

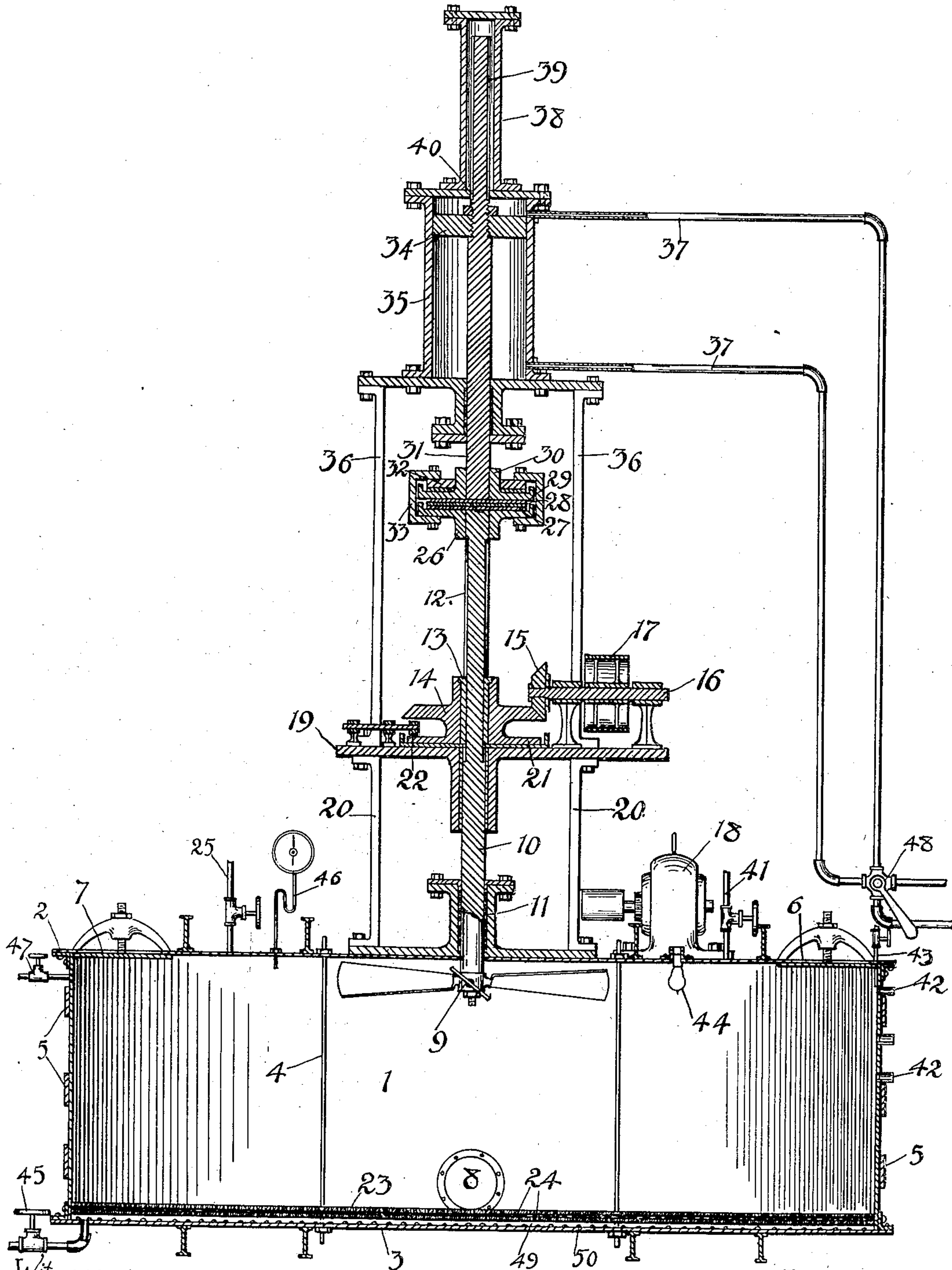
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METALLURGICAL APPARATUS.

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METALLURGICAL APPARATUS.

No. 898,415.

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To all whom it may concern:

Be it known that I, WILLIAM A. MERRALLS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Metallurgical Apparatus, of which the following is a specification.

