

No. 689,674.

Patented Dec. 24, 1901.

A. I. IRWIN.

MACHINE FOR EXTRACTING METAL FROM ORE.

(Application filed Sept. 26, 1900.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

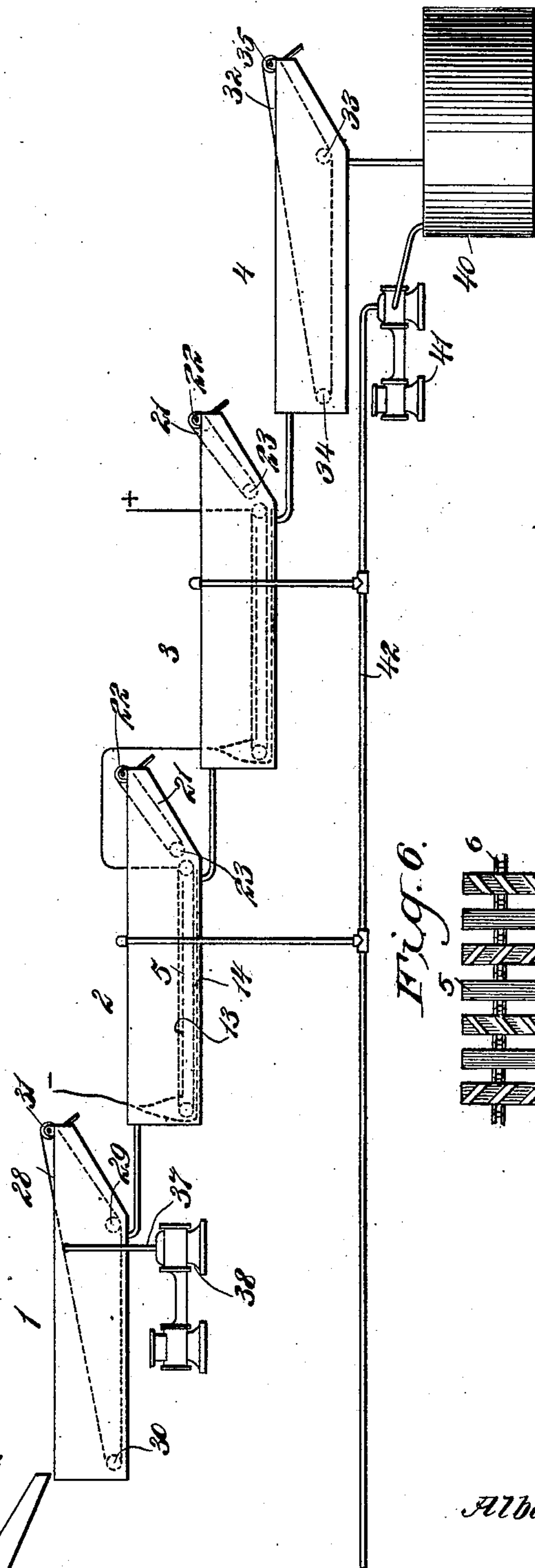
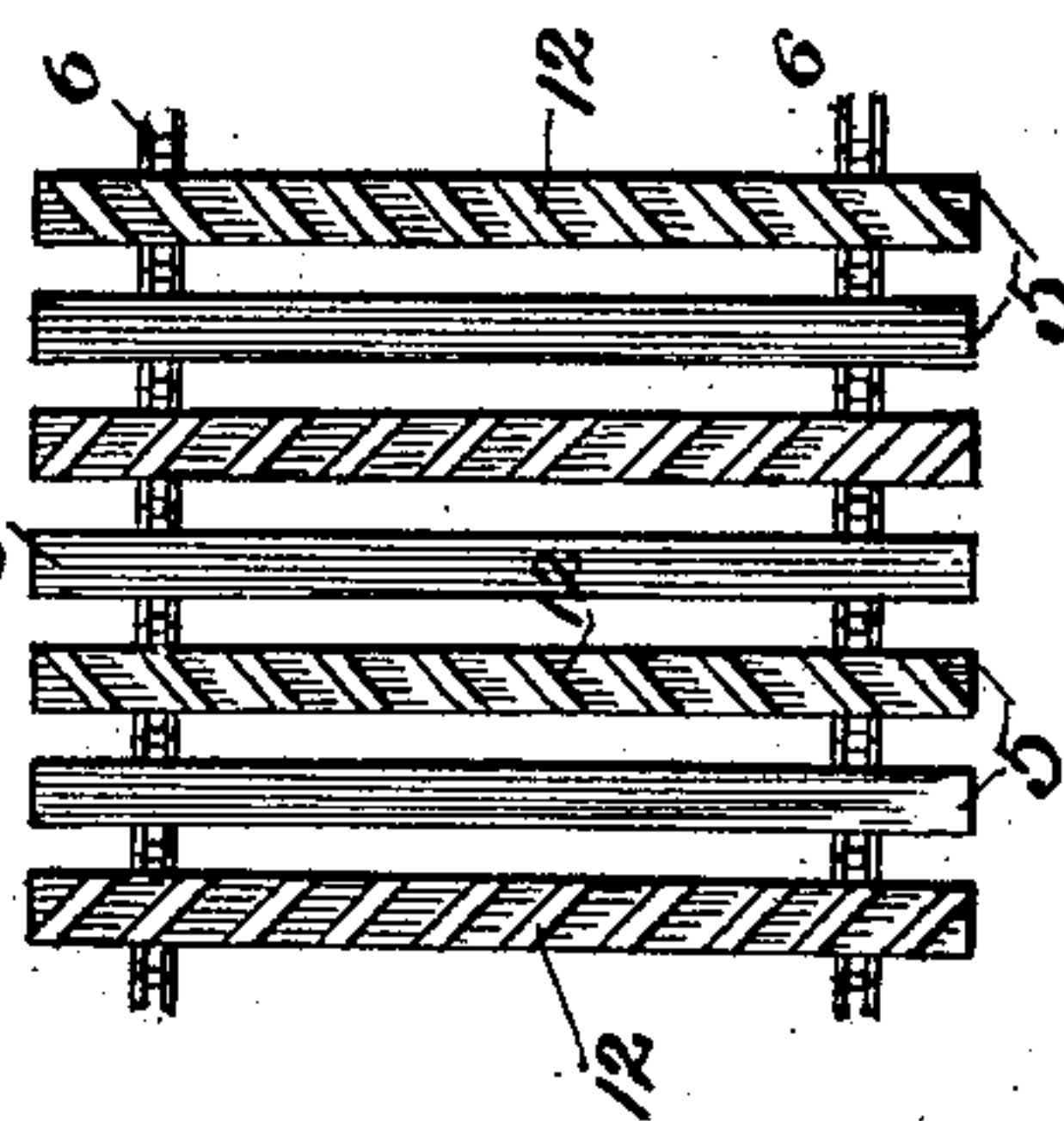


