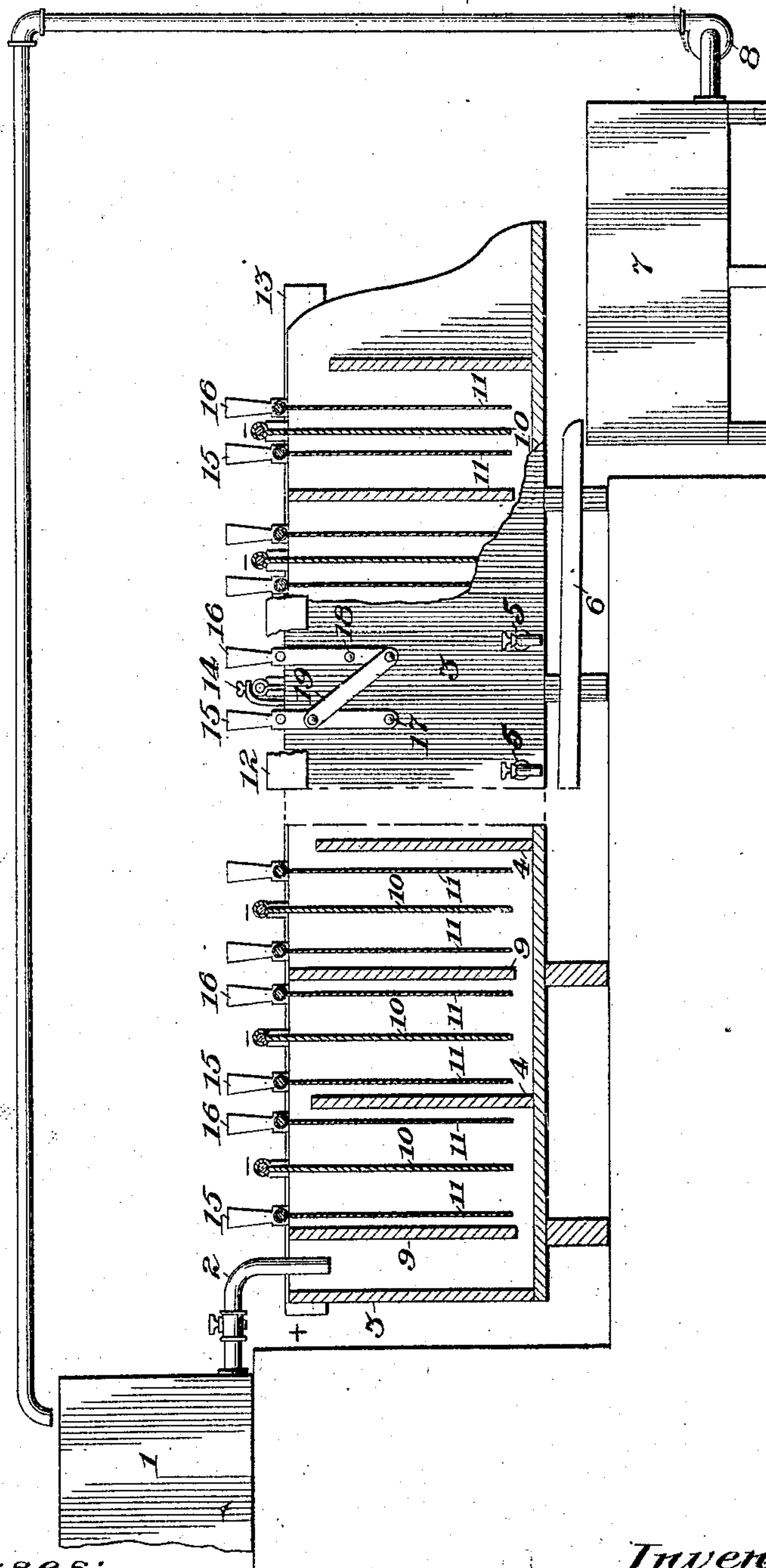


No. 841,720.

PATENTED JAN. 22, 1907.

J. H. RYAN.  
ELECTROLYTIC APPARATUS.

APPLICATION FILED MAR. 1, 1906.



Witnesses:  
*Chas. E. Chubb*  
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# UNITED STATES PATENT OFFICE.

JOHN H. RYAN, OF PORTLAND, OREGON.

## ELECTROLYTIC APPARATUS.

No. 841,720.

Specification of Letters Patent.

Patented Jan. 22, 1907.

Application filed March 1, 1906. Serial No. 303,663.

*To all whom it may concern:*

Be it known that I, JOHN H. RYAN, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Electrolytic Apparatus, of which the following is a specification.

The object of this invention is to provide a simple and effective apparatus for electrodepositing metals from their solutions and more particularly from their sulfate or sulfite solutions prepared in accordance with the method claimed in my copending application, Serial No. 303,664, filed March 1, 1906. Said solutions are prepared by leaching ores containing copper or copper and nickel or nickel and cobalt or cobalt after a preliminary treatment by roasting to bring the metals into a readily-soluble condition with a solution of sulfuric or sulfurous acid preferably prepared from the gases derived from the roasting operation. The metal to be deposited is separated from solution by electrolysis, using insoluble anodes and cathodes consisting usually of the metal to be deposited.

For a full understanding of my invention reference is made to the accompanying drawing, showing my improved apparatus, parts being broken away.

1 represents a continuous-flow leaching-tank of any suitable type, and 2 is a valved discharge-pipe for the clear metal-bearing solutions prepared therein.