The object of this invention is to provide an improved apparatus for metallurgical purposes, and particularly for the treatment of ores with cyanid solutions. By the use of the apparatus the cyaniding can be effected more expeditiously than heretofore and with greater economy, both in original cost and in operating expense.

In the accompanying drawing, the figure is a vertical section of a preferred form of apparatus embodying the invention.

Referring to the drawing, 1 indicates a tank, in which the several steps of the process are performed. Said tank is made sufficiently strong to withstand considerable internal pressure, and for this purpose the top 2 of the tank is secured to the bottom 3 by means of suitably arranged stay-bolts 4. The wall of the tank is also encompassed with strong bands 5.

The material to be treated is admitted through an inlet 6 in the top of the tank, and may flow out at the top by an outlet 7 therein.

8 is a discharge opening in the wall through which the refuse can be discharged. The material to be treated may be the tailings from a stamp or other mill, the liquid portion being only the water used in the operation of pulverizing the material in the mill; or the ore may be pulverized dry and introduced into the tank, and water may be added; or lime solution may be added for "sweetening" an acid ore; or cyanid solution may be added; or it may be the material already treated with the cyanid solution in the mill when pulverizing. In the first cases, when plain water or lime solution only is used, a sufficient quantity of the water and pulp is first allowed to pass into the tank by the inlet 6 and out by the outlet 7 until the pulp is sufficiently concentrated therein for a charge, and the openings 6, 7, are then closed. The water must now be expelled from the tank.

The solid material will naturally tend to settle with a surface sloping downwards from the inlet opening, and should now be stirred.

For this purpose, an agitator is used, preferably in the form of a propeller 9 on a vertical shaft 10 extending through the top of the tank and through a stuffing box 11 thereon, and having formed therein grooves 12 in which are feathers 13 secured in the hub of a bevel gear 14 driven by means of a bevel pinion 15 on a shaft 16 having a pulley 17, preferably driven by an electric or other motor 18, mounted upon the top of the tank. The bevel gear 14 rotates upon a support 19 mounted on posts 20 on the top of the tank, the hub of said bevel gear having a circular plate or flange 21, which, on the side opposite to the bevel pinion 15 is held down by a roller 22. By this construction the propeller 9 is given a rotary motion within the tank, stirring up the pulp and distributing it uniformly therethrough.

The material in the tank is now in the proper condition for the expulsion of the water. The bottom of the tank is formed with a filter of any form commonly used in cyaniding, the form here shown consisting of cloth 23 interposed between upper and lower wooden screens 24, resting upon beams 49 having grooves 50 in the lower edge. Some of the water will have already escaped through said filter. To force the water through the filter, compressed air is now admitted in the top of the tank by a pipe 25. The expulsive action of the air is greatly assisted by the agitation of the pulp by the rotating propeller; and the propeller is caused to descend in the tank with the level of the water therein so as to continue the agitation of the layer of sand and the slimes left by the expelled water. To provide for this descent of the propeller, the top of the shaft 10 has secured thereto a disk 26 on which rests a plate 27 of phosphor bronze on which is a plate 28 of steel, upon which rests another plate 29 of phosphor bronze, upon which rests a disk 30 secured to a piston rod 31, around which is a collar 32 of iron with a lower facing of phosphor bronze. The lower disk 26 and the upper collar 32 are secured together by means of a suitable number of U-clamps 33. With this construction, the propeller shaft 10 can rotate freely, and at the same time move vertically with the piston rod, which itself does not rotate. Said rod 31 is secured to a piston 34, which reciprocates in a cylinder 35 supported by posts 36. Said piston may be operated in either direction by any pressure fluid passed through

pipes 37 controlled by a four way valve 48. In order to prevent the piston 34 rotating, its rod is continued upwards into a tubular guide 38 secured upon the top of the cylinder, said rod having grooves 39 engaged by feathers 40. The phosphor bronze plates are for the purpose of permitting the propeller shaft to rotate without undue friction, notwithstanding that the piston rod itself does not rotate.