Fig. 6.



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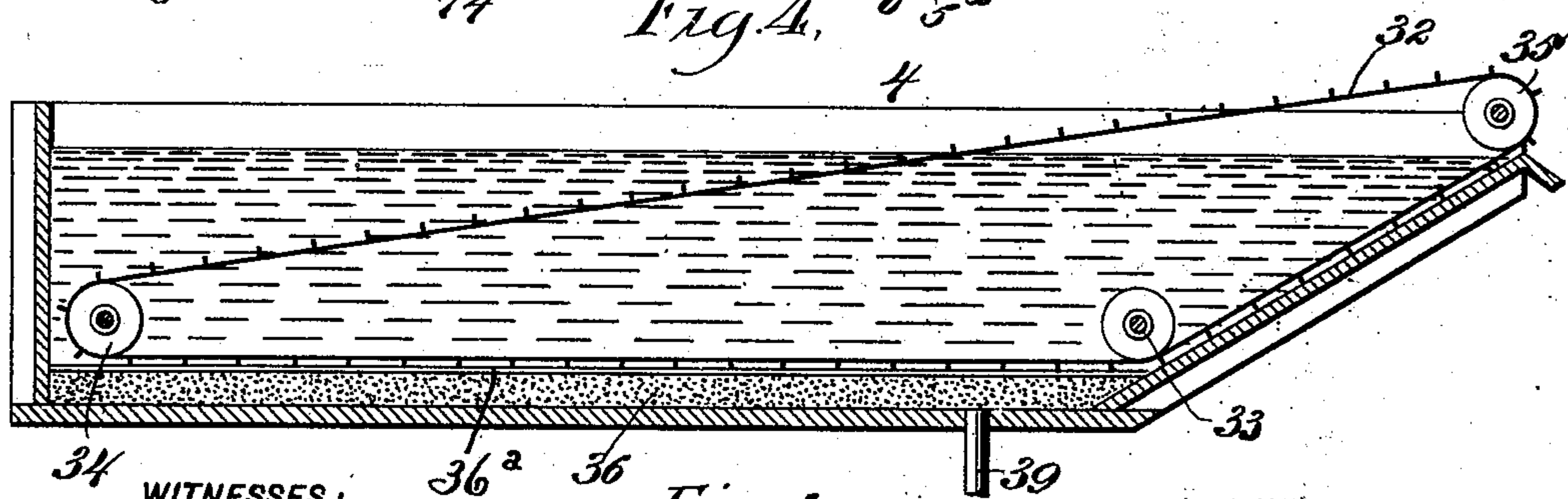
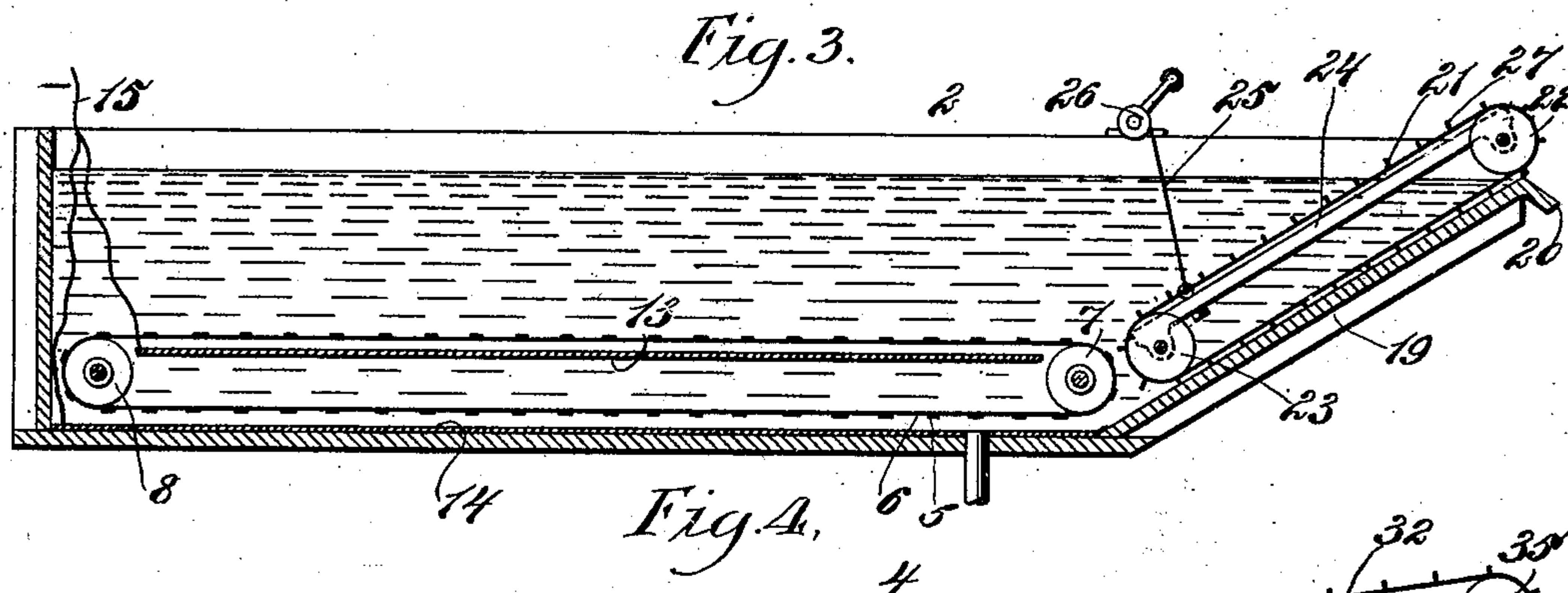
