D. BOSQUI.

PRECIPITATING APPARATUS FOR CYANID SOLUTIONS.

APPLICATION FILED DEC. 9, 1911.

1,035,941. Patented Aug. 20, 1912.

2 SHEETS—SHEET 1.

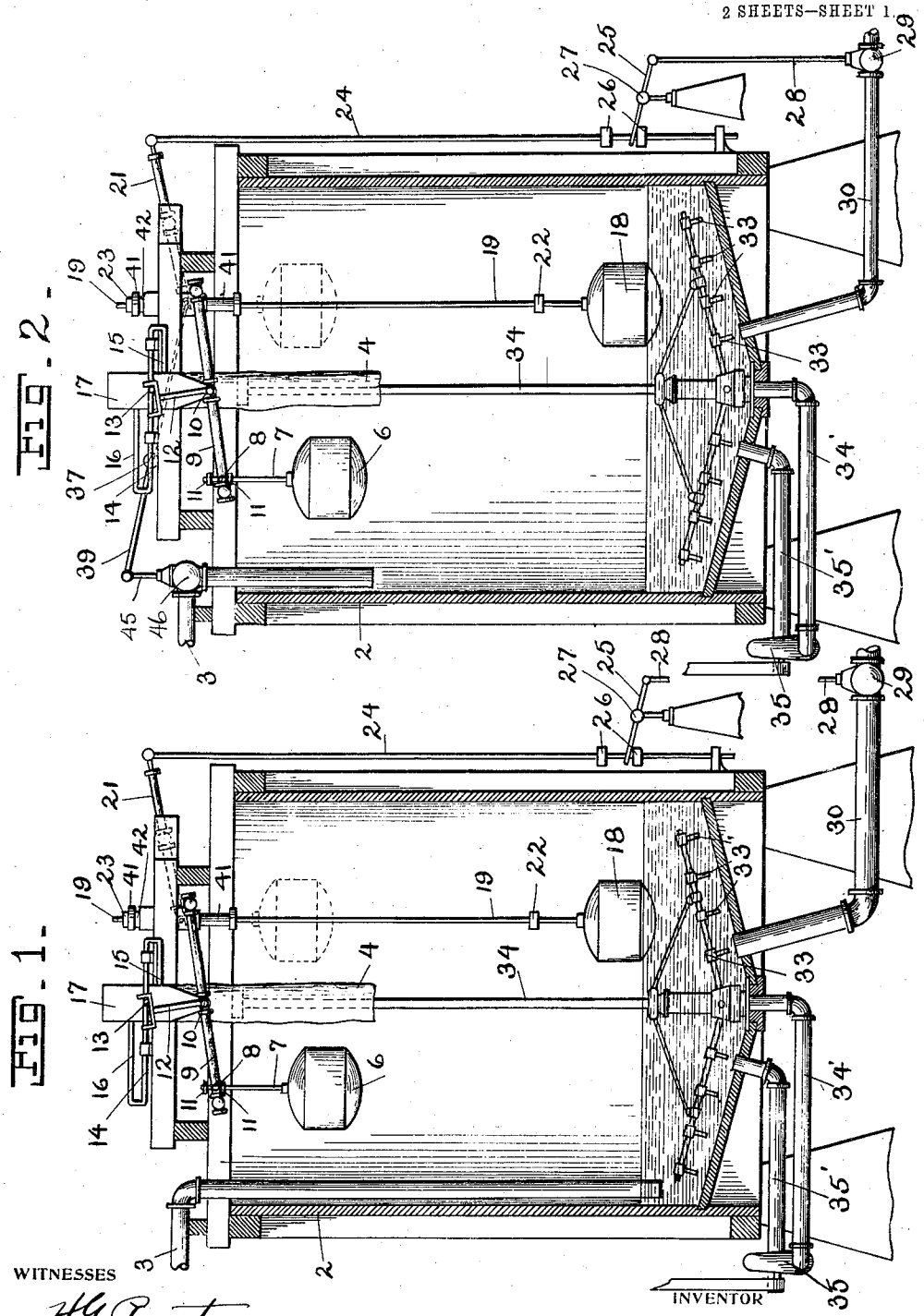

FIG. 2.

FIG. 1.

WITNESSES

H. G. Post

L. L. Dierssen

INVENTOR

DANIEL BOSQUI.

BY Miller & White

His ATTORNEYS.

