No. 865,027. PATENTED SEPT. 3, 1907.

O. A. ELLIS.

APPARATUS FOR EXTRACTING MINERALS FROM ORE.

APPLICATION FILED MAR. 24, 1903.

2 SHEETS—SHEET 1.

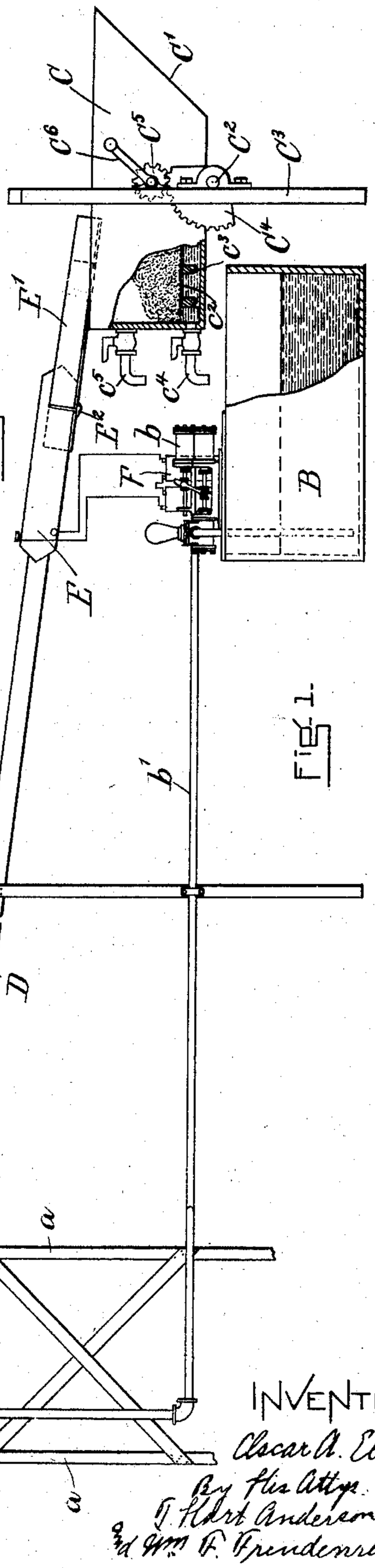

Fig. 4.

Fig. 1.

