No. 741,189. PATENTED OCT. 13, 1903.

H. H. THOMPSON.

APPARATUS FOR EXTRACTING PRECIOUS METALS.

APPLICATION FILED JULY 11, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

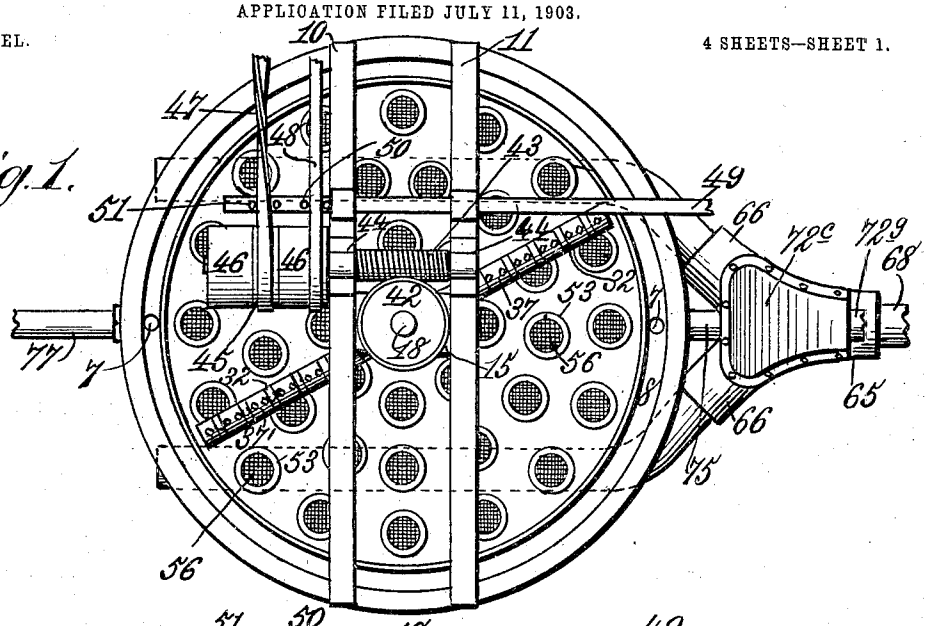
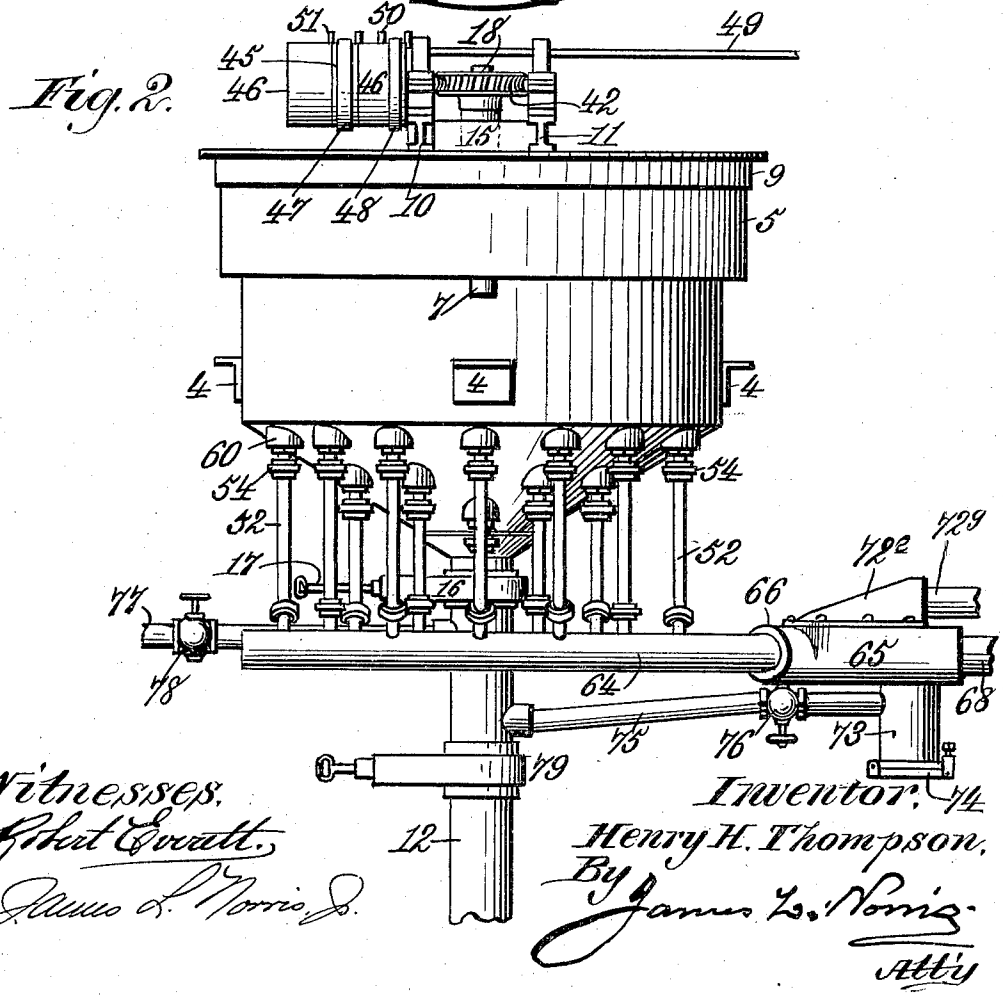


Fig. 2.