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Fig. 4.

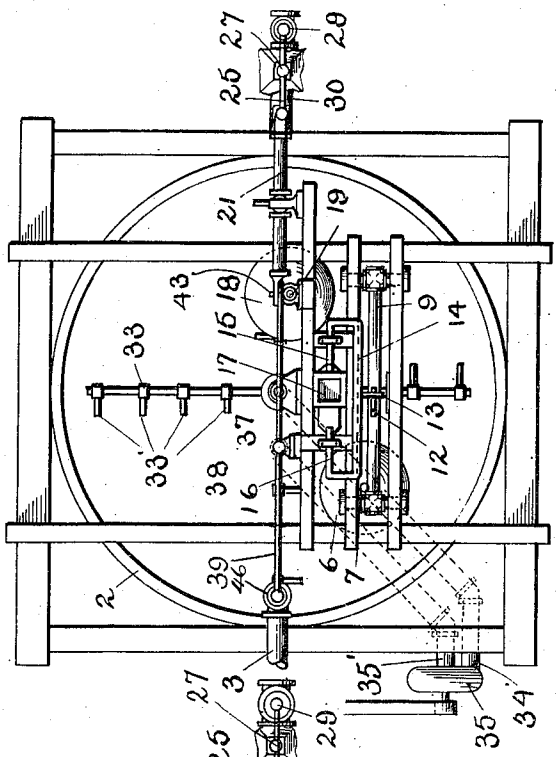


Fig. 3.

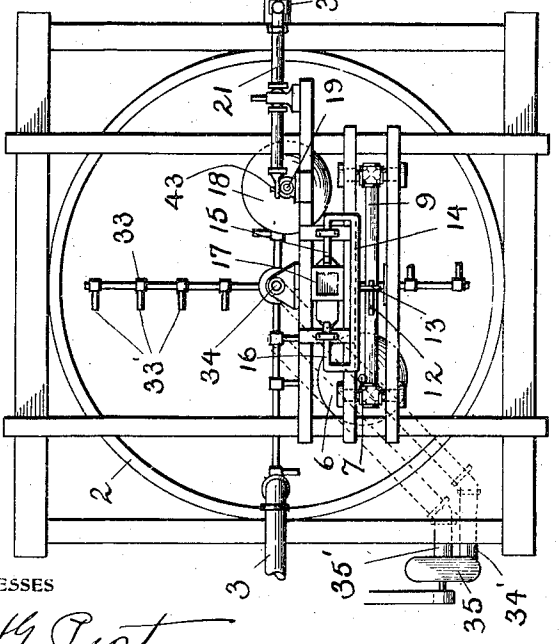


Fig. 6.

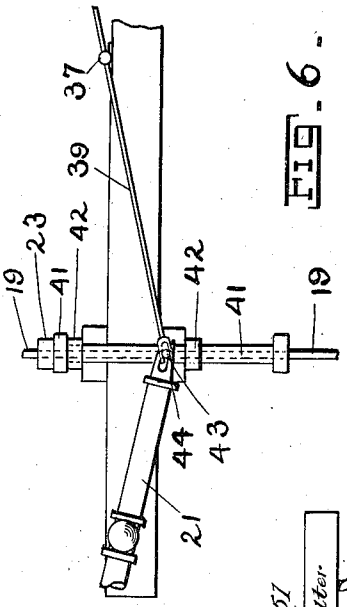
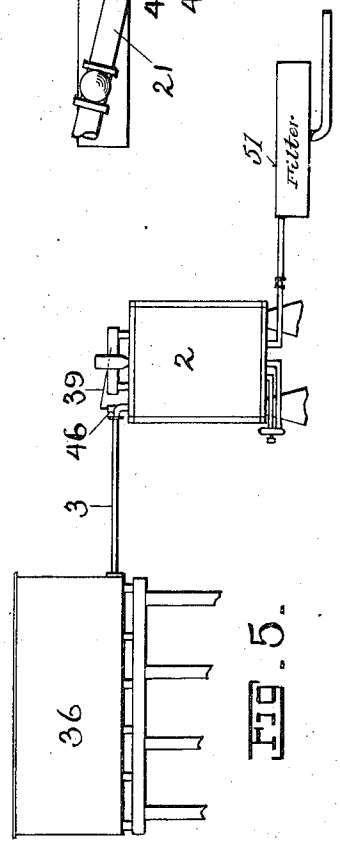


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

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PRECIPITATING APPARATUS FOR CYANID SOLUTIONS.