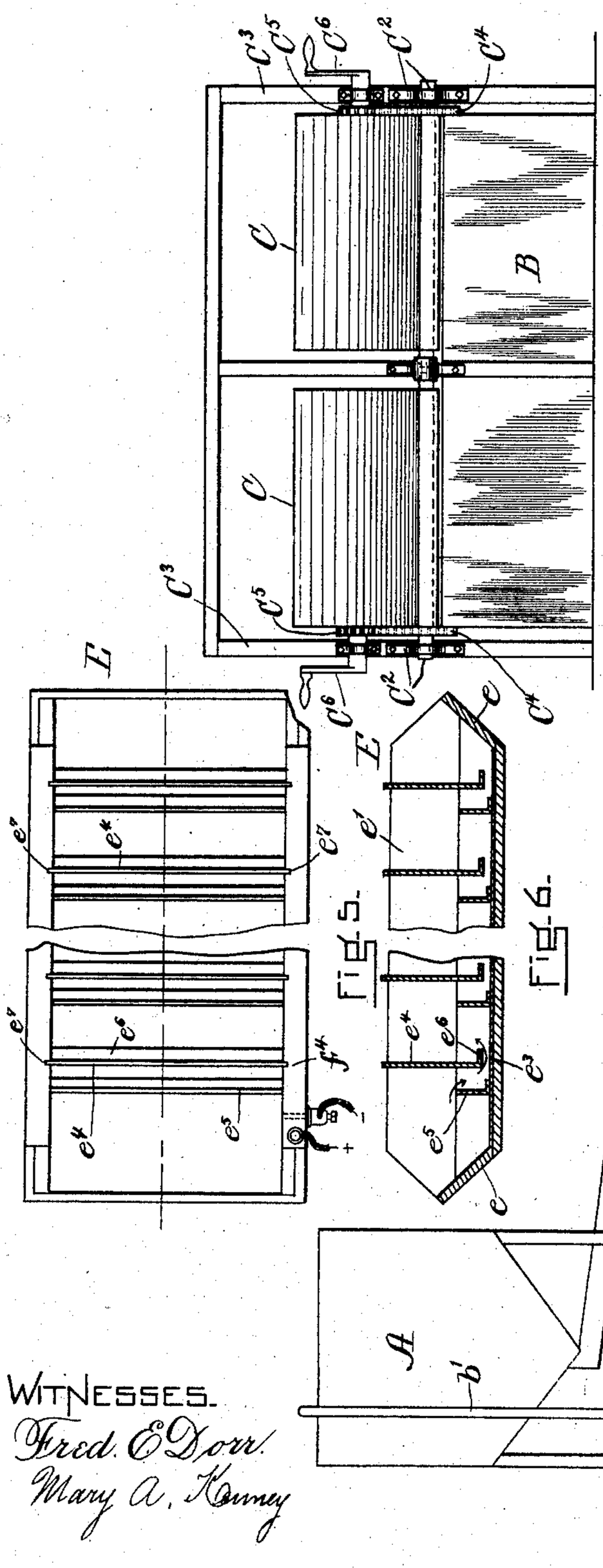

Fig. 5.

Fig. 6.

WITNESSES.

Fred. E. Dorr.

Mary A. Kenney

INVENTOR.

Oscar A. Ellis

By His Attys.

J. Hart Anderson

and Wm. F. Prendenreich.

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2 SHEETS—SHEET 2.