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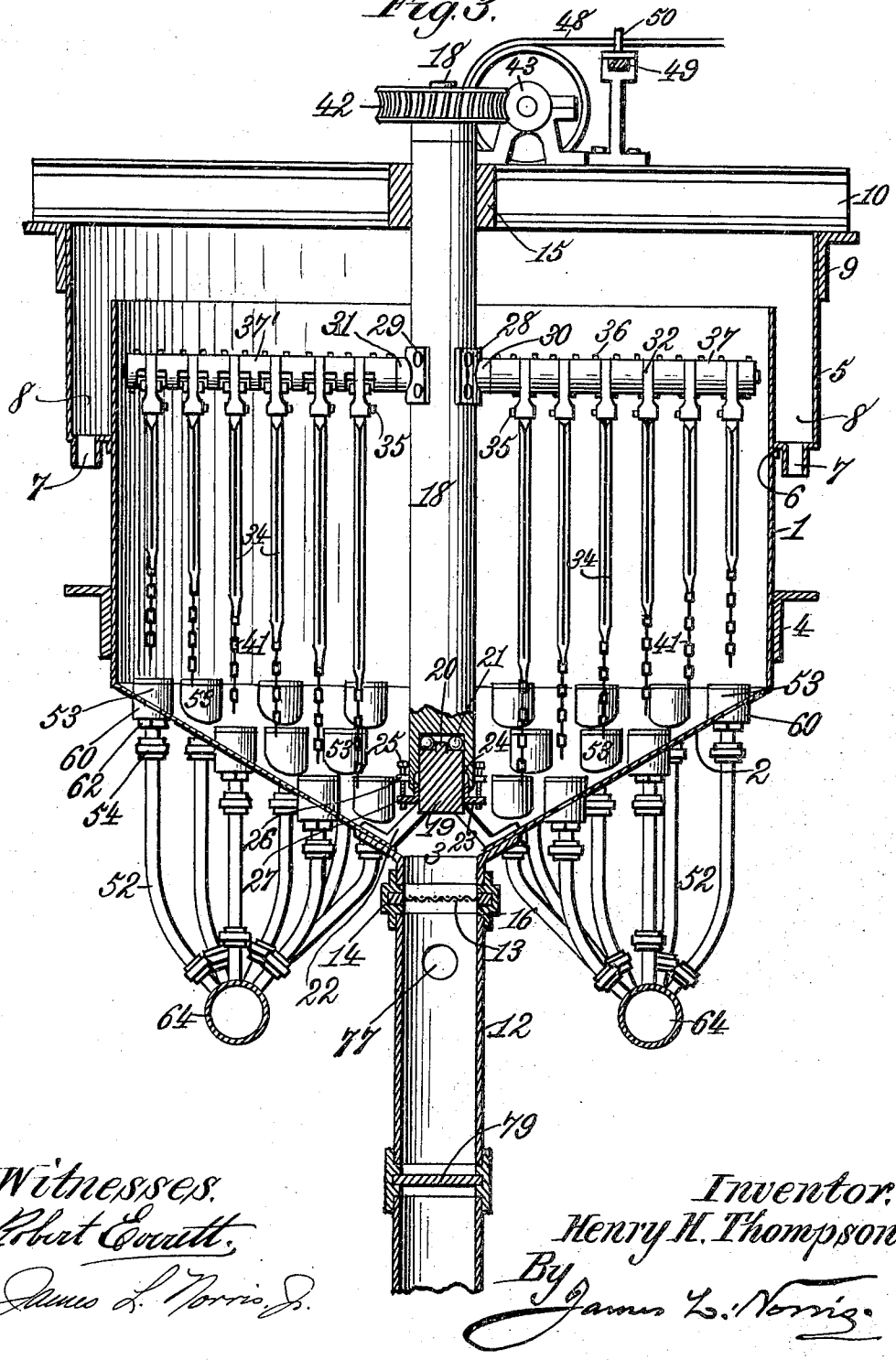
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 3.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 4.

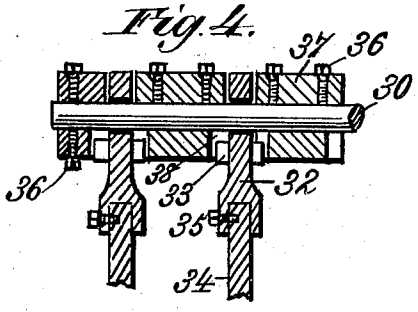


Fig. 5.

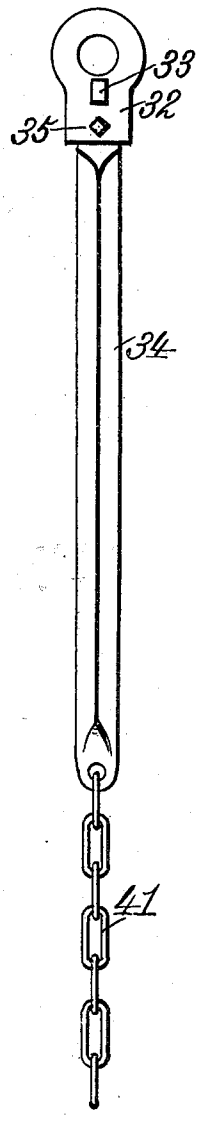


Fig. 6.

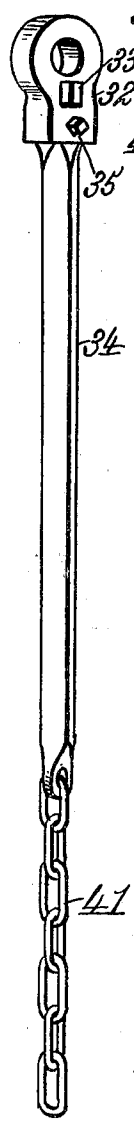


Fig. 7.

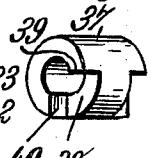


Fig. 8.

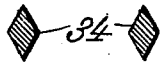
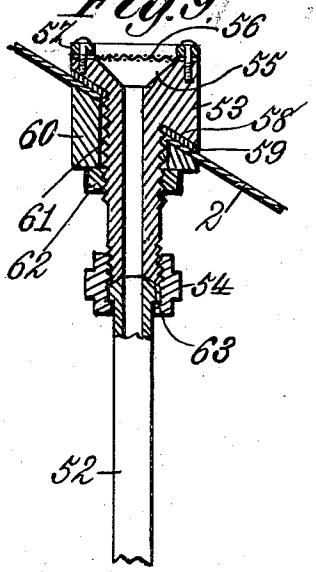


Fig. 9.



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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 10.

