PARKS.

Witnesses:
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