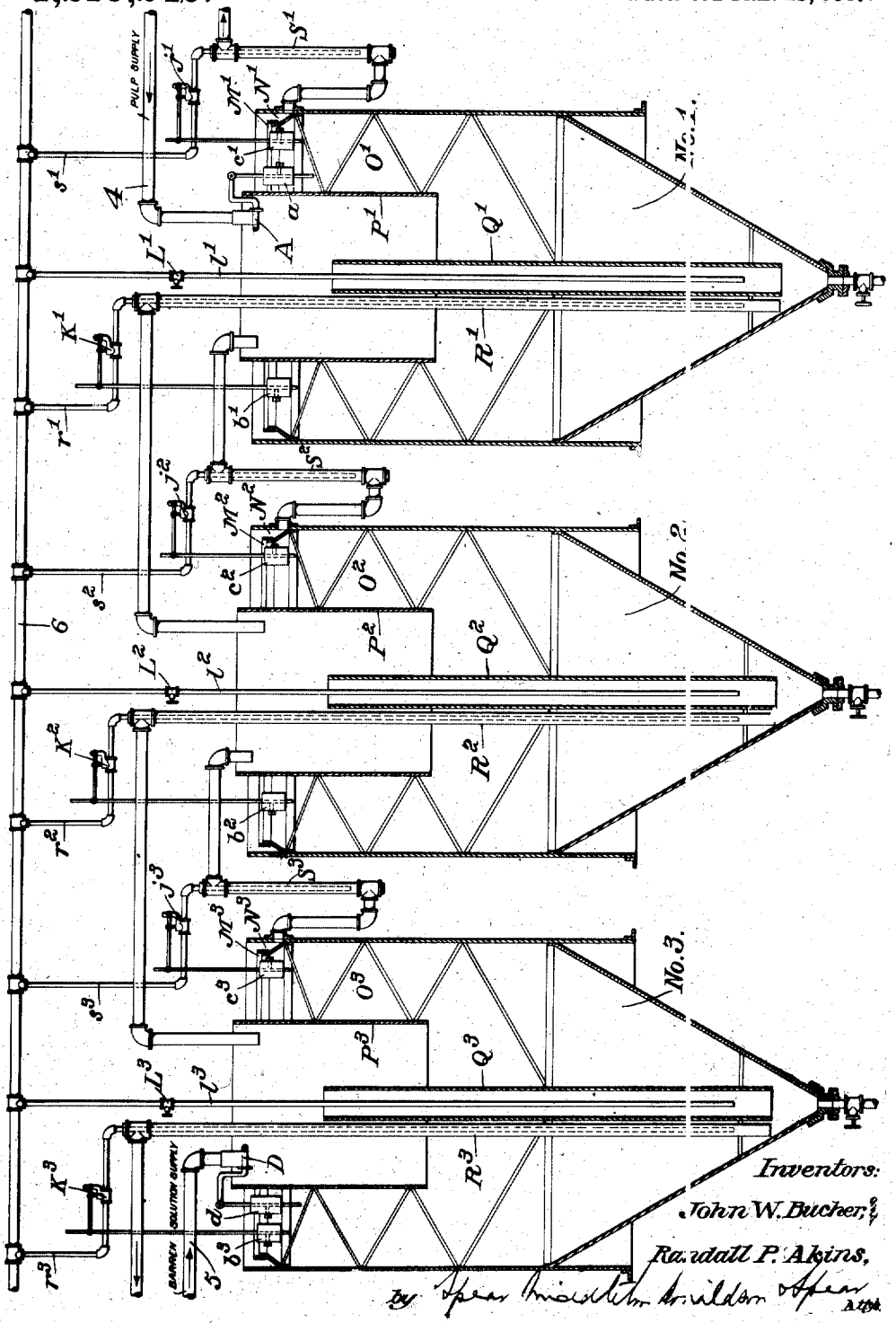
J. W. BUCHER & R. P. AKINS.

AUTOMATIC CONTROLLING SYSTEM FOR CONTINUOUS AGITATION AND TRANSFER SYSTEMS FOR TREATMENT OF ORES.

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*Inventors:*
*John W. Bucher,*
*Randall P. Akins,*
*by* Spear Middleton, Wildon & Spear
*Attys.*

# UNITED STATES PATENT OFFICE.

JOHN WM. BUCHER AND RANDALL P. AKINS, OF DENVER, COLORADO, ASSIGNORS TO COLORADO IRON WORKS COMPANY, OF DENVER, COLORADO, A CORPORATION OF MAINE.