1,035,941. Specification of Letters Patent. Patented Aug. 20, 1912.

Application filed December 9, 1911. Serial No. 664,744.

To all whom it may concern:

Be it known that I, DANIEL BOSQUI, a citizen of the United States, and a resident of Monahan, county of King, State of Washington, have invented certain new and useful Improvements in Precipitating Apparatus for Cyanid Solutions, of which the following is a specification.

The invention relates to an improved apparatus for use in precipitating materials from solution and especially in precipitating metals from cyanid solutions, and covers another form of the apparatus disclosed in my prior application, Serial Number 610,008, filed February 21, 1911.

The object of the invention is to provide a precipitating apparatus which is susceptible of adjustment to vary the time of contact of the solution and precipitant, and which, after the proper time contact has been determined, may be set to insure the fixed predetermined time contact.

Another object of the invention is to provide means for either intermittently or continuously carrying on the precipitating process by the use of one vessel or receiver.

Another object of the invention is to provide means for adding a predetermined quantity of precipitant to a given amount of solution in a containing vessel and discharging the mixture of solution, precipitant and precipitate from the vessel after a certain predetermined time of contact.

Another object of the invention is to provide a precipitating apparatus by means of which the mixture of cyanid solution and precipitant may be agitated without entraining any air in the mixture.

A further object of the invention is to provide a precipitating apparatus in which the larger and heavier particles of the precipitant are recirculated through the cyanid solution with the effect of reducing the diameter of these particles and obtaining an increased effect thereof on the solution.

In practice, metallic zinc-bearing materials or other metalliferous precipitants have heretofore been used to precipitate metals from cyanid solutions and the most practical results have been obtained in a closed receptacle or in such manner that the air has been excluded from the mixture of solution, precipitant and precipitate and subsequently conducting the mixture without additional agitation through a filter. By this method, however, it is difficult to adjust or prolong the contact between the solution and precipitant in accordance with the requirements of solutions low in cyanid content.

In practice zinkiferous precipitants have been used to precipitate cyanid solutions in the following ways. Said precipitants have been added to the solution and the mixture agitated usually by compressed air, and occasionally by mechanical stirrers. In either event an entrainment of material amounts of the oxygen of the air has resulted, which oxygen is a serious deterrent to the most efficient precipitation, which is a reducing reaction. For the purpose of best obviating this oxygenation, metalliferous precipitants have been added to the solution in a closed circuit and the mixture conducted without rest, without exposure to the atmosphere, and without prolonged agitation to a closed filter. In the latter method, however, it is difficult to adjust or prolong the contact between the solution and precipitant, which prolonged and adjustable contact is desirable when the solutions are low in strength or otherwise feeble in activity toward the precipitant.

In the present apparatus the time of contact of the precipitant with the solution may be prolonged and regulated to obtain the best results, depending upon the circumstances of operation, and the precipitant may be re-circulated through the solution so that it is continually brought into effective contact with the solution without subjecting the mixture of solution, precipitant and precipitate to the deleterious effects of entrained air, as is the case when the surface of the mixture is markedly agitated by means of mechanical agitators or when the mixture is agitated by compressed air.

The apparatus possesses other advantageous features, which, with the foregoing will be set forth at length in the following description, where I shall outline in full that form of embodiment of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. The novelty of the invention will be included in the claims succeeding said description. From this it will be apparent that I do not restrict myself to the showing made by such drawings and description as I may adopt many variations

within the scope of my invention as expressed in said claims.

The apparatus comprises preferably a receiving tank having a supply inlet and a discharge outlet, means for automatically delivering a predetermined charge of precipitant to the solution in the tank, means for agitating the mixture without entraining any air therein and means for automatically opening the discharge outlet after the mixture has been agitated for a predetermined time. Means may also be employed for automatically cutting off the flow of solution into the tank as the discharge outlet is opened.

Referring to the drawings:—Figure 1 is a side elevation of the apparatus showing the tank in vertical section, the apparatus being arranged for continually carrying on the precipitating process. Fig. 2 is a similar view of a modified form of the apparatus in which the process is carried on intermittently. Fig. 3 is a top or plan view of the apparatus as shown in Fig. 1. Fig. 4 is a top or plan view of the apparatus as shown in Fig. 2. Fig. 5 is an elevation showing the collecting tank which is used in connection with the apparatus shown in Fig. 2 in which the precipitating operation is carried on intermittently. Fig. 6 is a detail of the connections between the discharge controlling float and the discharge controlling mechanism.