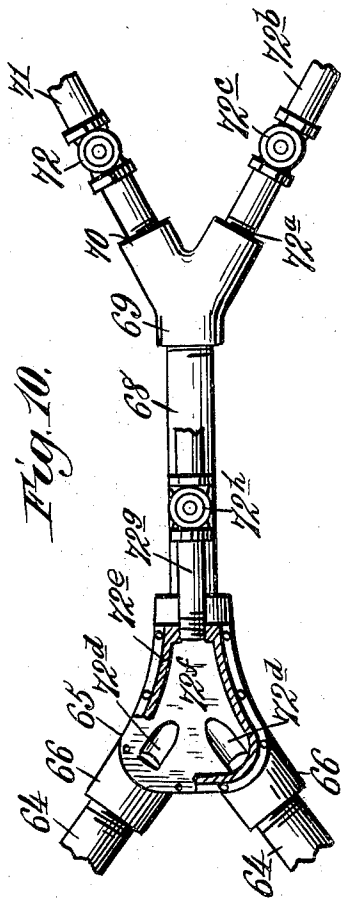
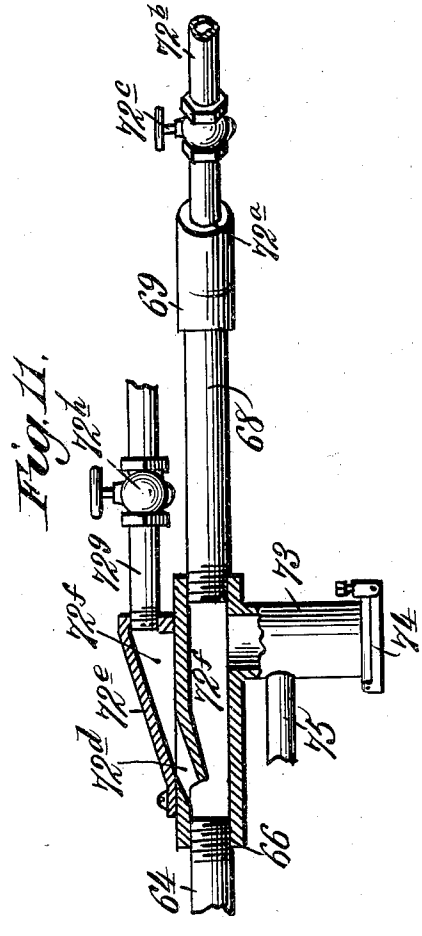


Fig. 11.



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No. 741,189. Patented October 13, 1903.

UNITED STATES PATENT OFFICE.

HENRY H. THOMPSON, OF CHURCHVILLE, NEW YORK.

APPARATUS FOR EXTRACTING PRECIOUS METALS.

SPECIFICATION forming part of Letters Patent No. 741,189, dated October 13, 1903.

Application filed July 11, 1903. Serial No. 165,176. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. THOMPSON, a citizen of the United States, residing at Churchville, in the county of Monroe and State of New York, have invented new and useful Improvements in Apparatus for Extracting Precious Metals, of which the following is a specification.

This invention relates to a certain new and useful improvement in apparatus for extracting precious metals.

My invention has principally for its object the construction of an apparatus adapted to extract gold from ores; but it may be used for obtaining silver from its ores when found in combination with gold or alone.

According to the method now generally employed in the recovery of gold and silver from their ores by means of solvent solutions of potassium cyanid, the sand or the ores, the latter being first crushed to the size desired, are placed in large vats or tanks and then flooded or saturated with a solvent solution and allowed to stand and leach until the solution has eaten out or extracted a greater or less percentage of the values of the ores or the sand. The solution is then drained or drawn out through the bottom of the tank, and the gold or silver that is held in solution is then precipitated by means of zinc or other methods of recovery. Experience and chemistry have shown that the chemical activity of a solvent solution of potassium cyanid in the extraction of gold or silver depends largely upon the amount of oxygen present during the leaching process.

Various attempts to furnish artificial oxygen have been made by adding other chemicals—such as permanganate of potash, ferricyanid of potassium, &c.—to the solvent solution potassium cyanid. It has also been proven that the presence of an increased supply of oxygen not only increases the chemical activity of the potassium cyanid during the leaching process, but that a much larger quantity of the potassium cyanid is used up.

One of the objects of my invention is to provide new and novel means so that the cyanid solution will be fed to the receptacle accompanied by compressed air, thereby providing the necessary amount of oxygen, consequently overcoming the objection of insufficient oxygen heretofore existing in methods or apparatus generally employed for the extraction of gold and silver from ores.

A further object of the invention is to provide new and novel means for washing the leached ore, so that when the leaching is completed the cyanid solution which has not overflowed can be entirely drawn off.

The invention further aims to provide an apparatus of this character by which the supply of compressed air and cyanid solution can be diminished or increased at the option of the operator; that will enable the supply of the cyanid solution and compressed air to the apparatus to be made through a combined compressed-air and cyanid nozzle, which projects into the receptacle containing the material to be treated; to supply the cyanid solution and compressed air separately or combined; to supply the cyanid solution and compressed air under pressure, and to provide suitable means for catching the overflow of cyanid solution from the receptacle containing the material to be treated, so that the said overflow can be conducted to a suitable means and the gold or silver precipitated.

The invention further aims to provide an apparatus of this character with means whereby the treated material can be thoroughly washed and discharged from the receptacle containing it by gravity and the supplying of the washing liquor through the combined compressed-air and cyanid nozzle.

The invention further aims to construct an apparatus of this character with new and novel means for feeding the cyanid solution, compressed air, and washing solution separately or combined, as desired.

A further object of the invention is to provide new and novel means for thoroughly agitating the material while it is subjected to the cyanid solution and compressed air, and thereby insure a thorough action of the solution upon the material.

The invention further aims to construct an apparatus for the purpose set forth which shall be simple in its construction, strong, durable, efficient in its use, and comparatively inexpensive to set up.

With the foregoing and other objects in view the invention consists of the novel combination and arrangement of parts hereinaf-

ter more specifically described, illustrated in the accompanying drawings, and particularly pointed out in the claims hereunto appended.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this specification, wherein like reference characters denote corresponding parts throughout the several views, and in which—

Figure 1 is a top plan view of the apparatus. Fig. 2 is a side elevation thereof. Fig. 3 is a sectional elevation thereof. Fig. 4 is a sectional detail of the upper portion of the agitator-arms and other suspension means. Fig. 5 is a side elevation of one of the agitator-arms. Fig. 6 is a perspective view of one of the agitator-arms. Fig. 7 is a perspective view of one of the spacing and stop collars for the agitator-arms. Fig. 8 illustrates cross-sections of the agitator-arms. Fig. 9 is a sectional detail of one of the screened nozzles for the feed-pipe. Fig. 10 is a detail of the couplings by which the cyanid, compressed air, or water is introduced to the auxiliary supply-pipes. Fig. 11 is a sectional elevation of Fig. 10.

