Dec. 6, 1927. 1,651,680

H. Y. EAGLE

LEACHING APPARATUS

Filed June 27, 1923

Fig. 1.

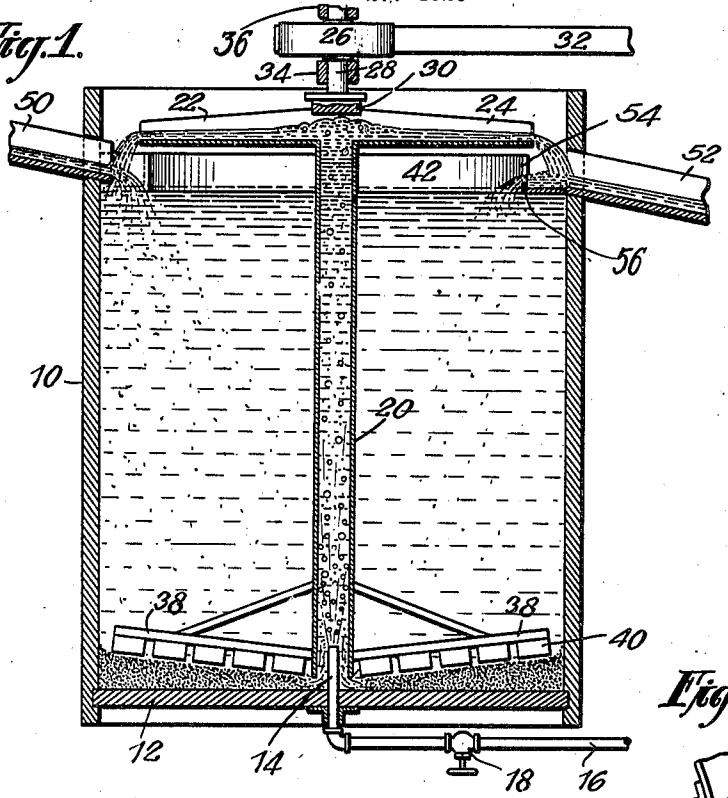


Fig. 3.

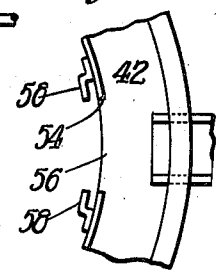
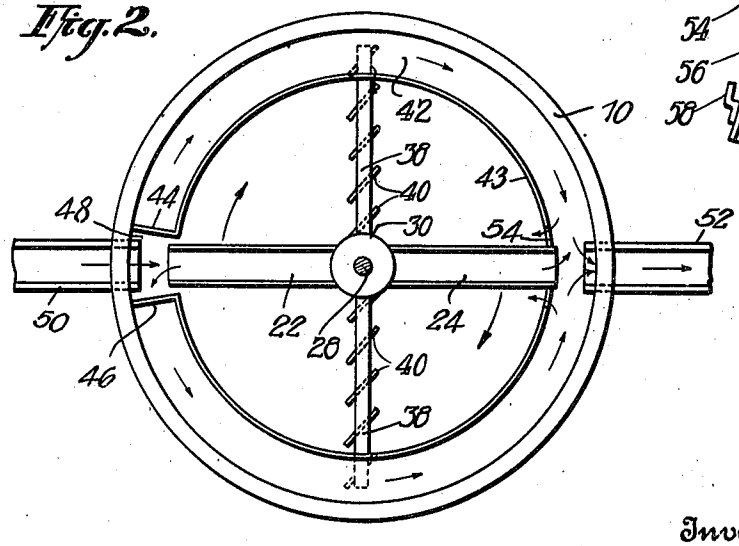


Fig. 2.



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UNITED STATES PATENT OFFICE.

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LEACHING APPARATUS.

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This invention relates to apparatus such as are used in installations where pulverized ore is subjected to the action of leaching solutions with agitation.

In the leaching of various materials, the dissolving of the soluble constituent of the material is effected in tanks provided with agitators, in which the material and the solution are continuously agitated for the length of time necessary to effect the desired degree of dissolution. Heretofore, the size of particle which such a leaching device could successfully handle has been limited to very small sizes. Moreover, on the largest sizes which have been successfully agitated, the work is only accomplished by maintaining definite conditions of pulp density—that is, the larger the size of particles to be kept in suspension, the thicker must be the pulp.

This limiting factor makes it necessary to grind the ore so as to form very fine particles, which is an expensive operation. With the larger size particle, requiring pulp of greater density to keep it in suspension, a correspondingly small quantity of solution per unit of solid results.