## AUTOMATIC CONTROLLING SYSTEM FOR CONTINUOUS AGITATION AND TRANSFER SYSTEMS FOR TREATMENT OF ORES.

1,219,240. Specification of Letters Patent. Patented Mar. 13, 1917.

Application filed October 7, 1915. Serial No. 54,634.

*To all whom it may concern:*

Be it known that we, JOHN WM. BUCHER and RANDALL P. AKINS, citizens of the United States, residing at Denver, Colorado, have invented certain new and useful Improvements in Automatic Controlling Systems for Continuous Agitation and Transfer Systems for Treatment of Ores, of which the following is a specification.

The present invention relates to certain improvements in the treatment of slimes of gold and silver ores with cyanid solution, and pertains more particularly to means for automatically controlling the continuous agitation and transferring of pulp from one tank to another in series and for simultaneously controlling the flow of the cyanid solution passing through the tanks in the opposite direction.

The principal object of the invention consists in the provision of automatically operated controlling valves, adapted to be used in connection with the several tanks of such a system for the purpose of regulating the pulp supply and barren solution supply thereto respectively.

A further object of the invention consists in the provision of a plurality of similar automatically operated controlling valves used in connection with the necessary air lift system and transfer pipes for regulating the transfer of the pulp through the system from one tank to the next succeeding one, and for simultaneously regulating the transfer of the counter current barren solution in a similar manner through the system in the opposite direction.

With these and other objects in view, which will be apparent from the subsequent disclosure, the invention consists of the combination and arrangement of parts more fully set forth in the following specification, illustrated in the accompanying drawing, and more particularly pointed out in the appended claims.

The accompanying drawing illustrates the invention diagrammatically, parts being shown in sectional elevation.

The pulp to be treated is passed through a series of tanks, where it is agitated, mixed with a counter current of barren cyanid solution and drawn off to the pulp filter. For the purpose of convenience the invention is illustrated and described as comprising a system of three such tanks, 1, 2 and 3, but it will be understood that the number of these tanks can be increased or the arrangement varied without in any way departing from the scope of the invention.

Pulp is supplied to tank 1 from a pipe 4 connected with a suitable source (not shown).

The tanks 1, 2 and 3 are provided with centrally located annular skirts $P'$, $P^2$, $P^3$, respectively, providing inclosed portions in which the pulp can be agitated, and at the same time producing outer annular settling spaces $O^1$, $O^2$, $O^3$, in which the clear solution can remain practically undisturbed and from which it can be withdrawn by means of overflow weirs $M^1$ $M^2$ and $M^3$ into launders $N^1$, $N^2$, $N^3$, extending circumferentially around the inner upper portions of the tanks. The tanks 1, 2 and 3 are provided with lower conically formed bottom walls having centrally located drain valves provided at their lowermost points, and are in other respects constructed in the usual manner. The barren cyanid solution is supplied to tank 3 through a pipe 5 connected with a suitable source (not shown).

The main air supply is represented by a header or supply pipe 6 from which air is led by a series of branch pipes to the several places where it is utilized for agitating or lifting purposes. A series of pulp transfer supply pipes $R^1$, $R^2$ and $R^3$ are provided extending from the bottom of one tank over to and terminating in the space inclosed by the annular skirt at the top of the next succeeding tank. Air is supplied to these pulp transfer pipes by a plurality of branch

pipes $r^1$, $r^2$ and $r^3$ each of which is provided with a controlling valve $K^1$, $K^2$, and $K^3$, respectively, automatically operated by floats $b^1$, $b^2$, $b^3$. A similar set of solution transfer pipes $S^3$, $S^2$ and $S^1$ are provided, extending from the launder at the top of one tank to the space inclosed by the annular skirt at the top of the next succeeding tank (in the reverse direction). Lifting air is supplied to these pipes by a series of branch pipes $s^3$, $s^2$, $s^1$, each of which is provided with a controlling valve $j^3$, $j^2$, $j^1$, respectively, automatically operated by floats $c^3$, $c^2$ and $c^1$. The air supply for agitation within the skirts $p^1$, $p^2$ and $p^3$ and the lower portion of the body of the tank is admitted from the main air supply pipe 6 through branch pipes $l^1$, $l^2$, $l^3$, extending centrally downward through a series of pipes $Q^1$, $Q^2$ and $Q^3$, by means of which the heavy pulp from the bottom of the cone is lifted to the upper inclosed portions within the skirts $P^1$, $P^2$ and $P^3$. The supply of air through these pipes is regulated by means of the hand operated valves $L^1$, $L^2$ and $L^3$.

