No. 775,509. PATENTED NOV. 22, 1904.

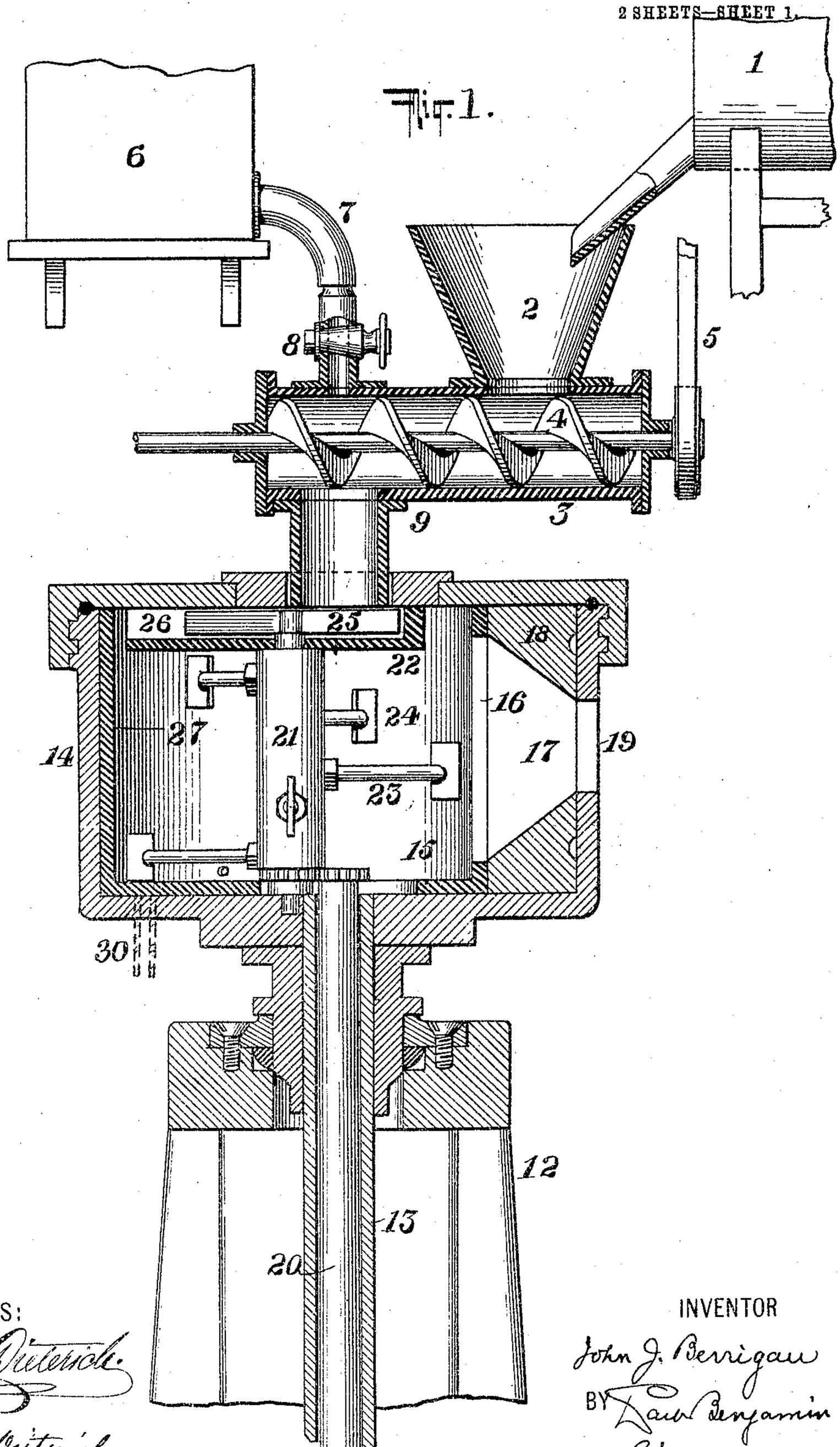
J. J. BERRIGAN.

PROCESS OF EXTRACTING PRECIOUS METAL FROM ORES.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Gustave Dieterich.