This latter effect naturally results in a solution carrying large quantities of the soluble material, and which makes the capital expenditure of any washing scheme in the resulting separation of the solids from the liquid, very expensive.

The solid material is agitated with the solvent, continuously flowing into the agitating tank at one point and out at another point at substantially the same rate. The difficulty is to get the larger particles to go to the outlet. Unless they do this, they gradually accumulate in the bottom of the tank and in time stop its operation. This necessity of carrying the larger particles to the outlet at the same rate at which they enter the tank has made it necessary to maintain the solution in the tank of a comparatively high density so that the solid particles will not fall rapidly through it, but will be held up long enough to pass to the outlet, near the level in the tank. And even with a comparatively dense solution the size of the solid particles which the ordinary machine can handle is limited. A portion of the solution, in the subsequent washing operations, is always held in the apparatus, and becomes practically part of the capital thereof, and this retained portion of the solution is the more valuable as the solution is denser.

By my invention I am enabled to use a less dense solution than was possible before my apparatus, and I am enabled to carry through the apparatus continuously solid particles of larger size than formerly, thus saving considerable expense in the grinding of solid material.

An embodiment of the invention is illustrated in the accompanying drawings in which—

Fig. 1 is a vertical longitudinal section;

Fig. 2 is a top plan thereof and Fig. 3 is a plan of a detail.

The apparatus comprises a substantially cylindrical wall 10 having a bottom 12 through the center of which extends a pipe 14 connected with a suitable air supply line 16 having a control valve 18 located therein. Centrally disposed within the tank 10 is a tubular shaft 20 having outwardly extending trough-like arms 22 and 24 connected at its upper end. The shaft 20 and arms 22 rotate together and are driven by a pulley 26 secured to a stub shaft 28 fast in a hub 30 which is suitably secured to the arms 22 and 24. The pulley 26 is driven by a belt 32 connected to a motor or other suitable source of power, not shown. Bearings 34 and 36 of any usual or suitable design are provided for rotatably mounting the shaft 20 and the parts carried thereby.

At its lower end, the shaft has secured thereto outwardly extending arms 38 provided with prongs or projections 40 which serve to rake the particles of material which fall to the bottom of the tank.

The projections 40 are inclined as shown in Fig. 2 so that they gradually force the large particles of solid material on the bottom to the center and to the inlet of the airlift.

Near the upper end of the tank, but below the trough-like arms 22 and 24, I mount an annular launder 42 which is adapted to receive the pulp which is discharged from the arms 22 and 24 as the latter rotate, it being apparent that the pulp discharged from the rotating troughs 22 and 24 will be distributed quite uniformly throughout the length of the annular launder.

The launder 42, as shown in Fig. 2, does not extend fully around the inner periphery

of the tank 10 but is formed with end walls 44 and 46 leaving an opening 48 into which extends the inlet launder 50 so that the material flowing therefrom enters directly into the tank and not into the peripheral launder 42. The launder 42 is adapted to discharge part of its contents into an outlet launder 52 and part of its contents into the tank through an outlet port 54 formed in the vertical wall 43 of said launder 42.

This general type of apparatus, in which the material is circulated by forcing it continuously from the bottom to the top is known and there are various machines operating on this principle. But the material (or most of the material) lifted to the top has generally been discharged directly into the tank again. And in order that it shall all pass out of the discharge launder it has been necessary to make the solution so dense and the particles so fine that they would pass from the upper part of the solution into the discharge launder. It is clear that any solid particle which enters the tank and which at the density of the pulp in the tank is incapable of being kept in suspension, will eventually find its way to the bottom of the tank. In agitating leaching apparatus heretofore constructed such particles have accumulated on the tank bottom and have frequently resulted in breaking the agitating mechanism or otherwise rendering it inoperative. Even in cases where the particles have been carried upward by the airlift, their quick settling properties have prevented them from being discharged.

In my improved apparatus the material flows in at the launder 50, the particles which settle on the bottom are carried to the center and the airlift carries them to a point above the level, as in previous machines. But, instead of discharging the lifted particles and solution, or most of them, back into the tank directly, I discharge substantially or approximately all of the pulp, that is the particles and the solution into the annular launder or receiver 42. Thence the pulp is discharged, without opportunity for the heavier particles to separate from the lighter, into the discharge launder 52 at substantially the same rate at which the solution and the solids enter the tank; the excess received by the annular launder being returned to the tank.