The floats $a$ and $d$ which control the pulp supply and barren solution supply, respectively, are adjustable vertically on their stems, and are adapted to open the valves in their lowered position and close them in their raised position.

The floats $b^1$, $b^2$, $b^3$ and $c^1$, $c^2$, $c^3$, are each adjustably carried on a depending rod and are adapted to open their respective valves in their raised positions and close them in their lowered positions.

The operation of the device is as follows:

If, for any reason, the pulp supply should diminish, the level of the solution in the annular space $O^1$ would tend to fall, thereby lowering the float $a$, and at the same time lowering the floats $b^1$, $b^2$, and $b^3$, thereby tending to open up the pulp supply valve A, and close the air valve K', $K^2$ and $K^3$, etc., thereby shutting off the air supply and thus tending to diminish the amount of pulp transferred.

Should the pulp supply for any reason increase, the tendency would be to lift the float $a$, and automatically diminish the amount of pulp supply by closing the pulp supply valve A, and at the same time lift the floats $b^1$, $b^2$, $b^3$, etc., opening the air valves K', $K^2$, and $K^3$, admitting more air and tending to increase the amount of pulp transferred until an equilibrium would be reached and maintained.

The barren solution supply comes into tank No. 3, thence to tank No. 2 and to tank No. 1. The float $d$ is so adjusted as to admit by means of the valve D a given amount or supply of barren solution into tank No. 3, and the floats $c^1$, $c^2$ and $c^3$ are adjusted so as to open or close their respective valves $j^1$, $j^2$ and $j^3$, thus admitting or cutting off the necessary quantity of air to transfer this given quantity of solution from the annular spaces $O^1$, $O^2$ and $O^3$, etc., into the central partition P', $P^2$ and $P^3$ of the next tank.

If, for any reason, the amount of barren solution should diminish, the float $d$ would tend to drop, and in consequence the float $c^3$ would also tend to drop, partially closing the valve $j^3$, diminishing the quantity of air supplied to the solution transfer $s^3$, and thus diminishing the quantity of the solution transferred from tank No. 3 to tank No. 2. In the same manner the flow is controlled from tank No. 2 to tank No. 1, and from tank No. 1 for subsequent treatment as to gold precipitation tanks.

Should the amount of barren solution for any reason be increased, the float, $d$, would have a tendency to rise, closing the valve D and shutting off the supply of barren solution; in consequence float $c^3$ would also tend to rise, thus opening the valve $j^3$, admitting more air into the air lift $S^3$, and transferring more solution into tank No. 2, until an equilibrium would be reached.

On account of the greater density of the pulp within the skirt P', $P^2$ and $P^3$, the undisturbed quiescent liquid in the outer annular spaces $O^1$, $O^2$ and $O^3$ will rise to a greater height than the heavy pulp within the skirts P' $P^2$ and $P^3$, and the floats to the various valves being located in this undisturbed space will not be influenced by the violence of the agitation in the central space.

Now, if for any reason the air supply should suddenly cease, the air lifts $S^1$, $S^2$ and $S^3$ and the air lifts $R^1$, $R^2$ and $R^3$ would cease to operate, and the solution would rise above the weirs $M^1$, $M^2$ and $M^3$, and thus close automatically the valve A, shutting off the pulp supply and also close the valve D, shutting off the barren solution supply. The solution levels inside P', $P^2$ and $P^3$, and within the annular rings $O^1$, $O^2$ and $O^3$, would then gradually come to the same level, as the solids settled to the bottom. When the air is again turned on, agitation will commence and transfer of pulp and solutions will begin until an equilibrium is again established.

The barren solution as it mixes with the pregnant solution in tank No. 3 lowers the valve of the resulting solution by dilution. It also lowers the valve of the remaining pulp by dissolving out or extracting any remaining undissolved gold values, for it is a well known fact in cyanid practice that a fresh barren solution will often extract

values from an ore, where a partially saturated solution which already contains dissolved gold and silver values will have but little effect.