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INVENTOR

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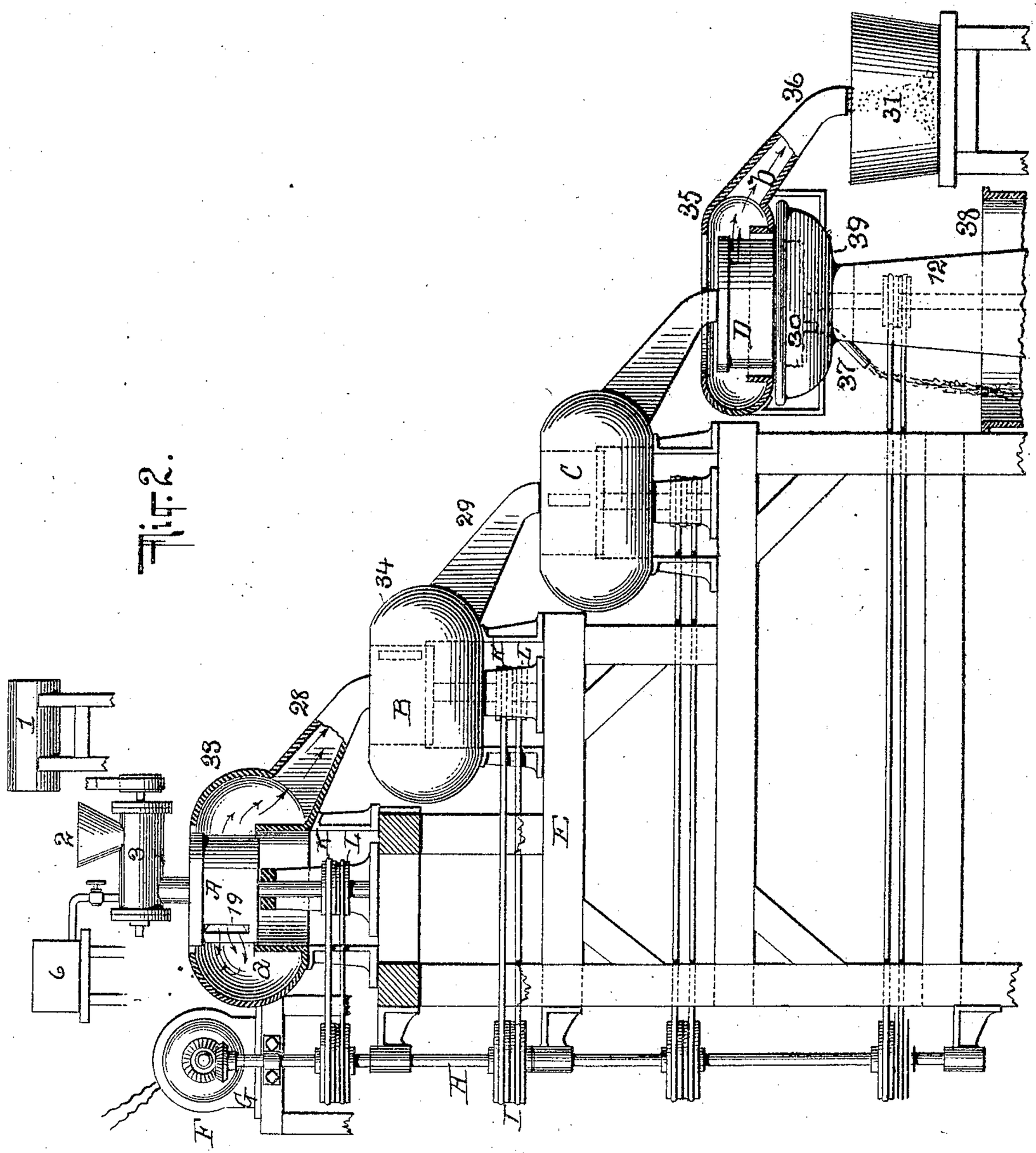
Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN JOSEPH BERRIGAN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO FRANCIS J. AREND, OF NEW YORK, N. Y., AND JOHN BERNSTROM, OF STOCKHOLM, SWEDEN.

PROCESS OF EXTRACTING PRECIOUS METAL FROM ORES.

SPECIFICATION forming part of Letters Patent No. 775,509, dated November 22, 1904.

Application filed February 11, 1904. Serial No. 193,146. (No specimens.)

To all whom it may concern:

Be it known that I, JOHN JOSEPH BERRIGAN, of East Orange, Essex county, New Jersey, have invented a new and useful Improvement in Processes for the Extraction of Precious Metals from Ores, of which the following is a specification.