Referring to the drawings by reference characters, 1 denotes a tank or receptacle which is adapted to receive the material to be operated upon, such as any gold-bearing substance. The tank or receptacle 1 is open at its top and is provided with a closed bottom 2, substantially in the form of an inverted cone, which is provided centrally with an outlet 3. The tank or receptacle 1 is stationary and, as shown, is substantially cylindrical in contour; but any preferred shape may be employed. The outer face of the tank or receptacle 1 has attached thereto a series of short angle-irons 4, which are adapted to rest upon any suitable means for supporting the apparatus in an upright position. Other means than that as shown for retaining the apparatus in an upright position can be employed. Surrounding the tank or receptacle 1, near the top thereof, and arranged a suitable distance from the outer face of the tank or receptacle 1 is a shell 5, connected at its lower end to the tank or receptacle 1 by an annular plate 6, provided with outlets 7. The shell 5 extends a suitable distance above the top edge of the tank or receptacle 1 and is in connection therewith, and the plate 6 forms an overflow-compartment 8 for the cyanid solution, the latter being discharged therefrom through the outlets 7, which are adapted to be connected to any suitable separating means for the solution. The top of the shell 5 has secured thereto an annular angle-iron 9, forming a support for a pair of I-beams 10 11. These latter are adapted to support the operating mechanism for the agitator-shaft, both of which will be hereinafter referred to.

Communicating with the outlet 3 of the conical bottom 2 is a discharge-pipe 12 for the solution which remains in the tank or receptacle 1 after the material has been treated and also for the discharge of the treated material. The discharge-pipe 12 near its junction with the conical bottom 2 is provided with an adjustable screen 13, its mesh being such as to prevent the passage of the material therethrough, but to permit of the passage of the solution. The screen 13 is carried by a slidable support 14, operating in a casing 16, which carries the support 14. The latter has connected thereto at one end a handle 17, so that the screen 13 can be readily removed from its position within the pipe 12, as well as replaced. The casing 16 is arranged between two sections of the pipe 12 and also forms a coupling for connecting the two sections of said pipe together.

Arranged within the tank or receptacle 1 is a series of agitating-arms, which are adapted to agitate the material when moving in one direction, but assume an inoperative position when moving in a counter direction. The agitator-arms are suspended from a vertically-extending shaft 18, rotatably supported at its lower end within the tank or receptacle 1 and at its upper end by the bearing 15, arranged between and secured to the I-beams 10 and 11 centrally of the apparatus. The shaft 18 is rotatably supported at its lower end within the tank or receptacle 1 by means of an abutment-block 19, which extends into the lower end of the shaft 18 and is provided at its top with a vertical projection 20, surrounded by the bearing-balls 21. The shaft 18 at its lower end is suitably recessed, so that it will fit closely, but permit of rotating around the abutment-block 19. The shaft 18 when set up rests upon the bearing-balls 21. The abutment-block 19 is supported within the tank or receptacle 1 by means of the inclined legs 22, secured at their lower ends to the inner face of the conical bottom 2 and at their upper ends to the block 19. Extending within the recessed end of the shaft 18 and surrounding the block 19 is a gland 23, between which and the shoulder 24, formed in the wall of the recesses in the end of the shaft 18, is arranged a suitable packing to prevent foreign matter entering the upper part of the recessed portion of the shaft 18. The gland 23 is adjustably connected to the shaft 18 by means of the bolts 25, extending through the lugs 26 on the shaft 18 and the screw-threaded lugs 27 on the gland 23.

Connected to the shaft 18, near the top thereof, as at 28 29, is a pair of radially-extending supporting-arms 30 31, respectively. Each of the arms 30 31 has loosely mounted thereon a series of hangers 32, provided on each side with a laterally-extending ear 33 and recessed in their bottom to receive the upper end of the agitator-arms 34, which are secured to the hangers by the set-screws 35. The agitator-arms 34 are substantially diamond-shaped in cross-section for the purpose hereinafter referred to. Fixedly secured, by means of the set-screws 36, upon the arms 30

31 is a series of spacing and stop collars 37 37′ for the hangers 32 and between which the hangers are arranged. Each end of the collars 37 37′ is cut away, as at 38, to form the shoulders 39 40, the shoulder 39 being arranged substantially at an angle of ninety degrees and the shoulder 40 substantially at an angle of one hundred and eighty degrees. The collars 37 and 37′ are secured, respectively, to the arms 30 and 31 in such a manner that when the shaft 18 is rotated in one direction the agitator-arms 34 will be rigid, consequently agitating the material within the tank or receptacle 1, and when the shaft 18 is rotated in the opposite direction the agitator-arms 34 will be moved from their vertical position, and consequently the material will not be agitated. This action is caused by the engagement of the ears 33 when the shaft 18 is rotated in one direction with the shoulders 40, owing to the fact that the material will offer a resistance to the arms 34, causing the ears 33 of the hangers 32 to bear against the shoulders 40; but when the shaft 18 is rotated in an opposite direction, there being no bearing-surface for the ears 33 to retain the hangers 32 and arms 34 in an upright position, the material will cause the agitator-arms and the hangers to swing upwardly until their movement will be arrested by the shoulder 39. Consequently the hangers 32 and arms 34 will extend at such an angle that their function of agitating will be lost; but immediately when the shaft is rotated in an opposite direction the agitator-arms 34 will be caused to assume a vertical position, owing to the action of the ears 33 bearing against the shoulders 40, and the arms 34 will be retained in such position and agitate the material until the movement of the shaft is reversed or stopped. As before stated, the arms 34 are diamond-shaped in cross-section, so that such shape will assist the said arms in cutting through the material when the arms 34 are retained in their upright position. To further assist in agitating the material when the shaft 18 is rotated in the direction which causes the agitator-arms 34 to remain in this upright position, the lower ends of each of the arms 34 carries an agitating-chain 41. It will be evident that when the arms 34 are rapidly revolved in their operating position and carry the chains 41 therewith the latter, owing to their flexibility, will also materially assist in agitating the material. The agitator-arms 34 are of a different size, gradually diminishing in length—that is to say, the outer arm being shorter than the adjacent inner arm. This manner of constructing the arms is necessary owing to the fact that the bottom of the receptacle or tank 1 is provided with the conical bottom 2. The shaft 18 is operated by means of a worm-wheel 42, carried on the upper end thereof and which is engaged and operated by means of a worm-shaft 43, supported by the bearing-brackets 44, mounted upon the I-beams 10 and 11. One end of the worm-shaft 43 projects from the I-beam 10 and carries the fixed driving-pulley 45 and a pair of loose pulleys 46. The reference characters 47 48 denote, respectively, a twisted belt and an untwisted belt, which are connected to a prime mover for operating the worm-shaft 43. The belt 47, as before stated, is twisted, and when it is shifted onto the pulley 45 to connect it to the prime mover it will cause the worm-shaft 43 to revolve in such a manner so as to rotate the shaft 18 in an opposite direction to that direction imparted to the shaft 18 by the shaft 43 when the belt 48 is shifted upon the pulley 45 for connecting it to the prime mover. The loose pulleys 46 are of such a width that both belts can be shifted so they will not engage the pulley 45, thereby discontinuing the operation of the apparatus. The reference character 49 denotes the shifting-rod for the belts 47 and 48. The rod 49 is supported by the I-beams 10 and 11 and is provided with two pairs of vertically-extending studs 50 51 for the belts 47 and 48, respectively. It will be evident that by shifting the rod 49 the belts 47 and 48 can be shifted as desired upon the pulley 45, so that the proper rotation can be imparted to the shaft 18, and, furthermore, the belts 47 and 48 can be so shifted as not to engage the pulley 45 for the purpose heretofore set forth.