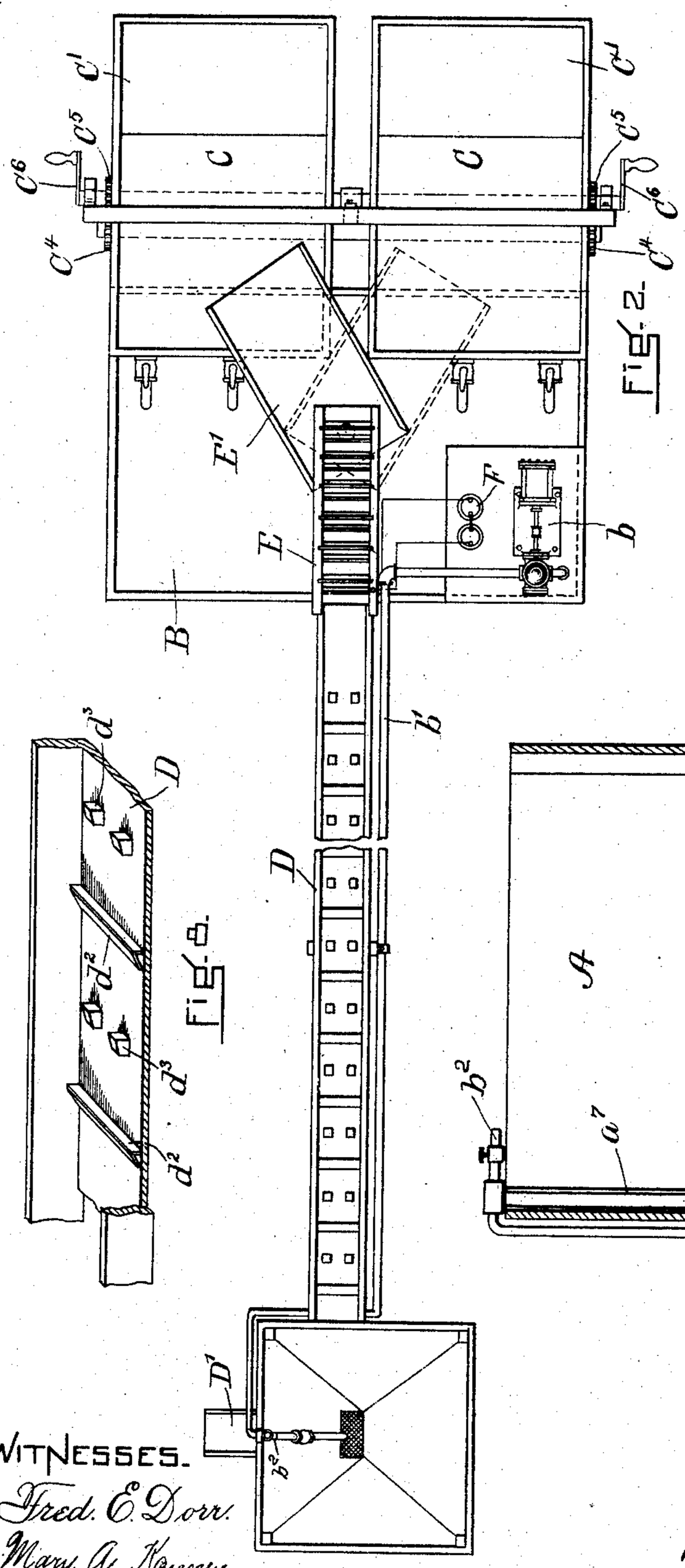

Fig. 2.

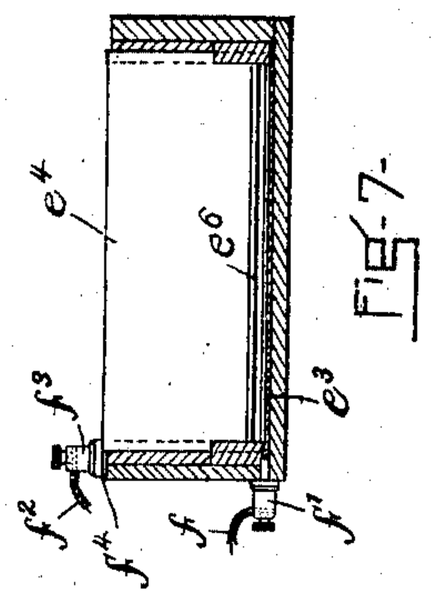

Fig. 7.

Fig. 8.

Fig. 5.

WITNESSES.

Fred. E. Dorr.

Mary A. Kenney

INVENTOR.

Oscar A. Ellis,

By His Attys.

T. Hart Anderson

and Wm. R. Baldemeich.

UNITED STATES PATENT OFFICE.

OSCAR A. ELLIS, OF SAN FRANCISCO, CALIFORNIA.

APPARATUS FOR EXTRACTING MINERALS FROM ORE.

No. 865,027. Specification of Letters Patent. Patented Sept. 3, 1907.

Application filed March 24, 1903. Serial No. 149,321.

To all whom it may concern:

Be it known that I, OSCAR A. ELLIS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Apparatus for Extracting Minerals from Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to apparatus for extracting minerals from ores, and more particularly to an improved apparatus embodying means for utilizing an electro-chemical process of extracting gold and silver from ores.

In an application filed by me on June 16, 1902, Serial No. 111,812, for an apparatus for extracting minerals from ores, I have illustrated an apparatus to be used in carrying out a similar process, and the present invention relates to improvements thereon.

In the application referred to above, the apparatus is designed to receive a mixture of crushed ore and chemical solution, the mixture or pulp flowing through the action of gravity through the precipitating box and into the tailing tank. In this apparatus it is necessary to have a receiving hopper of some kind in which the mixing takes place and in which the ore is partially leached before it is passed into the precipitating box. The process is, therefore, not an entirely continuous one, since the mixture must be allowed to stand for some time in the hopper in order that the leaching may be effected.

The object of the present invention is to provide means whereby the leaching hopper may be dispensed with and the ore taken directly from the crushers, the process being thereby made continuous.

A further object of the present invention is to provide means for thoroughly aerating the mixture of ore and chemical solution previous to its entrance into the precipitating box.

A further object consists in providing means for breaking up the slimes and preventing them from settling, thereby permitting thorough aeration.

A further object of the present invention consists in an improved tailing tank into which the exhausted ore and chemical solution flows after leaving the precipitating box.

Further objects of the present invention will appear in connection with the following description and mode of operation thereof.

To the above ends the present invention consists of the devices and combinations of devices which will be hereinafter described and particularly pointed out in the claims.

