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METAL EXTRACTING AND ORE LIXIVIATING APPARATUS.

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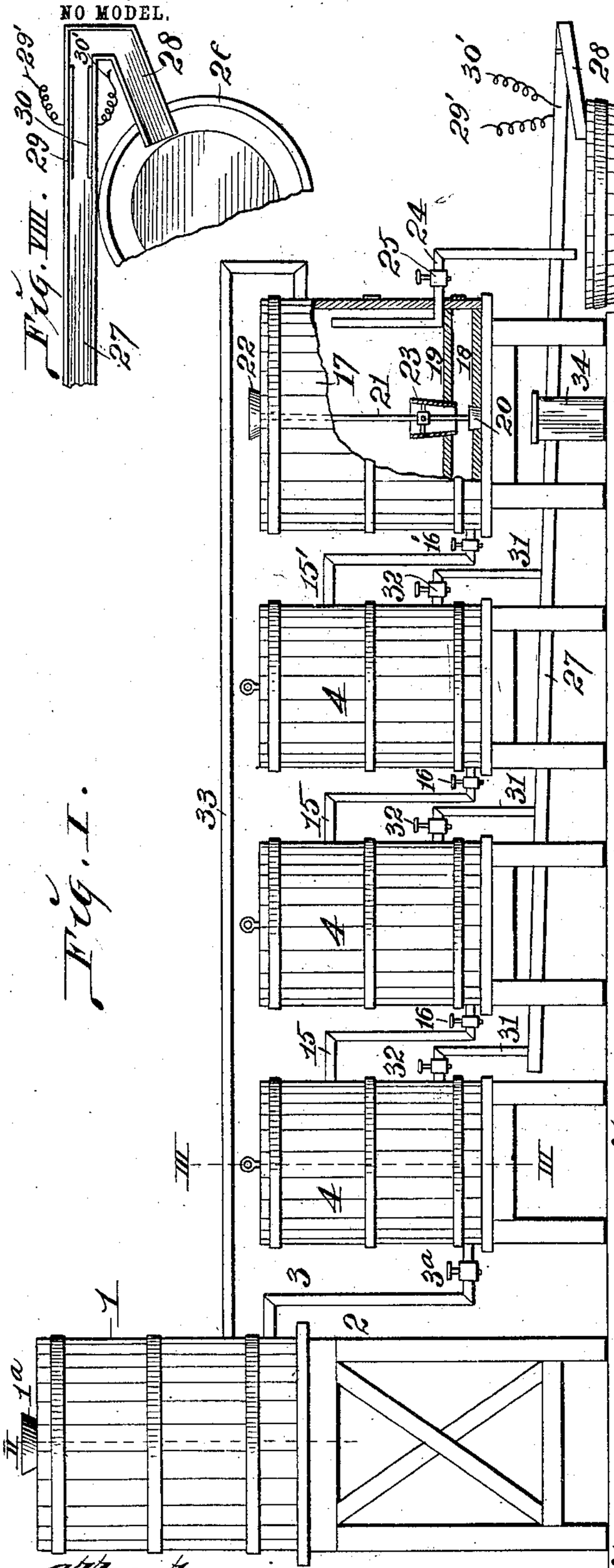
NO MODEL.



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UNITED STATES PATENT OFFICE.

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METAL-EXTRACTING AND ORE-LIXIVIATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 735,960, dated August 11, 1903.

Application filed October 10, 1902. Serial No. 126,645. (No model.)

To all whom it may concern:

Be it known that we, GEORGE S. FOSTER, residing in the city of St. Louis, and STEPHEN A. D. STRINGER, residing at St. Clair, in the county of Franklin, State of Missouri, citizens of the United States, have invented certain new and useful Improvements in Metal-Extracting and Ore-Lixiviating Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

Our invention relates to an apparatus for extracting metals from their ores by lixiviation or leaching; and the invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a side elevation of our apparatus. Fig. II is a vertical section of the solution-supply tank. Fig. III is a vertical section of one of the leaching-tanks, taken on line III III, Fig. I. Fig. IV is a horizontal section of one of the leaching-tanks, taken on line IV IV, Fig. III. Fig. V is a perspective view of the upper end of one of the vertical solution-distribution tubes located in the leaching-tanks. Fig. VI is a cross-section taken on line VI VI, Fig. V. Fig. VII is a vertical section of the horizontal solution-distribution tubes. Fig. VIII is a top view of the discharge end of the launder of the apparatus. Fig. IX is a vertical section of the charcoal-precipitation box.

1 designates the solution-supply tank, which is mounted on a support 2 at an elevation with respect to the remainder of the apparatus, so that the solution contained by said tank will flow by gravity therefrom to the leaching-tanks of the apparatus. This tank is filled through a funnel 1^a, that is normally closed by a stopper 1^b.