The solution to be precipitated is conveyed to the receiving tank 2 through the conductor 3 which is in connection with the source of supply. In the apparatus shown in Fig. 1 this conductor extends downward into the receiving tank 2, preferably to such distance, that at all times during the operation of the apparatus the solution is discharged below the surface of the mixture therein. This construction prevents the entraining of any air in the mixture and consequently obviates the deleterious effect of entrained air.

As shown in the drawing the discharge outlet of the tank is closed, and on account of the inflow of solution through the conductor 3, the level of the liquid in the tank rises. As the level of the liquid approaches the filling point of the tank, predetermined by the length of contact required for the precipitant, preferably zinc dust, to be supplied thereto, the liquid acts against the float 6 suspended within the tank and raises the same, the stem 7 of which float works through a guide 8 clamped to the inner end of a tilting lever 9. The position of the float within the tank is adjustable so that the zinc dust may be added to the solution at a certain predetermined time depending upon the characteristics of the solution. The lever 9 consists of a tubular rod or pipe, partly filled with quicksilver and supported centrally on the journal 10. To the stem 7 are secured, above and below the guide 8, the collars 11, which are adjustable on the stem, the lower one of which on the upward movement of the float 6 raises the inner end of the pivoted or tilting lever 9. Attached to said lever and projecting upwardly centrally therefrom is a forked arm 12, the free ends of which, depending on the upward or downward movement of the float 6, engage with a pin 13 projecting laterally from a horizontally slidable arm 14 and moves the same inwardly or outwardly. This slide arm carries the cutter blades 15 and 16, which move within the precipitant or zinc dust feed box or receptacle 17 from opposite sides working within milled grooves in said box. The cutter blades are separated or spaced apart vertically and the inner end of blade 16 overlaps the inner end of blade 15 for a slight distance, about one half of an inch, so that when the blade 16 makes its return stroke from within the box 17, the same moving in unison with the blade 15, no zinc dust feeds out of the box.

As the inner end of the lever 9 is carried past the horizontal by the uprise of the float 6, the quicksilver contained therein flows to the opposite end of the tube-lever 9 and the forked arm 12, attached to said lever impinges on the pin or stud 13 and shifts the arm 14 to move the cutter blade 16 within the feed box 17 and the cutter blade 15 from within the same, allowing the zinc dust to drop from within the feed fox into the solution contained within the tank, the amount or charge of the zinc dust depending upon the inside measurement of the feed box 17 and the distance that the cutter blades 15 and 16 are spaced apart. The amount of zinc dust contained in one charge, is the amount which has been found by previous operations to be sufficient to meet the requirements of operation. To the bottom of the feed box I preferably attach a canvas chute 4 which extends downward into the tank to a point slightly below the bottom of float 6. The lower end of the chute will therefore be immersed in the liquid before the zinc dust is discharged from the feed box, and the zinc dust will be conducted directly under the surface of the liquid, with very slight agitation of the surface of the liquid.

As the liquid in the tank rises it raises the float 18 attached to the stem or rod 19 which is slidable vertically through the slidable bearing 41 supported in the bearings 42. A pin 43 on the slidable bearing is engaged by a fork 44, attached to the end of the lever 21 pivoted at the top of the tank. As the liquid in the tank reaches the filling point thereof, a collar 22 on the rod 19 bears against the lower end of the bearing 41, moving it upward and consequently tilting the

lever 21. The lever 21 is preferably centrally pivoted, and formed of a hollow rod or tube partially filled with quicksilver for the same reasons as lever 9.

Pivotally attached to the outer end of lever 21 is a vertically movable rod 24 which operates to control the outflow of the mixture from the tank. The lower end of the rod 24 works through a slotted lever 25, which is acted on by the collars 26 adjustably secured to said rod above and below the lever 25. The lever 25 is fulcrumed at 27 and the outer end thereof is connected to a stem 28 projecting from the controlling valve 29 situated within the discharge pipe 30, consequently when the upper collar acts against the inner end of the lever 25 on the downward movement thereof, the same is carried therewith and its outer end thrown upwardly, drawing therewith the stem 28 and raising or unseating the valve 29 to permit the discharge of the mixture from the tank through the discharge pipe 30, permitting the mixture to be conducted to the filter 51.