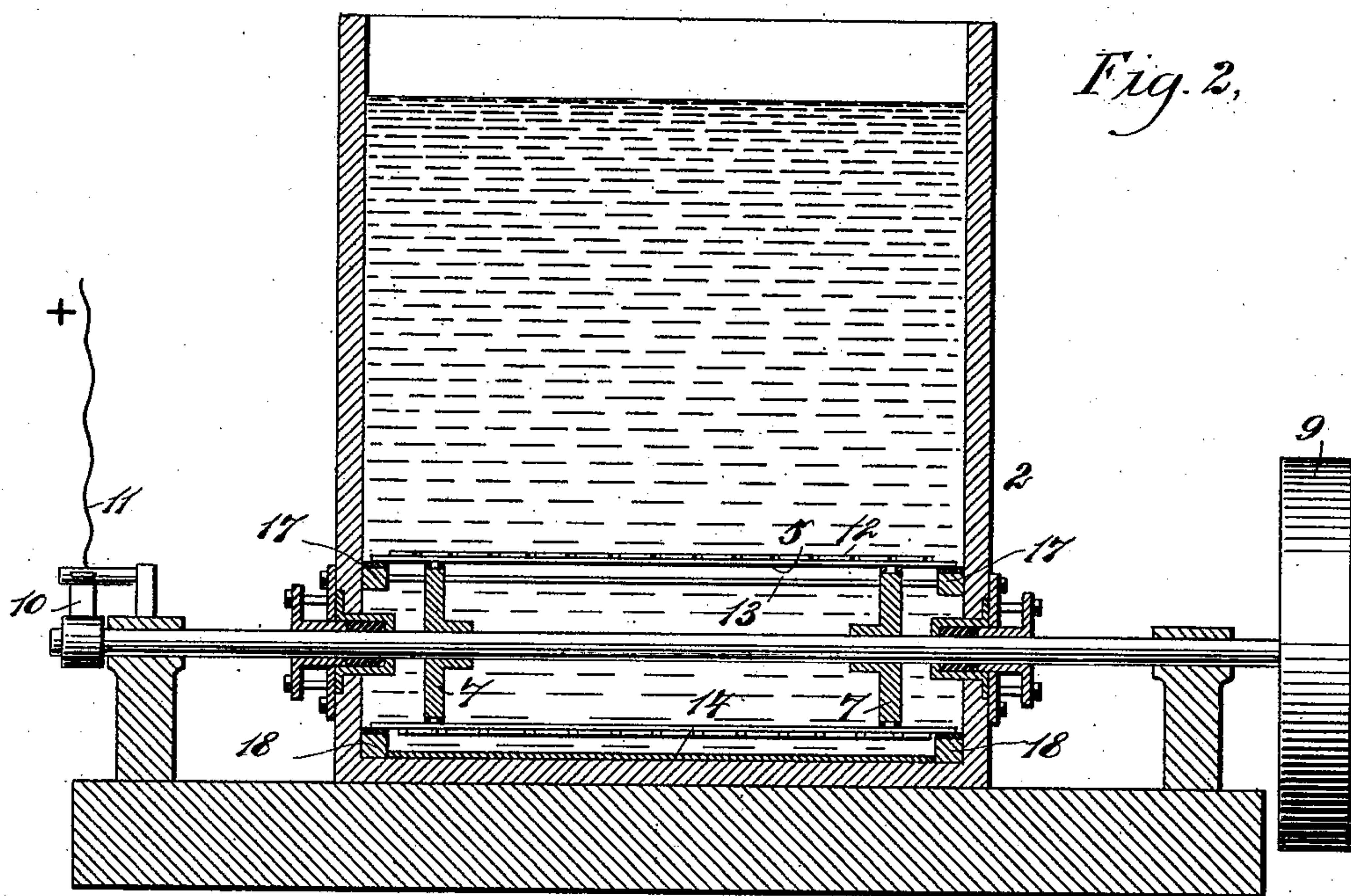
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Fig. 5.