The same condition obtains in regard to solution going to tank No. 2 and to tank No. 1, so that the solution drawn from tank No. 1 and going to the gold precipitation tanks will be of a high value in gold and silver, whereas the pulp transferred to the filter will be very low in gold and silver values, and therefore easy of treatment for the final wash to free it from dissolved values in gold and silver.

Having described my invention what I claim is:

1. Apparatus for treatment of ores comprising a series of tanks, means for conducting a continuous flow of pulp through said tanks in one direction, means for conducting a continuous flow of solution through said tanks in the opposite direction, and means for automatically controlling the transfer of the pulp from one tank to another in the series.

2. Apparatus for treatment of ores comprising a series of tanks, means for conducting a continuous flow of pulp through said tanks in one direction, means for conducting a continuous flow of solution through said tanks in the opposite direction, and means for automatically controlling the transfer of the solution from one tank to another in the series.

3. An apparatus for the treatment of ores comprising in combination a series of tanks, means for establishing a continuous flow of pulp through said tanks in one direction, means for establishing a continuous counter-flow of solution in the opposite direction, means for supplying air to the system for agitation purposes, means automatically operated for supplying air for transfer purposes, and means automatically operated, independent of said air controlling means, for shutting off the supply of pulp and barren solution respectively.

4. An apparatus for the treatment of ores comprising in combination a series of tanks, means for conducting a continuous current of pulp through the system, means for conducting a counter - current of solution through the system in the opposite direction, means automatically controlling the transfer of the pulp flow from one tank to another, and means for automatically controlling the counter-flow of the solution from one tank to another.

5. An apparatus for the treatment of ores comprising in combination a series of tanks, means for conducting a continuous current of pulp through the system, means for conducting a counter - current of solution through the system in the opposite direction, means for automatically controlling the supply of said pulp to the system, and means for automatically controlling the transfer of the pulp from one tank to another.

6. An apparatus for the treatment of ores comprising in combination a series of tanks, means for conducting a continuous current of pulp through the system, means for conducting a counter - current of solution through the system in the opposite direction, means for automatically controlling the supply of barren solution to the system, and means automatically controlling the counter flow of the said solution from tank to tank.

7. An apparatus for the treatment of ores comprising a series of connected tanks, means for establishing a flow of pulp through the series in one direction, means establishing a counter flow of solution through the series in the opposite direction, and a plurality of automatically operated float valves controlling the transfer of pulp from one tank to another.

8. An apparatus for the treatment of ores comprising a series of connected tanks, means for establishing a flow of pulp through the series in one direction, means for establishing a counter flow of solution through the series in the opposite direction, and a plurality of automatically operated float valves controlling the transfer of the solution in its counter flow through the series.

8. An apparatus for the treatment of ores comprising a series of connected tanks, means for establishing a flow of pulp through the series in one direction, means establishing a counter flow of solution through the series in the opposite direction, an automatically operated float valve for controlling the supply of pulp to the system, and a plurality of automatically operated float valves controlling the transfer of the pulp from one tank to another.

10. An apparatus for the treatment of ores comprising a series of connected tanks, means for establishing a flow of pulp through the series in one direction, means for establishing a counter flow of solution through the series in the opposite direction, an automatically operated float valve for controlling the supply of barren solution to the system, and a plurality of automatically operated float valves controlling the transfer of the solution in its counterflow from one tank to another.

11. An apparatus for the treatment of ores comprising a plurality of connected tanks, means for conducting a continuous flow of pulp through the system in one direction, means for conducting a continuous flow of

solution through the system in the opposite direction, means for supplying air to the several tanks for agitating the mixtures therein, and manually operated means for controlling the supply of air for agitation purposes.

12. An apparatus for the treatment of ores comprising a plurality of connected tanks, means for conducting a continuous flow of pulp through the system in one direction, means for conducting a continuous flow of solution through the system in the opposite direction, means for supplying air to the system for effecting the transfer of the pulp and solution from one tank to another, and automatically operated float valves for regulating the supply of air to the several tanks.

In testimony whereof, we affix our signatures in presence of two witnesses.

JOHN WM. BUCHER.
RANDALL P. AKINS.

Witnesses:
P. J. ZWIER,
H. F. MILLS.

**Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."**