3 is the electrodepositing-tank, which may be of wood coated with an acid-resisting paint and is preferably in the form of an elongated trough, as shown, the discharge end of the trough being situated over the sump-tank. The electrodepositing-tank is divided into a plurality of independent but communicating compartments by partitions 4, also of wood, extending from the bottom to a point slightly below the normal solution-level. The tank 3 is preferably inclined in the general direction of flow of the solution, the preferred inclination being about one inch in each foot, whereby the rate of flow may be increased to such degree as to effectively agitate the solution during deposition, or each partition 4 may be made slightly lower than the preceding one in the line of flow, as shown. Each of the independent compartments so formed is provided with a draw-off cock 5, through which its contents

may be discharged into a trough or launder 6, leading to the sump 7. A pump 8 is arranged to return the solution from the sump 7 to the leaching-tank 1. The provision of separate draw-off cocks 5 is advantageous, for the reason that it permits the use of any portion of the apparatus corresponding to the quantity of solution in circuit.

Each of the independent compartments of the tank 3 is provided with a depending partition 9, which is centrally disposed in all compartments except the first, the purpose of the partitions 9 being to direct the electrolyte in a downward and upward course past the electrodes in each compartment. The first partition 9 is illustrated as adjacent to the end of the tank 3 to provide a free inlet thereto.

The cathodes 10 consist, preferably, of thin sheets of the metal to be deposited and are centrally supported in electrical contact with the cathode buss-bars 12 between the anodes 11. Preferably the cathode-supporting bars are clamped in position, one of the clamps being indicated at 14. The anodes 11 may be of lead or other suitable conductive material substantially unattacked by the electrolyte and are supported in contact with the anode buss-bar 13 and are free to slide thereon to permit adjustment of their position relative to the cathodes.

In the deposition of metals from their solutions by means of insoluble anodes there occurs a progressive impoverishment of the solution, and in order to insure the highest efficiency of operation and substantial uniformity in character and quantity of deposited metal throughout the electrodepositing-tank it is desirable that the electrodes should be more closely spaced in proportion as the electrolyte becomes depleted of metal—that is to say, the anodes and cathodes should be more widely separated at the inlet end of a continuous-flow electrodepositing-tank than at its effluent end, such arrangement being clearly shown in the drawings. The effect of this arrangement where the electrodes are connected electrically in multiple is to compensate for variations in composition of the electrolyte from end to end of the depositing-tank and to insure a substantially equal deposition of metal throughout the same. It will be understood that it is not necessary in the practice of my invention that the solution should be completely exhausted of metal, but merely



that sufficient metal should be deposited to restore the solvent character of the solution. The circulation of the solution is continued until the extraction of the metals from the ore in the leaching-tank is substantially complete.

I prefer to provide means whereby each pair of anodes 11 11 may be simultaneously and equally adjusted. I do not limit myself to any particular means for effecting this adjustment; but as one such means I have shown each anode-supporting bar as provided at each end with a hand-lever, the hand-levers 15 16 at adjacent ends of a pair of anode-bars being pivoted, as shown at 17 and 18, respectively, and so connected by a link 19 as to secure uniformity of movement of the two bars either toward or from the central cathode. This arrangement insures that the anodes on opposite sides of a cathode shall at all times be equally spaced therefrom, thereby securing an equal deposition on opposite sides of the cathode. The arrangement further permits their ready adjustment.

It will be obvious that the cathodes may be located on opposite sides of a central anode and may be adjusted with respect thereto; but I consider such arrangement to be less desirable.

I claim—

1. An electrolytic apparatus comprising a trough adapted for conveying a stream of electrolyte, electrodes therein connected electrically in multiple, and means operating simultaneously on a plurality of said electrodes to adjust their positions, substantially as described.

2. An electrolytic apparatus comprising a tank having inlet and outlet for electrolyte, means for directing the electrolyte in a tortuous path therethrough, electrodes therein connected electrically in multiple, and means operating simultaneously on a plurality of said electrodes to adjust their positions, substantially as described.

3. An electrolytic apparatus comprising a tank, inlet and outlet for electrolyte at oppo-

site ends thereof, and electrodes therein connected electrically in multiple and progressively more closely spaced in the general line of flow of the electrolyte, substantially as described.

4. An electrolytic apparatus comprising a tank, inlet and outlet for electrolyte at opposite ends thereof, means for directing the electrolyte in a tortuous path therethrough, and electrodes in said tank connected electrically in multiple and progressively more closely spaced in the general line of flow of the electrolyte, substantially as described.

5. An electrolytic apparatus comprising a trough adapted for conveying a stream of electrolyte, partitions therein dividing the tank into a plurality of independent but communicating compartments, anodes and cathodes in each of said compartments, and separate outlets for said compartments, substantially as described.

6. An electrolytic apparatus comprising a trough adapted for conveying a stream of electrolyte, partitions therein dividing the tank into a plurality of independent but communicating compartments, anodes and cathodes in each of said compartments connected electrically in multiple, and separate outlets for said compartments, substantially as described.

7. An electrolytic apparatus comprising a leaching-tank, a continuous-flow depositing-tank, a sump-tank, connections between said tanks, partitions in the depositing-tank dividing the same into independent but communicating compartments, anodes and cathodes in each of said compartments, and means in connection with said compartments for discharging the contents thereof into said sump-tank, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN H. RYAN.

Witnesses:

C. W. FOWLER,

J. B. HILL.