The cyanid solution, compressed air, and water are supplied to the tank or receptacle 1 separately or combined by means of the feed-pipes 52, which communicate with the tank or receptacle 1 through the medium of the nozzles 53, connected to the bottom 2. These nozzles 53 are attached to the upper end of the feed-pipes 52 by means of the couplings 54 and are each provided with a flaring mouth 55, having extending across the same a screen 56, connected to the nozzle by means of the screws 57 or other suitable device. The mesh of the screens 56 is such as to permit of the passage therethrough of the cyanid solution or the water, as well as the compressed air, but will arrest the passage of the material to the feed-pipe 52. The nozzle 53 is provided with an enlarged discharge end, which is cut away so as to conform to the inclination of the bottom 2. This cutting away of the enlarged discharge end of the nozzle 53 forms a shoulder 58, adapted to rest upon the inner face of the bottom, but preferably to form a water-tight joint between the shoulders 58 and inner face of the bottom 2 a suitable packing is interposed, as at 59. The bottom 2 is provided with an opening to permit of the extending therethrough of that portion of the nozzle of smaller diameter. Each of the nozzles 53 is secured in position by means of a collar 60 abutting against the lower face of the bottom 2, the upper face of the collar 60 being constructed to conform to the shape of the bottom 2 for such purpose and which is retained in position by means of the set-nut 62,

which engages the screw-threads 61 of the nozzle against the collar 60. The feed-pipes 52 near their juncture with the nozzles 53 are shouldered, as at 63, so that when the coupling 54 is screwed home the nozzles 53 and feed-pipes 52 will be securely clamped together.

Arranged below the bottom 2 of the tank or receptacle 1 are the auxiliary supply-pipes 64, two of which are preferably employed and to which the lower ends of the feed-pipes 52 are connected. The feed-pipes 52 have portions of their length bent in a curvilinear manner and the remaining portions in a vertical manner, so that the cyanid solution, water, or air will be fed in a vertical manner to the tank or receptacle 1. By this arrangement only two auxiliary supply-pipes are necessary. The auxiliary supply-pipes 64 extend in a horizontal manner the major portion of their length, are closed at one end, and at their other end are bent toward each other and connected to one end of the Y-shaped coupling 65, as at 66. The other end of the coupling 65 is connected by a branch pipe 68 with one end of a Y-shaped coupling 69. This latter coupling has connected thereto, as at 70, a cyanid-solution-supply pipe 71, provided with the cut-off 72, the pipe 71 being in communication with a cyanid-solution supply. (Not shown.) The coupling 69 is also connected, as at 72^a, with a water-supply pipe 72^b, provided with a cut-off 72^c. The pipe 72^b is also in communication with a water-supply. (Not shown.) The cyanid solution and water are supplied to the apparatus under pressure. Any suitable means may be employed for this purpose. The top of the coupling 65 is provided with a pair of diverging openings 72^d, which depend downwardly at an inclination and extend in the same direction as the bent ends of the auxiliary supply-pipes 64. Mounted upon the top of the coupling 65 is a casing 72^e, which forms, in connection with the top wall of the coupling 65, a compressed-air chamber 72^f. The casing 72^e is connected to the coupling 65 in any suitable manner. Connected to one wall of the casing 72^e and communicating with the compressed-air chamber 72^f is a compressed-air-supply pipe 72^g, provided with a cut-off 72^h. The pipe 72^g is in communication with a suitable compressed-air supply. The cut-offs 72, 72^c, and 72^h are adapted to control the cyanid-solution supply, water-supply, and compressed-air supply, respectively, either separately or in any preferred combination. By extending the openings 72^d in the top wall of the coupling 65 in a diverging manner, or so that the openings will extend in the same direction as the auxiliary supply-pipes 64, the compressed air and cyanid solution will be evenly distributed when they are supplied to the receptacle.

The coupling 65 has depending therefrom a trap 73, closed by means of the gate 74. The trap 73 is adapted to receive any of the material which might pass through the screens 56 during the discharge of the cyanid from the tank or receptacle 1 after the ore is treated. The trap 73 also communicates with the discharge-pipe 12 by means of the inclined pipe 75, which is provided with a cut-off 76. This discharge-pipe 12 will permit of the draining off of any of the cyanid solution remaining in the nozzles 53, feed-pipes 52, auxiliary supply-pipes 64, coupling 65, and trap 73 after the material has been treated. Communicating with the discharge-pipe 12 is a draw-off pipe 77, having a cut-off 78, and which is adapted to draw off the cyanid solution which remains in the tank or receptacle 1, pipe 12, coupling 65, and trap 73 after the material has been treated, as well as prior to the discharge of the material. The pipe 77 may be connected to a suitable pump to assist in the withdrawing of the cyanid solution. The discharge-pipe 12 is provided with a gate-valve 79, which when open and the screen 13 withdrawn will permit of the treated material being discharged from the tank or receptacle 1, as it will be evident that owing to the conical bottom 2 of the tank or receptacle 1 the material will flow by gravity out through the outlet 3 into the discharge-pipe 12, from where it can be conducted to any suitable point.