The present invention is illustrated in the accompanying drawings, in which:—

Figure 1 shows in side elevation and partial section the preferred form of the apparatus; Fig. 2 shows a top plan view of the apparatus. Fig. 3 is a transverse vertical section showing a receiving hopper and its immediately adjacent parts. Fig. 4 is an end elevation showing the tilting tailing tanks. Fig. 5 is a broken top plan view of one of the precipitating boxes. Fig. 6 is a longitudinal sectional view of said precipitating box. Fig. 7 is a transverse sectional view of said precipitating box. Fig. 8 is a perspective view, partly in section, showing the construction of the launder connecting the hopper with the precipitating box.

Similar letters of reference will be employed throughout the specification and drawings to designate corresponding parts.

In the drawings, A represents a receiving hopper; B represents the vat in which the chemical solution is prepared and retained. *b* indicates a pump of any preferred form which is used to force the chemical solution through the pipe b^1 and into the hopper A. These elements may be of the same construction as in my previous application, the hopper being shown instead of a crushing mill, for the reason that in reworking old tailings a hopper of some sort should be used to facilitate the mixing, though not for the purpose of leaching to any extent.

In working ore originally, the hopper is dispensed with, since the apparatus may be connected directly to the crushing mill, the pipe b^1 in this case extending to the mill and discharging the chemical solution upon the ore as it is being crushed.

One or more tanks or vats C are located at a considerable distance from the hopper or mill for the purpose of receiving the mixture of exhausted ore and chemical solution from a launder D and precipitating box E and filtering the chemical solution from the ore. From the tanks or vats C, the ore is discharged on a dump or refuse heap.

I have shown two filtering or tailing tanks C and a swinging chute E_1 for connecting the precipitating box E with either tank. This is the preferred arrangement, since it enables the apparatus to be continuously operated, giving, however, sufficient time for properly filtering the chemical solution from the exhausted ore. A single tailing tank or more than two may be employed; this depending largely upon the quantity and character of the materials operated upon and the desire or necessity for the expeditious handling thereof.

One of the principal features of the present invention lies in the chute or launder D, down which the pulp or mixture of crushed ore and chemical solution flows before it passes into the precipitating box.

The launder comprises preferably an inclined open trough which may, in some cases, be several hundred feet long; the trough having cleats or riffles d^2 and d^3 arranged transversely of its bottom. The cleats d^2 may extend entirely across the trough, while the cleats d^3 are preferably quite short; the object of these cleats being to break the continuity of the stream of ore and liquid, agitating it violently and causing it to splash, presenting thereby a large surface composed of finely divided particles upon which the air may freely act. This also prevents the formation of large masses of slimy matter, since the constant agitation disintegrates any mass of considerable size upon its formation.

As is the case in my previous application, it is not my intention that the minerals should be dissolved to any extent, but enough only to clean and partially free them. A very weak cyanid solution may, therefore, be employed in this process, the thorough aerating causing it to act with great vigor for a short time. In fact, it has been found that the cleansing of the particles of gold and silver and the partial freeing thereof is more completely effected during the passage of the pulp down the launder than during hours of leaching in a hopper or tank.

From the launder D the pulp passes into the precipitating box E, this box being similar in all respects to that disclosed in my application previously referred to, and consists of an elongated trough having inclined ends e and side walls e^1. A bottom plate e^3 of copper is provided, this plate having upwardly projecting webs e^5. Alternating with these webs e^5 are plates e^4 extending downwardly and closely adjacent to the metallic bottom, but not touching it. These intercalated plates (see Figs. 6 and 7) are connected to the opposite poles of an electric battery or generator F, whereby, as the pulp flows through the box, the electricity flows through the pulp, separating the mineral from the ore and depositing it on the cathode plates.

From the precipitating box the chemical solution and solid matter is discharged into the tanks or vats C, in which the liquid is separated from the solid, the liquid being returned to the tank B, and the solid matter being discharged upon the dump, as has been hereinbefore described.

For the purpose of separating the chemical solution from the solid matter, the tank C is provided with a screen or reticulated bottom c^2 located at some distance above the bottom of the tank, and supported upon transverse wooden strips c^3, leaving a space beneath the reticulated bottom c^2, into which the chemical solution is filtered and from which it flows, through suitable valves or faucets c^4, into the tank or vat B, to be again pumped up through the pipe b^1 and discharged into the receiving hopper A. Other gates or cocks c^5 may be located near the tops of the tanks to take care of any possible accumulation of liquid.