3 is a solution-conducting pipe leading from the tank 1.

4 designates leaching-tanks, of which there are a series, that are connected together for intercommunication, as will hereinafter appear. The solution-conducting pipe 3 leads from the tank 1 to the leaching-tank 4 situated nearest to it, and the pipe enters said leaching-tank at the bottom thereof, as seen in Figs. I and III. Each of the leaching-tanks 4 has a top 5, that is provided with an ore-introduction orifice which is closed by a plug 6. The bottoms 7 of the tanks 4 are provided with outlets that are closed by plugs 8, which are carried by rods 9, extending downwardly through the center of the tanks from the plugs 6. (See Fig. III.)

10 designates false bottoms positioned above the bottoms 7 of the tanks 4 to provide chambers 11 between the bottoms and the false bottoms.

9^a designates plugs that are carried by the rods 9 and by which orifices in the false bottoms 10 are closed.

12 designates upright tubes, having closed upper ends and having their lower ends seated in the false bottoms 10 of the leaching-tanks and provided with vertical longitudinal slits 13, through which the solution escapes after entering the chambers 11 at the lower ends of the tanks.

14 designates short tubes extending horizontally from the upright tubes 12 and positioned at a slight elevation from the false bottoms 10. These horizontal tubes are provided with perforations 14^a in their lower sides (see Fig. VII) through which the solution entering the upright tubes escapes and is directed downwardly toward the false bottoms.

15 designates overflow solution-conducting pipes that lead from each leaching-tank 4 at a point preferably above the vertical center thereof and extend therefrom to the lower ends of the next adjacent leaching-tanks, into which they enter to discharge the solution into the chamber between the bottom and false bottom of the tank. Each of the pipes 15 is provided with a shut-off valve 16.

17 designates a water-tank arranged in proximity to the last of the series of leaching-tanks 4 and connected to said leaching-tank by a fume-conducting pipe 15′, that leads from the upper portion of said leaching-tank to the lower end of the water-tank and is provided with a shut-off valve 16′. The water-tank 17 is of a capacity corresponding to the multiple of the capacity of the leaching-tanks 4, and it is provided with a bottom 18 and false bottom 19. The bottom of the water-

tank contains a central orifice which is normally closed by a plug 20, carried by a rod 21, that extends downwardly through the tank from a plug 22, that closes an inlet-orifice in the top of the tank.

23 is a tube carried by the rod 21 and arranged to seat in a central orifice in the false bottom 19.

24 is an outlet-pipe that extends upwardly within the water-tank 17 from its lower end and is open for communication with said tank. The pipe 24 extends exterior of the water-tank and is provided with a valve 25.

26 designates a precipitation-vat located in proximity to the water-tank 17 and over which the outlet-pipe 24 extends.

27 designates a launder extending longitudinally of the apparatus beneath the leaching-tanks 4 and provided with a return-leg 28, that is positioned above the precipitation-vat 26. (See Figs. I and VIII.)

29 and 30 are positive and negative electrodes arranged in the launder in advance of the return-leg and which are provided with connection to suitable batteries by wires 29′ and 30′.

31 designates drain-pipes which are provided with shut-off valves 32 and are connected to the lower ends of the leaching-tanks for communication with the leaching-chambers thereof. These drain-pipes are arranged to discharge into the launder 27.

33 designates a gas-conveying pipe leading from the upper end of the water-tank 17 to the solution-supply tank 1. (See Figs. I and II.)

34 designates a precipitation-box positioned in the course of the launder 27. This box is adapted to contain a quantity of charcoal, as seen at A, Fig. IX, when the apparatus is used in extracting gold from its ore, the gold in solution resulting from the separating action in the leaching-tanks passing through the launder into the box to be precipitated by the charcoal, which is subsequently burned for the recovery of the metal. Where the apparatus is used for the recovery of metals other than gold, the presence of charcoal therein is not required, and, if desired, the box may be in an empty condition or it may be removed and the gap between the launder at the location of the box may be completed by the substitution of a connecting section of launder.

Having described the construction of our apparatus, we will now set forth the practical operation in its use.