My invention relates to the extraction of precious metal from its ore by means of a solution chemically active to dissolve said metal. In the case of gold or silver, heavy ores, such a solution is one containing a cyanid, which, as is well known, has a selective action to dissolve gold or silver in preference to the baser metals.

My present invention consists, broadly, in the improvement in the art of extracting such precious metal from the ore by forcing the said ore in comminuted form through said solution, also in doing this by centrifugal force, also in the continuous process whereby the mixed ore and solution are conducted through a plurality of agitators and then separated, also in the various subprocesses, all as more particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical section of the mixing device and one of the agitators which receives the cyanid or other solution chemically active to dissolve the precious metal, hereinafter termed the "solution," and the comminuted ore or ore-pulp, hereinafter termed the "ore." Fig. 2 is a side elevation of the entire apparatus.

Similar characters of reference indicate like parts.

The ore is placed in any suitable receptacle, as 1, from which it is delivered by the spout shown into the hopper 2. From the hopper 2 it passes to the interior of the conveyer-chamber 3, in which chamber is a spiral conveyer 4, rotated by any suitable means, such as the belt and pulley 5.

6 is a tank in which is placed the solution and which communicates with the interior of the conveyer-chamber 3 by means of the pipe 7, provided with a suitable valve 8. As fast as the ore enters the chamber 3 it is carried by the rotating screw conveyer 4 longitudinally said chamber until it meets the descending stream of solution from the tank 6. The combined solution and ore then pass from the conveyer-chamber 3 by the pipe 9, which is directly below the inlet for the solution, into the agitator 10. The construction of this agitator is similar to that of the separator illustrated in United States Letters Patent No. 677,926, granted to me July 9, 1901, with the difference that the sole outlet is arranged above the bottom of the bowl, and hence there is no separate liquid-outlet in the bottom of the bowl, as shown in my said patent. By reason of this omission the apparatus can no longer act as a separator for solids and liquids, but only as an agitator and means for centrifugally forcing the ore through the solution in the manner hereinafter explained. My said agitator is provided with a standard 12, in which is journaled the hollow rotary shaft 13, which carries the revolving bowl 14. In said bowl is a separating-chamber 15, eccentrically placed, having an outlet-opening 16, which by passage 17 in the partition 18 communicates with the outlet 19 in bowl 14. Within the shaft 13 is another rotary shaft 20, which by suitable gearing rotates the shaft 21, journaled in the bottom of bowl 14 and also in the receiving-box 22. Said shaft 21 carries radial arms 23, provided with scrapers 24, and within the box 22 it carries radial arms 25.

The combined solution and ore passing through the pipe 9 enters the receiving-box 22, from which it is ejected by centrifugal force of rotation and also by the rotary arms 25 at the open side 26. It thus becomes thrown toward the eccentric wall 27 of the separating-chamber 15, while the liquid forms a ring around the inner periphery of the bowl. This liquid ring of solution remains during the operation of the apparatus. The ore is thrown through it, and so against the inner surface of the bowl, with great force. It is then carried by the scrapers 24 around to the opening 16, where, together with such moisture as may remain in it, it is ejected through the passage 17 and opening 19 into the surrounding casing 33, as indicated by arrows

a, and so by gravity is conducted through the conduit 28 to the second agitator B of the series. This agitator is similar to the first agitator A, Fig. 2. The liquid which remains in the ore delivered into it forms a ring, as before, which remains, while the ore, again containing a percentage of moisture, proceeds by the casing 34 and conduit 29 to agitator C. Here it is again subjected to the same treatment and finally escapes to the separator D.

The construction of the separator is exactly the same as that of each of the agitators, with the difference that it has a liquid-outlet, as indicated at 30, dotted lines, Fig. 1, and as shown in my patent aforesaid. Its operation upon the combined materials is fully set out in said Letters Patent. The exhausted ore from which the metal has now been removed passes from the separator, as indicated by the arrows *b*, to the casing 35 and delivery-spout 36, and so to receiving vessel 31. The liquid escapes by pipe 30 to a fixed cup 39 on standard 12 and thence by pipe 37 to any suitable vat 32.

The agitators A B C may be supported, as shown, at different levels upon a suitable frame E. Power may be obtained from an electric motor F, operating by gearing G, the vertical shaft H, supported on said frame E, which shaft has pulleys I, from which extend belts which actuate the driving-pulleys K L on the several agitators and separator.