The diameter of the discharge pipe 30 is preferably larger than the diameter of the inlet pipe 3, and with the aid of a pump, not shown, the mixture is discharged from the tank much more quickly than the solution enters, so that the level of the liquid in the tank falls. As the level is lowered, the float 18 and the rod 19 move downward. Arranged on rod 19 near the upper end thereof is a collar 23, which at the proper time in the discharge of the tank acts against the top of the bearing 41 moving it downward and causing the lever to tilt to close the valve 29. The collars 22 and 23 are adjustable upon the rod 19 so that the time of opening and closing the discharge valve may be regulated and fixed to meet any condition of operation. As the level of the liquid in the tank was falling the float 6 had operated to tilt the lever 9 and place the precipitant feeding apparatus in proper position to be again actuated by the rise of the liquid.

Within the tank is located an agitator 33, which is carried by the vertical shaft 34. The tubular radial arms of the agitator, are provided with depending inclined nipples 33′ and the agitator is connected by a pipe 34′ to a centrifugal pump 35, which takes liquid from within the tank by means of a suction pipe 35′. The liquid thus drawn from the tank is forced by the centrifugal pump 35 back into the hollow armed agitator 33 through the pipe 34′, the pressure of the liquid thus forced into the agitator escapes through the nozzles 33′ causing the agitator to be rotated at a suitable speed. The disposition of the nozzles or nipples 33′ relative to the tubular arms is such, that at each complete revolution of the agitator the discharge from the nozzles or nipples, which are arranged at an angle to the bottom of the tank, sweeps the entire surface of the bottom.

The disturbance of the mixture caused by the agitator is such that the upper surface thereof is not markedly affected thereby and remains placid after it has reached the level at which the precipitant is deposited in the solution.

The jets of liquid striking the bottom of the tank prevent any settlement of the precipitant of precipitates. Through the agency of the agitator an agitation of the mixture is maintained that brings the zinc dust particles and the pregnant solution into intimate, recurring and prolonged contact, and the circular motion of the tubular arms gives a rotary movement to the solution while the jets of discharge create an upward current of the mixture, all tending to produce perfect agitation and at the same time admitting or entraining no air to the solution.

When the zinc dust is added to the solution, it sinks to the bottom where it is stirred up and mixed with the solution by the agitator, a portion of the zinc dust and particularly the heavier and larger particles thereof which have a greater tendency to settle to the bottom are continuously drawn from the tank with the solution passing through the pump and are discharged into the solution in the tank from the agitator nipples. This re-circulation of the precipitant causes an intimate recurring and prolonged contact with the pregnant solution and assists in producing a substantially complete and perfect precipitation. Furthermore, by this re-circulation, the diameter of these heavier and coarser particles is reduced by contact with the solution and a correspondingly greater amount of precious metals is precipitated.

In that construction of apparatus wherein the process is to be carried on intermittently, some means must be employed for cutting off the inflow of the solution into the tank when the discharge is opened. In this construction also, the inlet pipe need only extend downward into the tank to a point slightly below the level of the float 6, in order to cause the solution to enter the mixture in the tank below the surface thereof. A collecting tank 36 of larger capacity than the receiving tank should also be provided for receiving the solution from the source of supply and collecting the same, during the time that the inlet valve is closed.

The operation of the inlet valve 46 is preferably accomplished by means of a lever 39 connected at its inner end to the pin 43 on the slidable bearing 41 and fulcrumed at 37 to a pivoted arm 38. The outer end of the lever 39 may be pivotally connected

to the valve stem 45 or it may be provided with a forked end engaging collars on the stem. As the lever 21 is tilted to actuate the discharge valve 29, the lever 39 is simultaneously operated to actuate the inlet valve 46. As the discharge valve is opened the inlet valve is closed and as the inlet valve is opened the discharge valve is closed, all of which operations are performed automatically by the rise and fall of the liquid in the tank beyond certain levels.

By the use of the described apparatus there is a positive feed of a predetermined quantity of zinc dust to a given quantity of cyanid to be precipitated, the flow of the solution for a single charge of the zinc dust therefor being automatically controlled, a positive time contact for the zinc dust with the solution is provided, which may be varied according to the requirements of the solution to be precipitated and in individual cases may thereafter be fixed. At the same time the mixture is maintained in a continuous agitated condition during the entire operation of precipitation and the precipitant is re-circulated through the mixture without subjecting the mixture to the oxidizing effects of entrained air.