The discharge from the annular launder into the tank is over a low weir 56 calculated to deliver into the tank the excess of solution carried to the annular launder over that which enters the tank from the inlet launder 50. This weir in fact may be low enough or wide enough to deliver back to the tank slightly more than the calculated requirement (the excess stated above). In that case, the level of the tank will rise so as to retard the flow from the annular launder to the tank, or even cause a slight flow in the opposite direction. In either case the level will maintain itself in the tank substantially constant. The result in any case is that all the solid particles are withdrawn continuously from the tank and carried away by the outlet launder 52. The rise in the level will occur of course only during the period in which the discharge continues to be less than the feed. We assume the feed to be constant. While the level in the tank is below the weir a certain percentage of the solution will flow out through the launder 52, the quantity which will be discharged in this way being dependent on the height of the weir. If the weir is too high the outflow will be greater than the inflow through the launder 50. If the weir is lowered progressively, the outflow through the launder 52 will be reduced to a point where it is less than the inflow, and the level in the tank will gradually rise to the weir and slightly above it, thus increasing the outflow to the launder 52 until a balance is reached and the level in the tank remains stationary slightly above the weir.

The port 54 may be adjustable, as shown in Fig. 3. For this purpose, I would provide flanges 58 at the sides for the introduction of plates of different sizes, to reduce the opening accordingly. Generally the opening should be regulated so that the level of the pulp in the annular launder maintains itself an inch or two above the level in the tank.

My invention not only permits the use of particles of larger maximum size than those permissible in previous apparatus, but it also makes it unnecessary to secure the accurate sizing of the materials which was formerly required. The apparatus may be used also for pulp of different densities, which in ordinary leaching work permits the use of low grade solutions and of a cheap washing installation.

As I have said above, there are various styles of agitator in which the pulp is agitated and then forced from a lower to an upper zone and circulated thus through the tank. My invention is applicable to various agitators working on this principle, and improves their operation and their capacities as described by receiving the pulp thus lifted to an upper zone and discharging it at the desired rate without giving the solid particles therein an opportunity to settle into the tank again before reaching the outlet launder.

The annular launder may be substituted by receptacles of various other shapes according to the design of the agitator to which it is to be applied. And the term "launder" herein is used generally to indicate a variety of receptacles and pipes which will serve the same purpose. Also the

apparatus may comprise other known means of agitation and of directing the larger particles at the bottom to the air lift.

In the case illustrated the annular launder is arranged to receive approximately or substantially all the pulp lifted. But it will be appreciated that it may be arranged to receive less than this and still function satisfactorily. It is important that it shall be of such size as to hold a substantial proportion of the coarser material which is in process of passing through the tank at any given time. Of the material lifted into the annular launder, the coarser particles move the more slowly toward the outlet. Thus after a short initial period the annular launder will carry at all times a sufficient proportion of the coarser particles to substantially diminish the tendency to choke the air lift.

Though I have described with great particularity the details of the embodiment of the invention herein shown, it is not to be construed that I am limited thereto, as changes in arrangement and substitution of equivalents may be made by those skilled in the art without departing from the invention as defined in the appended claims.

What I claim is:

1. A leaching apparatus comprising a tank provided with means for admitting and discharging pulp, means for agitating and forcing pulp from a lower zone of the tank to an upper zone and means adapted to receive and hold more lifted pulp than is introduced through said admitting means in a given time and adapted to discharge part of it directly and return part of it to the tank.

2. A leaching apparatus comprising a tank with inlet and outlet launders near the top thereof, means for lifting the pulp from a lower to an upper zone in the tank and a receiving launder for the pulp thus lifted having a discharge opening into said outlet launder.

3. A leaching apparatus comprising a tank with inlet and outlet launders near the top thereof, means for lifting the pulp from a lower to an upper zone in the tank and a receiving launder for the pulp thus lifted having a discharge opening into said outlet launder, and having also a discharge opening into the tank.

4. A leaching apparatus comprising a tank having at a point above the normal level of the pulp a receiver arranged to discharge part of its contents from the tank and to return part to the tank, and means for lifting agitated pulp into said receiver.

5. A leaching apparatus having an air lift adapted to distribute the pulp in a circular zone near the top of the apparatus and a receiver for the pulp so distributed, said receiver having a discharge opening to a point outside of the apparatus and having an opening discharging back into the apparatus and adapted to maintain the level thereof.

6. A leaching apparatus having an air lift with a rotary member adapted to distribute the pulp in a circular zone near the top of the tank and an annular receptacle having a discharge opening to a point outside of the tank, said receptacle being adapted to receive and to hold a substantial proportion of the coarser material which is in the tank at any given time.

In witness whereof, I have hereunto signed my name.

HENRY Y. EAGLE.