The operation of the apparatus as a whole is as follows: Because the ore is conducted by the conveyer into a descending stream of solution the two ingredients enter the first agitator well combined and with a large amount of air intermingled with them. The ore in this first agitator being thrown with great force through the liquid ring formed of solution every particle of it becomes subjected to the effect of that solution. Inasmuch as in the remaining agitators similar rings are formed from the liquid, the ore is forced again and again through this liquid, and so subjected to repeated action thereof. The same thing happens in the separator, but from this the exhausted ore and enriched liquid separately escape. The supply of material being continuous and its flow through the apparatus due to gravity as it descends from receptacle to receptacle being constantly maintained the liquid rings once established remain, the percentage of solution which is removed in the ore escaping from each agitator being replaced by new solution from the next preceding agitator or from the initial mixing device, so that whatever the amount of enriched liquid may be which finally flows from its outlet in the separator per given time it is replaced by the liquid entering the apparatus from the mixing device in approximately the same time. The forcible agitation of the mixture constantly introduces oxygen from the air in large amounts, and this, as is well known, greatly facilitates the reaction of the solution on the ore. The solution does not percolate through the ore, nor is the dry ore merely stirred into it. The fine ore and mingled air are literally sprayed through the rings of solution. The result is a great saving of time and a great increase in the percentage of metal taken up by the solution. The latter is treated to obtain the metal by any well-known method.

I claim—

1. The process of extracting precious metal from ore which consists in projecting the ore in comminuted form through an aqueous solution chemically active to dissolve said precious metal.

2. The process of extracting precious metal from ore which consists in centrifugally projecting the ore in comminuted form through an aqueous solution chemically active to dissolve said precious metal.

3. The process of extracting precious metal from ore which consists in first mixing the ore in comminuted form with an aqueous solution chemically active to dissolve said precious metal and then projecting the solid material in suspension through a body of solvent solution.

4. The process of extracting precious metal from ore which consists in first causing a stream of ore in comminuted form to meet a current of solution chemically active to dissolve said precious metal and thus mixing said ore and solution with atmospheric air and then projecting the ore in suspension in said aerated mixture of ore and solution through a body of solvent solution.

5. The process of extracting precious metal from ore which consists in projecting the ore in comminuted form through successive bodies of an aqueous solution chemically active to dissolve said precious metal.

6. The process of extracting and separating precious metal from ore which consists in projecting the ore in comminuted form through a solution chemically active to dissolve said precious metal and centrifugally separating said enriched solution from said ore.

7. The process of extracting and separating precious metal from ore which consists in centrifugally forcing the ore in comminuted form through a solution chemically active to dissolve said precious metal and centrifugally separating said enriched solution from said ore.

8. The process of extracting and separating precious metal from ore which consists in projecting the ore in comminuted form through successive bodies of solution chemically active to dissolve said precious metal and finally centrifugally separating said enriched solution from said ore.

9. The process of extracting precious metal from ore which consists in agitating said ore and simultaneously projecting it in commi-

nuted form through an aqueous solution chemically active to dissolve said precious metal.

10. The process of extracting precious metal from ore which consists in first mixing the ore in comminuted form with a solution chemically active to dissolve said precious metal and then agitating said ore and simultaneously projecting it through a body of solvent solution.

11. The continuous process of extracting precious metal from ore which consists in projecting said ore in comminuted form through successive bodies of an aqueous solution chemically active to dissolve said precious metal disposed in a series of communicating vessels.

12. The continuous process of extracting and separating precious metal from ore which consists in projecting said ore in comminuted form through successive bodies of a solution chemically active to dissolve said precious metal disposed in a series of communicating vessels and finally centrifugally separating said enriched solution from said ore.

13. The process of extracting and separating precious metal from ore which consists in mixing comminuted ore with a solution chemically active to dissolve said precious metal, and then simultaneously centrifugally agitating the mixture and separating the said enriched solution from said ore.

14. The continuous process of extracting and separating precious metal from ore which consists in causing a mixture of comminuted ore and solution chemically active to dissolve said precious metal to descend by gravity centrifugally agitating the same during said descent and thereafter centrifugally separating said enriched solution from said ore.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN JOSEPH BERRIGAN.

Witnesses:
WM. H. SIEGMAN,
I. A. VAN WART.