The leaching solution, which may be of any well-known composition—such as sulfuric acid or nitric acid, hydrochloric acid, and chlorid of sodium—is introduced into the solution-supply tank through the inlet in the closed top of said tank. It will be understood that the composition of the solution above referred to depends entirely upon the ores to be treated. The ore to be treated is introduced into the leaching-tanks 4 through the orifices in the closed tops of the tanks, for the introduction of which the plugs 6 seated therein are lifted from their seats. The water-tank 17 is filled with water to a level with the upper open end of the outlet-pipe 24, arranged therein. The valve 3ª in the conducting-pipe 3, leading from the supply-tank, is then opened, and the valves 16 in the overflow-pipes 15 being opened the leaching operation is begun. The solution flows from the supply-tank into the first leaching-tank and after passing therethrough enters the subsequent tanks by overflowing through the pipes 15, leading thereinto. In each leaching-tank the solution enters the chamber 11 between the bottom and false bottom of the tank and passes upwardly from said chamber through the upright tubes 12 to gain access to the ore in the chamber of the tank. From each of the upright tubes the solution escapes through the vertical slits 13 therein to percolate among the ore. The solution also enters the horizontal tubes 14, projecting from the upright tubes near their lower ends, and escapes therefrom through the perforations 14ª, so as to be directed downwardly into the denser mass of ore at the bottom of the tank, into which the solution escaping from the vertical slits cannot as readily enter by reason of the density of the mass. The fumes of the acids comprising the ingredients of the solution used in the apparatus find egress from the last of the series of leaching-tanks through the fume-conducting pipe 15′ upon the valve 16′ therein being opened, and they enter the water-tank 17 at the lower end thereof and pass upwardly through the tube 23 into the body of water in said tank in which the acid fumes of the solution are taken up and dissolved. The non-liquefiable gases arising from the solution in the leaching operation enter the water-tank from the leaching-tanks with the acid fumes and mingle with the oxygen contained by the water in said tank. The gases then pass from the water-tank through the gas-conducting pipe 33 to the solution-supply tank 1 and again follow the original circuit of the solution from the supply-tank to the leaching-tanks to assist in the leaching action therein. The gases thus make a complete circuit through the apparatus, which continues throughout the leaching operation, and in their circuit through the leaching-tanks they act as an agitator to continue stirring the solution among the ore particles, thereby rendering the leaching action much more efficient than it would otherwise be.

The solution, combined with the water in the tank 17, may be removed therefrom and rendered suitable for reuse in the apparatus by the addition of a quantity of the ingredients of the original solution to render it of the proper strength, the quantity of new ingredients being determined by the number of leaching-tanks, the capacities of which are

the equivalent of the capacity of the water-tank.

The chlorids or nitrates obtained in the leaching-tanks as a result of the leaching action of the solution passed therethrough are drawn off through the drain-pipes 31 from each tank and pass through the launder 27 to the precipitation-vat 26, in which they are precipitated in the well-known manner. In the treatment of copper-bearing ores the electrodes 29 and 30 are made use of for electrolytical recovery, the return-bend in the launder 27 serving to retard the flow of the the solution sufficiently to effect the deposit on the electrodes.

The pipe 24 serves as an overflow-pipe for the water in the tank 17 when an excess quantity of water is introduced thereinto, thereby providing for the presence of the precise amount of water in the tank according to the requirement necessitated by the quantity of solution passed through the leaching-tanks. The pipe is also of utility for the escape of fumes or gases from the water-tank in any instance where it is not desired to retain them for service.

We claim as our invention—

1. In an apparatus of the character described, the combination of a solution-supply tank, a series of intercommunicating leaching-tanks adapted to receive solution from said supply-tank, a water-tank having fume-conducting connection with said leaching-tanks, and a gas-conducting pipe leading from said water-tank to said solution-supply tank, substantially as described.

2. In an apparatus of the character described, the combination of a solution-supply tank, a series of intercommunicating leaching-tanks adapted to receive solution from said supply-tank, upright distribution-tubes located in said leaching-tanks, and horizontal perforated tubes extending laterally from said distribution-tubes, substantially as described.

3. In an apparatus of the character described, the combination of a solution-supply tank, a series of intercommunicating leaching-tanks adapted to receive solution from said supply-tank, upright distribution-tubes located in said leaching-tanks, and horizontal perforated tubes extending laterally from said distribution-tubes at the lower ends thereof, substantially as described.

4. In an apparatus of the character described, the combination of a solution-supply tank, a series of leaching-tanks adapted to receive solution from said supply-tank, overflow-pipes providing communication between said leaching-tanks, a water-tank and a fume-conducting pipe leading from one of said series of leaching-tanks to said water-tank, substantially as described.

5. In an apparatus of the character described, the combination of a solution-supply tank, a series of intercommunicating leaching-tanks adapted to receive solution from said supply-tank, drain-pipes leading from said leaching-tanks, a launder into which said drain-pipes are arranged to discharge, and electrodes positioned in said launder, substantially as described.

6. In an apparatus of the character described, the combination of a solution-supply tank, a series of intercommunicating leaching-tanks adapted to receive solution from said supply-tank, drain-pipes leading from said leaching-tanks, a launder into which said drain-pipes are arranged to discharge, and a charcoal-box connected to said launder, substantially as described.

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In presence of—
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