The operation of the apparatus is as follows: The material to be treated is delivered in any suitable manner into the tank or receptacle 1 to a suitable level. The cyanid solution and compressed air are then introduced into the tank or receptacle 1 through the medium of the nozzles 53 and feed-pipes 52, the cut-offs 72 and 72^h being opened to permit of the passage of the solution and air from their supply through the couplings 65 69, branch pipe 67, supply-pipes 71 72^g, feed-pipes 52, and nozzles 53. The cyanid solution and compressed air are supplied to the tank or receptacle 1 in such a manner as to make the ore or sand boil up, and at this stage the shaft 18 is rotated in such a manner that the agitator-arms will rise or be elevated and the chains 41 stir the top of the material. This operation of the shaft 18 is only for a few minutes, in fact, sufficient to stir the top of the material, so that the cyanid can thoroughly act thereon. The motion of the shaft 18 is then reversed and the agitator-arms 34 caused to assume their vertical position, and as the shaft 18 rotates the arms 34 and chains 41 will thoroughly agitate the material during the leaching thereof. The upward leaching of the cyanid solution through the material causes a thorough permeation of the mass and absorption of the metals desired to be separated. The action of the cyanid solution will be materially assisted by the presence of the necessary amount of oxygen, which is obtained by the supplying of the compressed air simultaneously with the feeding of the cyanid solution, the solution and air being fed under pressure, and the material is thoroughly agitated in the manner as here-

inbefore set forth during the leaching thereof by the solution. The overflowing cyanid solution carrying the gold and silver, for example, is collected into the overflow-chamber 8, from where it is discharged through the outlets 7 and conducted in any suitable manner to the separating apparatus to precipitate the metals from the solution. After a thorough leaching in the manner as set forth the supply of the solution and air is discontinued by closing the cut-offs 72 and 72^g. The cyanid solution remaining in the tank is drawn off by means of opening the cut-off 76 of the pipe 75 and the cut-off 78 of the pipe 77. To the latter a suction device may be attached. The backflow of the solution will be through the outlet 3 into the pipe 12. From the latter the material will be discharged through the pipe 77, where it is conducted to a suitable separating apparatus. The solution will also flow backward through the nozzle 53, feed-pipes 52, auxiliary supply-pipes 64, coupling 65, trap 73, pipe 75, and into pipe 12, from whence it is discharged through the pipe 77. During the exhausting of the solution from the tank or receptacle 1 the screen 13 extends across the pipe 12 to prevent the material entering the same. The gate-valve 79 remains closed when the solution is exhausted to prevent the discharge of the material through said pipe 12. During the withdrawal of the cyanid solution the operation of the shaft 18 is discontinued. After the solution is removed the cut-offs are closed and the material is washed and loosened up by the supplying of water to the tank or receptacle 1 through the nozzles 53, feed-pipe 52, auxiliary supply-pipe 64, couplings 65 69, and water-pipe 72^b, the cut-off 72^c being open for such purpose. After a sufficient quantity of water is supplied, the shaft 18 is slowly rotated, which in connection with the water thoroughly loosens the material or causes the material to assume a liquid state. The screen 13 is then removed and the gate-valve 79 opened, which permits the material to discharge itself by gravity from the tank or receptacle 1 through the outlet 3 of the bottom 2 into the pipe 12, where it is conducted to any suitable point. The shape of the bottom 2 permits of the tank or receptacle 1 emptying itself by gravity.

It is thought the many advantages of my improved apparatus for extracting precious metals from ores or sand can be readily understood from the foregoing description, taken in connection with the accompanying drawings, and it will furthermore be evident that changes, variations, and modifications can be resorted to without departing from the spirit of the invention or sacrificing any of its advantages, and I therefore do not wish to restrict myself to the details of construction hereinbefore described and as shown in the accompanying drawings, but reserve the right to make such changes, variations, and modifications as come properly within the scope of the protection prayed.

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

1. An apparatus for extracting precious metals comprising a receptacle, a series of nozzles communicating therewith, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

2. An apparatus for extracting precious metals comprising a receptacle, a series of nozzles extending through and connected to the bottom of said receptacle, said nozzles communicating with the interior of said receptacle, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

3. An apparatus for extracting precious metals comprising a receptacle, a series of screened nozzles communicating therewith, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

4. An apparatus for extracting precious metals comprising a receptacle, a series of screened nozzles extending through and connected to the bottom of said receptacle, said nozzles communicating with the interior of said receptacle, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

5. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of nozzles communicating with said receptacle and connected with said coupling, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

6. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of nozzles extending through and connected to the bottom of said receptacle, said nozzles further connected to said coupling and communicating with the interior of said receptacle, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

7. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of screened nozzles projecting in said receptacle, communicating therewith and connected with said coupling, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

8. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of screened nozzles extending through and connected to the bottom of said receptacle, said nozzles further connected to said coupling and communicating with the interior of said receptacle, and pipes for supply-

ing a cyanid solution, compressed air and water communicating with said coupling.

9. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of nozzles communicating with said receptacle and connected with said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply the cyanid solution and compressed air and separately supply the water to each of said nozzles.

10. An apparatus for extracting precious metals, a coupling, a series of nozzles extending through and connected to the bottom of said receptacle, said nozzles further connected to said coupling and communicating with the interior of said receptacle, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply the cyanid solution and compressed air and separately supply the water to each of said nozzles.

11. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of screened nozzles communicating with said receptacle and connected with said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply the cyanid solution and compressed air and separately supply the water to each of said nozzles.

12. An apparatus for extracting precious metals comprising a receptacle, a coupling, a series of screened nozzles extending through and connected to the bottom of said receptacle, said nozzles further connected to said coupling and communicating with the interior of said receptacle, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply the cyanid solution and compressed air and separately supply the water to each of said nozzles.

13. An apparatus for extracting precious metals comprising a receptacle, a series of nozzles projecting therein and communicating therewith, means for supplying a cyanid solution, compressed air and water to each of said pipes either separately or in any preferred combination, and an agitating means arranged within and supported by the top of said receptacle.

14. An apparatus for extracting precious metals comprising a receptacle, a series of nozzles extending through and connected to the bottom of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and an agitating means arranged within and supported by the top of said receptacle.

15. An apparatus for extracting precious metals comprising a receptacle, a series of screened nozzles extending through and connected to the bottom of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and an agitating means arranged within and supported by the top of said receptacle.

16. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a series of nozzles projecting in said receptacle and communicating therewith, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

17. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a series of nozzles extending through and connected to the bottom of said receptacle, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

18. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a series of screened nozzles extending through and connected to the bottom of said receptacle, and means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination.

19. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a series of nozzles extending through and connected to the bottom of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and an agitating means arranged within and supported by the top of said receptacle.

20. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a series of screened nozzles projecting in said receptacle and communicating therewith, means for supplying the cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and an agitating means arranged within and supported by the top of said receptacle.

21. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of nozzles communicating with said receptacle and connected with said coupling, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

22. An apparatus for extracting precious

metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of nozzles extending through and connected to the bottom of said receptacle, said nozzles communicating with the interior of said receptacle and connected with the said coupling, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

23. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of screened nozzles communicating with said receptacle and connected with said coupling, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

24. An apparatus for extracting precious metals comprising a receptable having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of screened nozzles extending through and connected to the bottom of said receptacle, said nozzles communicating with the interior of said receptacle and connected with the said coupling, and pipes for supplying a cyanid solution, compressed air and water communicating with said coupling.

25. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of nozzles communicating with said receptacle and connected with said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply cyanid solution and compressed air and separately supply water to each of said nozzles.

26. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of nozzles extending through and connected to the bottom of said receptacle, said nozzles communicating with the interior of said receptacle and connected with the said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply cyanid solution and compressed air and separately supply water to each of said nozzles.

27. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of screened nozzles communicating with said coupling and said receptacle, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling said pipes to conjointly supply cyanid solution and compressed air and separately supplying water to each of said nozzles.

28. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of nozzles communicating with said compartment and with said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, means for controlling said pipes to conjointly supply cyanid solution and compressed air and separately supplying water to each of said nozzles, and an agitating means arranged within and supported by the top of said receptacle.

29. An apparatus for extracting precious metals comprising a receptacle having its upper portion surrounded by an overflow-compartment provided with an outlet, a coupling, a series of screened nozzles communicating with said receptacle and connected with said coupling, pipes for supplying a cyanid solution, compressed air and communicating with said coupling, means for controlling said pipes to conjointly supply cyanid solution and compressed air and separately supply water to each of said nozzles, and an agitating means arranged within and supported by the top of said receptacle.

30. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening, a series of nozzles disposed throughout said bottom, connected thereto and communicating with the interior of said receptacle, and means connected with the nozzles and adapted to supply conjointly a cyanid solution and compressed air and separately supply water to each of said nozzles.

31. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-compartment having an outlet, a coupling, a series of nozzles disposed throughout said bottom, connected thereto and communicating with the interior of said receptacle, said nozzles further connected with said coupling, cyanid-solution, compressed-air and water supply pipes communicating with said coupling, and means connected to the said pipes for controlling the supply of said solution, air and water through said coupling.

32. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-compartment having an outlet, a coupling, a series of screened nozzles disposed throughout said bottom, connected thereto and communicating with the interior of said receptacle, said nozzles further connected with said coupling, cyanid-solution, compressed-air and water supply pipes communicating with said coupling, and

means connected to the said pipes for controlling the supply of said solution, air and water through said coupling.

33. An apparatus of the character described comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening, a series of nozzles disposed throughout said bottom and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and an agitating means arranged within and supported by the top of said receptacle.

34. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-compartment having an outlet, a coupling, a series of nozzles disposed throughout said bottom, connected thereto and communicating with the interior of said receptacle, said nozzles further connected with said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, means connected to the said pipes for controlling the supply of said solution, air and water through said coupling, and an agitating means arranged within and supported by the top of said receptacle.

35. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-compartment having an outlet, a coupling, a series of screened nozzles disposed throughout said bottom, connected thereto and communicating with the interior of said receptacle, said nozzles further connected with said coupling, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, means connected to the said pipes for controlling the supply of said solution, air and water through said coupling, and an agitating means arranged within and supported by the top of said receptacle.

36. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, auxiliary supply-pipes arranged below the bottom of said receptacle, a series of nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to the top of said pipes, a coupling attached to one end of said pipes, pipes for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling the supply of said solution, air and water through said coupling and auxiliary supply-pipes to said nozzles.

37. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, auxiliary supply-pipes arranged below the bottom of said receptacle, a series of screened nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to the top of said pipes, a coupling attached to one end of said pipes, means for supplying a cyanid solution, compressed air and water supply pipes communicating with said coupling, and means for controlling the supply of said solution, air and water through said coupling and auxiliary supply-pipes to said nozzles.

38. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, auxiliary supply-pipes arranged below the bottom of said receptacle, a series of nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to the top of said pipes, a coupling attached to one end of said pipes, means for supplying a cyanid solution, compressed air and water communicating with said coupling, means for controlling the supply of said solution, air and water through said coupling and auxiliary supply-pipes to said nozzles, and an agitating means arranged within and supported by the top of said receptacle.

39. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, auxiliary supply-pipes arranged below the bottom of said receptacle, a series of screened nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to the top of said pipes, a coupling attached to one end of said pipes, means for supplying a cyanid solution, compressed air and water communicating with said coupling, means for controlling the supply of said solution, air and water through said coupling and auxiliary supply-pipes to said nozzles, and an agitating means arranged within and supported by the top of said receptacle.

40. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, auxiliary supply-pipes arranged below the bottom of said receptacle, a series of nozzles disposed throughout said bottom, projecting therethrough and connected therewith, said nozzles communicating with the interior of said receptacle and connected with said pipes, a coupling attached to one end of said pipes, means for supplying a cyanid solution, compressed air and water communi-

cating with said coupling, means for controlling the supply of said solution, air and water, an agitating means arranged within and supported by the top of said receptacle, and means communicating with the outlet of said bottom and with said coupling for exhausting the solution which remains in said receptacle.

41. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, a discharge-pipe communicating with said opening and provided with a screen and a closure-valve, auxiliary supply-pipes arranged above the bottom of said receptacle, a series of nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to said supply-pipes, a coupling attached to one end of said supply-pipes and provided with a trap, a pipe having a cut-off adapted to establish communication between the trap and said discharge-pipe, means for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling the supply of said solution, air and water.

42. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and at its upper portion surrounded by an overflow-chamber having an outlet, a discharge-pipe communicating with said opening and provided with a screen and a closure-valve, auxiliary supply-pipes arranged above the bottom of said receptacle, a series of screened nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to said supply-pipes, a coupling attached to one end of said supply-pipes and provided with a trap, a pipe having a cut-off adapted to establish communication between the trap and said discharge-pipe, means for supplying a cyanid solution, compressed air and water communicating with said coupling, and means for controlling the supply of said solution, air and water.

43. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having a centrally-arranged outlet-opening and its upper portion surrounded by an overflow-chamber having an outlet, a discharge-pipe communicating with said opening and provided with a screen and a closure-valve, auxiliary supply-pipes arranged above the bottom of said receptacle, a series of nozzles disposed throughout said bottom, communicating with the interior of said receptacle and connected to said supply-pipes, a coupling attached to one end of said supply-pipes and provided with a trap, a pipe having a cut-off adapted to establish communication between the trap and said discharge-pipe, means for supplying a cyanid solution, compressed air and water communicating with said coupling, means for controlling the supply of said solution, air and water, and an agitating means arranged within and supported by the top of said receptacle.

44. An apparatus for extracting precious metals comprising a receptacle provided with an overflow-compartment having an outlet, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, and rotating means for said arms.

45. An apparatus for extracting precious metals comprising a receptacle, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, and rotating means for said arms.

46. An apparatus for extracting precious metals comprising a receptacle, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, rotating means for said arms, and means for changing the direction of movement of said operating means.

47. An apparatus for extracting precious metals comprising a receptacle provided with an overflow-compartment having an outlet, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, rotating means for said arms, and a chain secured to the lower end of each of said arms.

48. An apparatus for extracting precious metals comprising a receptacle, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their

operative position and rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, rotating means for said arms, and a chain secured to the lower end of each of said arms.

49. An apparatus for extracting precious metals comprising a receptacle provided with an overflow-compartment having an outlet, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of screened nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, and rotating means for said arms.

50. An apparatus for extracting precious metals comprising a receptacle provided with an overflow-compartment having an outlet, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of screened nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, rotating means for said arms, and means for changing the direction of movement of said rotating means.

51. An apparatus for extracting precious metals comprising a receptacle, a series of bodily-movable agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of screened nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, rotating means for said arms, and a chain secured to the lower end of each of said arms.

52. An apparatus for extracting precious metals comprising a receptacle provided with an overflow-compartment having an outlet, a series of bodily-movable diamond-shaped agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of screened nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, and rotating means for said arms.

53. An apparatus for extracting precious metals comprising a receptacle, a series of bodily-movable diamond-shaped agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of screened nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, and rotating means for said arms.

54. An apparatus for extracting precious metals comprising a receptacle, a series of bodily-movable, diamond-shaped agitating-arms suspended in said receptacle and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when rotated in an opposite direction, a series of screened nozzles connected to the bottom of and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles, either separately or in any preferred combination, rotating means for said arms, and means for changing the direction of movement of said operating means.

55. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having an outlet and its upper portion surrounded by an overflow-compartment having an outlet, a series of bodily-movable and loosely-mounted agitator-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for suspending said arms within said receptacle, a series of nozzles disposed throughout and connected to said conical bottom and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and operating means for said rotatable suspension means.

56. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having an outlet and its upper portion surrounded by an overflow-compartment having an outlet, a series of bodily-movable and loosely-mounted agitating-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for sus-

pending said arms within said receptacle, a series of screened nozzles disposed throughout and connected to said conical bottom and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, operating means for said rotatable suspension means, and means for changing the direction of movement of said operating means.

57. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having an outlet and its upper portion surrounded by an overflow-compartment having an outlet, a series of bodily-movable and loosely-mounted diamond-shaped agitating-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for suspending said arms within said receptacle, a series of nozzles disposed throughout and connected to said conical bottom and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, operating means for said rotatable suspension means, and means for changing the direction of movement of said operating means.

58. An apparatus for extracting precious metals comprising a receptacle provided with a conical bottom having an outlet and its upper portion surrounded by an overflow-compartment having an outlet, a series of bodily-movable and loosely-mounted agitator-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for suspending said arms within said receptacle, a series of nozzles disposed throughout and connected to said conical bottom and communicating with the interior of said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, operating means for said rotatable suspension means, and means communicating with said supply means and the outlet of said bottom for exhausting the solution from said receptacle.

59. An apparatus for extracting precious metals comprising a receptacle provided with an outlet, a series of bodily-movable and loosely-mounted agitating-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for suspending said arms within said receptacle, said rotatable means and arms bodily movable, a series of nozzles communicating with said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and operating means for said rotatable means.

60. An apparatus for extracting precious metals comprising a receptacle provided with an outlet, a series of bodily-movable and loosely-mounted agitating-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for suspending said arms within said receptacle, said rotatable means and arms bodily movable, a series of nozzles communicating with said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, operating means for said rotatable means, and means communicating with said supply means and the said outlet for exhausting the solution from said receptacle.

61. An apparatus for extracting precious metals comprising a receptacle provided with an outlet, a series of bodily-movable and loosely-mounted agitating-arms gradually decreasing in length and adapted to be retained in their operative position when rotated in one direction and to assume an inoperative position when moved in an opposite direction, a rotatable means for suspending said arms within said receptacle, said rotatable means and arms bodily movable, a series of screened nozzles communicating with said receptacle, means for supplying a cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, operating means for said rotatable means, and means communicating with said supply means and the said outlet for exhausting the solution from said receptacle.

62. An apparatus for extracting precious metals comprising a receptacle, a series of nozzles projecting therein and communicating therewith, means for supplying cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and means for evenly distributing the compressed air and solution during the supply thereof.

63. An apparatus for extracting precious metals comprising a receptacle, a coupling, a casing mounted on the coupling and forming a compressed-air chamber communicating with the interior of the coupling, a series of nozzles projecting in said receptacle and communicating with said coupling, and means communicating with said coupling and said chamber for supplying to said receptacle through the said nozzles a cyanid solution, compressed air and water either separately or in any preferred combination.

64. An apparatus for extracting precious metals comprising a receptacle, a series of

screened nozzles projecting therein and communicating therewith, means for supplying cyanid solution, compressed air and water to each of said nozzles either separately or in any preferred combination, and means for evenly distributing the compressed air and solution during the supply thereof.

65. An apparatus for extracting precious metals comprising a receptacle, a coupling, a casing mounted on the coupling and forming a compressed-air chamber communicating with the interior of the coupling, a series of screened nozzles projecting in said receptacle and communicating with said coupling, and means communicating with said coupling and said chamber for supplying to said receptacle through the said nozzles a cyanid solution, compressed air and water either separately or in any preferred combination.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HENRY H. THOMPSON.

Witnesses:

JAMES L. NORRIS, Jr.,

N. LOUIS BOGAN.