The perforated bottom of the tanks or vats C may be of any material capable of separating the liquid matter from the solid, such as canvas or wire netting.

The chute E^1 is pivoted at E^2 and is adapted to be swung so as to lead into the one or the other of the tailing tanks C, (see Fig. 2) so that the chemical solution may be thoroughly filtered from the exhausted ore in one tank, while the other is being charged.

The refuse may be removed from the tailing tanks in any convenient or desired manner, but, as a means for accomplishing this, I have illustrated these tanks as being mounted on horizontal shafts C^2 supported in suitable bearings on the standards C^3. Each shaft is provided with a toothed segment C^4 which intermeshes with a pinion C^5 revolubly mounted on the standards C^3. Cranks C^6 are connected to the pinions C^5, whereby a turning of the cranks tilts the tanks.

When the refuse in a tank has been sufficiently strained or filtered, the corresponding crank is turned, tilting the tank and discharging the contents thereof. As shown, the rear ends of the tanks are made inclined as at C^1, to facilitate the discharge.

The manner of using my improved apparatus is as follows:—If tailings are being reworked, a small hopper may be employed, the ore being dumped into said hopper. The pump b is then set in operation, causing a discharge of the chemical solution upon the ore, the mixture so formed flowing freely down the launder D and being thoroughly aerated during such passage. From the launder the mixture flows through the precipitating box over the plates e^5 and under the plates e^4, the minerals being extracted from the ores, and deposited on the metallic bottom and plates e^5. The chute E^1 is placed so as to connect the precipitating box with one of the tailing tanks, the exhausted mixture flowing from the precipitating box through this chute into this tailing tank. After a sufficient quantity of the mixture has been deposited within one tailing tank, the chute E^1 may be shifted so as to discharge into the other of said tanks, the exhausted ore and chemical solution being separated from each other in one tank while the other is being filled. When the exhausted ore in either tank becomes sufficiently dry, the tank is dumped, discharging such ore upon the refuse heap. The chemical solution is returned to the tank B through the cocks c^4 and c^5, and from this tank it is again taken by the pump and discharged upon the ore in the hopper or in the mill.

It will now be seen that I have provided apparatus in which an electro-chemical process may be carried on continuously, and one in which the slimes are prevented from settling, carrying with them the minerals and preventing thereby the efficient working of the process.

While I have described the construction of the launder specifically, yet it is of course understood that the present invention is not limited to such details, since it contemplates any apparatus which will act or operate upon a mixture of ore and chemical solution, breaking up the mass, or causing it to be broken up, in such a manner as to present to the action of the air large areas composed of finely divided particles.

Having described my invention, I claim as new and desire to protect by Letters Patent of the United States:

1. An apparatus for separating minerals from ores, having in combination, a long, inclined, open chute or launder, provided with riffles, and a precipitating box located adjacent the lower end thereof, whereby a mixture of ore and chemical solution will flow by gravity down the launder and through the precipitating box together with means for passing an electric current through said precipitating box, substantially as described.

2. An apparatus for separating minerals from ores having in combination, a launder comprising a shallow sta-

tionary open chute arranged on an incline and provided with a series of long and short cleats across the bottom thereof whereby a stream of crushed ore and chemical solution will flow down the launder automatically and will be violently agitated, a precipitating box connected with the lower end of the launder, and means for passing an electric current through said precipitating box, substantially as described.

3. An apparatus for separating minerals from ores, having in combination, an inclined chute, an inclined precipitating box connected therewith, a plurality of filtering tanks and means for connecting the precipitating box with any one of the filtering tanks, substantially as described.

4. An apparatus for separating minerals from ores, comprising the hopper A, the open launder D provided with the riffles d^2 and d^3, the precipitating box E and the tank or vat C, the precipitating box being shorter than the open launder, substantially as described.

5. In an apparatus for separating minerals from ores, comprising a hopper A, the open launder D, provided with the riffles d^2 and d^3, the precipitating box E, the tanks or vats C arranged side by side and the chute E′ pivotally supported beneath the precipitating box and arranged to be shifted laterally to discharge into either of the vats C, substantially as described.

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

OSCAR A. ELLIS.

Witnesses:

AUGUSTA W. DUISENBERG,

Mrs. E. D. DOYLE.