By the admission of the pressure fluid into the cylinder 35, the propeller can be raised or lowered while in rotation, and consequently can be applied to the pulp, as the water descends, to disperse the same and permit the permeation of the liquid there-through to allow it to escape through the filtering material. The propeller, rotating at a high speed, in one direction produces a powerful suction towards the center at the bottom of the tank, creating a very rapid vortex motion of the water, which thus very quickly takes up in suspension the whole of the solid matter in the tank. If rotated in the opposite direction, the suction is at the top of the tank and the water and solid matter are driven outwards at the bottom, but the same vortex effect is produced. By this means the slimes and other solid material are prevented from unduly packing, while the compressed air powerfully depresses the water and forces it out through the filtering material, the water passing through an outlet pipe 45. To permit of the next operation the compressed air is now released from the tank by means of a valve release pipe 47. If the ore is an acid ore, and requires to be sweetened, the above operation is repeated with a solution of lime. It should be noted that, in case the ore has already been treated in the battery with the cyanid solution instead of with plain water, the above described steps would not be necessary. The water, or lime solution, as the case may be, having been expelled from the tank and only the solid material containing the values now remaining therein, the cyanid solution is admitted to the tank through a pipe 41, where-upon the tank having been filled, or nearly filled with the solution, and the pipe 41 having been closed, the first step is to effect the solution of the gold. For this purpose the propeller is set in motion, and this motion is continued until the whole of the contents of the tank are in thorough agitation, and uniformly dispersed throughout the interior of the tank, and for a sufficient length of time to permit the cyanid solution to thoroughly act upon and dissolve the gold.

When the gold has been completely dissolved, it is then necessary to expel the solution from the tank. For this purpose compressed air is again admitted into the tank in like manner as before, and the pressure of the air on the top of the solution forces the solu-

tion through the filtering material, and out through the pipe 45. By maintaining the propeller in operation simultaneously with the admission of compressed air the slimes are not allowed to settle, and thus clog up the filtering material, and the expulsion of the solution through the filtering material is thus rendered comparatively easy. The solution thus expelled is conducted to the zinc boxes or other like devices and treated in the ordinary manner as now practiced in cyaniding to recover the gold therefrom.

When all of the solution has been expelled and thoroughly washed, water being added for that purpose, either by gravity or under pressure, the residual cake of solid material must be removed from the tank, which may be done either by hand, or by hydraulicing it out with water. Or a sufficient quantity of water may be turned into the tank, the propeller started, and the solid material thereby dispersed and suspended in the water in the same manner as it was in the cyanid solution, and may be run out of the tank through the outlet 8.

42 indicates sight-holes through which the interior of the tank may be inspected, the inner surfaces of the glass windows therein being washed by water from a conduit 43. Electric lamps 44 are also provided to illuminate the interior of the tank. A pressure gage 46 indicates the pressure in the tank.

While only the specific metal, gold, is referred to in the specification, this is for the sake of brevity and clearness only, and it is to be understood that the apparatus herein disclosed and claimed can be used, for the recovery of all metals for which cyaniding is, or can, be practiced.

I claim:—

1. Metallurgical apparatus comprising a closed tank, a filter in the lower portion thereof, a liquid outlet beneath said filter, a mechanical agitator in said tank, sources of supply for pulp, solutions and compressed air, connections between said sources of supply and the upper portion of said tank, and means for closing said connections.

2. Metallurgical apparatus comprising a closed tank, a filter in the lower portion thereof, protecting means for the upper surface of said filter, a liquid outlet beneath said filter, a mechanical agitator in said tank, sources of supply for pulp, solutions and compressed air, connections between said sources of supply and the upper portion of said tank, and means for closing said connections.

3. Metallurgical apparatus comprising a closed tank, a filter in the lower portion thereof, a liquid outlet beneath said filter, a rotatable agitator vertically adjustable in said tank, sources of supply for pulp, solutions and compressed air, connections between said sources of supply and the upper

portion of said tank, and means for closing said connections.

4. Metallurgical apparatus comprising a closed tank, a filter in the lower portion thereof, protecting means for the upper surface of said filter, a liquid outlet beneath said filter, a mechanical agitator in said tank, sources of supply for pulp, solutions and compressed air, connections between said sources of supply and the upper portions of said tank, means for closing said connections,

a discharge opening in the tank wall immediately above said filter, and a closure for said discharge opening.

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

WILLIAM A. MERRALLS.

Witnesses:

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