By "predetermined" in this specification is meant predetermined in a practical sense as metallurgically applied to the operation of reduction works. For instance, a predetermined amount of zinc dust means the amount which has been found by previous operations to be sufficient to best meet the requirements of the general operation of the plant. Similarly, predetermined time of contact means that period which experience has demonstrated gives the best average results, all things considered, for the efficient and economic operation of the works.

I claim:

1. A precipitating apparatus comprising a receiving vessel for the solution and precipitant and means for adjusting the apparatus to vary the time of contact of solution and precipitant and for fixing the apparatus in adjusted positions.

2. A precipitating apparatus comprising a receiving vessel for the solution, means for adding a predetermined amount of precipitant to said solution and means for adjusting the apparatus to vary the time of contact of solution and precipitant and for fixing the apparatus in adjusted positions.

3. A precipitating apparatus comprising a receiving vessel for the solution, means actuated by the rise of solution in the vessel for adding a predetermined amount of precipitant thereto, and means for adjusting the apparatus to vary the time of contact of said solution and precipitant and for fixing the apparatus in adjusted positions.

4. A precipitating apparatus comprising a receiving vessel for the solution, means actuated by the solution reaching a given level for adding a predetermined amount of precipitant thereto, means for adjusting the apparatus to vary the level at which said means are actuated and means for discharging the mixture after a predetermined time contact.

5. A precipitating apparatus comprising a receiving vessel for the solution, means for feeding a predetermined amount of precipitant to said solution, a float within the vessel for operating said feeder on the solution reaching a given level, means for varying the level at which said feeder is operated and means for discharging the mixture after a predetermined time contact.

6. A precipitating apparatus comprising a receiving vessel for the solution, means for feeding a predetermined amount of precipitant to said solution at a predetermined time in the filling of the vessel, a valve controlled outlet to said vessel, means for operating said valve on the mixture reaching a given level and means for varying the level at which said valve is operated.

7. A precipitating apparatus comprising a receiving vessel for the solution, means for feeding a predetermined amount of precipitant to said solution, a valve controlled outlet to said vessel, automatically operated means for opening said valve after a predetermined time of contact of the solution and precipitant, and means for adjusting the apparatus to vary said time of contact.

8. A precipitating apparatus comprising a receiving vessel for the solution, means for adding a predetermined amount of precipitant to said solution, a valve controlled outlet to said vessel, a float in said vessel for operating said valve on the mixture reaching a given level, means connecting said float with the valve operating mechanism and means for adjusting said connecting means for varying the level at which the float actuates the valve operating mechanism.

9. A precipitating apparatus comprising a receiving vessel for the solution to be precipitated, means for conducting the solution to said vessel, means operated by the rise of the solution in the vessel for supplying a charge of precipitant to the solution in said vessel, means for agitating the mixture and means automatically thrown into action for controlling the discharge of the mixture from the vessel.

10. A precipitating apparatus comprising a receiving vessel, means for conducting the solution to said vessel, means operated by the rise of solution in the vessel for supplying a charge of a precipitant thereto, means for agitating the mixture and means operated by the further rise of the mixture for controlling the discharge of the mixture from the vessel.

11. A precipitating apparatus comprising

a receiving vessel, means for conducting the solution to said vessel, means for automatically adding a predetermined charge of precipitant to said solution, means for agitating the mixture, and adjustable means for automatically discharging the mixture from said vessel after a predetermined time of contact of the precipitant and solution.

12. A precipitating apparatus comprising a receiving vessel, means for conducting the solution to said vessel, an automatically operated precipitant feeder for delivering a predetermined charge of precipitant to said solution, a float within the vessel for operating said feeder on the solution reaching a given level, means for agitating the mixture in the vessel, a discharge outlet to said vessel and means operated by the further rise of the mixture in the vessel for controlling said outlet.

13. A precipitating apparatus comprising a receiving vessel, for the solution to be precipitated, means for conducting the solution to said vessel, a plurality of floats within said vessel, an automatically operated precipitant feeder for delivering a predetermined charge of precipitant, arranged to be operated by one of said floats on the solution reaching a given level, a valve controlled discharge outlet to said vessel, and connections between said valve and the second float for operating said valve as the level of the mixture in the vessel reaches a certain predetermined height.

14. A precipitating apparatus comprising a receiving vessel having a valved outlet, means for supplying solution to said vessel, means operative by the rise of solution in the vessel for adding a predetermined charge of precipitant thereto, means for agitating the mixture and means for automatically controlling the valved outlet consisting of a float and mechanism connecting said float with the valve for opening and closing the valve as the level of the mixture in the vessel reaches certain predetermined upper and lower limits.

15. A precipitating apparatus comprising a receiving vessel, means for conducting the solution to said vessel, means for supplying a precipitant to said solution, means for agitating the mixture and means automatically thrown into operation for controlling the discharge of the mixture from the vessel and the inflow of the solution thereto.

16. A precipitating apparatus comprising a receiving vessel, means for conducting the solution to be precipitated to said vessel, automatically actuated means for supplying a predetermined charge of precipitant to said solution, means for agitating the mixture and automatically actuated means for controlling the discharge of the mixture from said vessel and the inflow of solution thereto.

17. A precipitating apparatus comprising a receiving vessel, means for conducting the solution to be treated to said vessel, an automatically operated precipitant feeder for delivering a predetermined charge of precipitant to said solution, a float within the vessel for operating said feeder on the solution reaching a given level, a discharge outlet to said vessel, and means operated by the further rise of the mixture in the vessel for opening the discharge outlet and stopping the inflow of solution to said vessel.

18. A precipitating apparatus comprising a receiving vessel for the solution to be precipitated, means for conducting the solution to said vessel, a plurality of floats within said vessel an automatically operated precipitant feeder for delivering a predetermined charge of precipitant to said solution arranged to be operated by one of said floats on the solution reaching a given level, a valve controlled discharge outlet to said vessel, connections between said valve and the second float for operating said valve as the level of the mixture reaches a predetermined height, and means for simultaneously controlling the inflow of solution into the vessel.

19. A precipitating apparatus comprising a receiving vessel having a valved outlet, valve controlled means for supplying solution to said vessel, means operative by the rise of solution in said vessel for adding a predetermined charge of precipitant thereto, means for agitating the mixture and means for automatically controlling the valved inlet and outlet consisting of a float and mechanism connecting said float with said valves for operating the valves in opposite directions as the level of the mixture reaches certain predetermined heights.

20. A precipitating apparatus comprising a receiving vessel, means for supplying solution thereto, means for adding a predetermined charge of precipitant to said solution, means for agitating the mixture in the vessel, automatically operated means for controlling the discharge of the mixture from said vessel, a filter, and a conductor for conducting the mixture to said filter.

21. A precipitating apparatus comprising a receiving vessel for the solution and precipitant and means for agitating the mixture by withdrawing the mixture from the vessel at a point adjacent to the bottom and forcing it back into the vessel below the level of the mixture therein through a closed circuit, all the parts of said circuit being normally located below the liquid level in the vessel.

22. A precipitating apparatus comprising a receiving vessel for the solution and precipitant, a closed circuit opening at both ends into said vessel adjacent the bottom, all parts of the closed circuit being normally

below the liquid level in the tank, and means for circulating the mixture through said circuit.

23. A precipitating apparatus comprising a receiving vessel for the solution and precipitant, a pump, and suction and discharge pipes therefor opening into the vessel adjacent the bottom, said pipes forming a closed circuit whose parts are all normally located below the liquid level in the vessel.

24. A precipitating apparatus comprising a receiving vessel, a conductor for supplying solution thereto, means for supplying a predetermined charge of precipitant to said solution, means for agitating the mixture within the vessel, comprising a pump and suction and discharge pipes therefor entering the vessel adjacent the bottom thereof and automatically operated means for controlling the inflow of the solution and the discharge of the mixture actuated by the mixture reaching a certain predetermined level.

25. A precipitating apparatus comprising a receiving vessel having valve controlled inlet and discharge passages, automatically actuated means operated by the level of the solution reaching a certain point for supplying a predetermined charge of precipitant, means for agitating the mixture in the receptacle without entraining any air in the mixture and means actuated by the further rise of the mixture within the vessel to a certain level to open the discharge outlet and close the inlet passage.

In testimony whereof, I have hereunto set my hand at Issaquah, King Co., Washington, this 28th day of November, 1911.

DANIEL BOSQUI.

In presence of—
W. E. GIBSON,
IDA A. GIBSON.