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UNITED STATES PATENT OFFICE.

ALBERT ISALAH IRWIN, OF CRIPPLECREEK, COLORADO, ASSIGNOR OF ONE-THIRD TO CALEB F. BRYANT, OF CRIPPLECREEK MINING DISTRICT, TELLER COUNTY, COLORADO.

MACHINE FOR EXTRACTING METAL FROM ORE.

SPECIFICATION forming part of Letters Patent No. 689,674, dated December 24, 1901.

Application filed September 26, 1900. Serial No. 31,144. (No model.)

To all whom it may concern:

Be it known that I, ALBERT ISALAH IRWIN, a citizen of the United States, and a resident of Cripplecreek, in the county of Teller and State of Colorado, have invented a new and Improved Machine for Extracting Metal from Ore, of which the following is a full, clear, and exact description.

This invention relates to improvements in machines for separating metals from their ores; and an object is to provide a simple mechanical device to be used in conjunction with any suitable solution and an electric current for the continuous and automatic treatment of the metals, making extraction and deposition of precious metals at one and the same time.

I will describe a machine for extracting metal from ore embodying my invention and then point out the novel features in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side view of a machine embodying my invention. Fig. 2 is a cross-section of one of the electric-treatment tanks. Fig. 3 is a longitudinal section thereof. Fig. 4 is a longitudinal section of a washing and filtering tank employed. Fig. 5 shows a portion of one of the anodes employed. Fig. 6 is a plan view of a portion of one of the anodes.

In Fig. 1 I have shown a preliminary washing-tank 1, two treatment-tanks 2 3, and a final and filtering tank 4. These are arranged to discharge one into another. It is to be understood, however, that but a single treatment-tank need be employed or a greater number than shown may be employed. In each treatment-tank is a rotating anode consisting of a series of iron straps or bars 5, separated one from another or, rather, spaced apart, and all connected to endless chains 6, which extend around sprocket-wheels 7 8 at opposite ends of the tank. The shaft of the sprocket-wheels 7 extends outward through the sides of the tank and has bearings in suitable stuffing-boxes, and on one end of the shaft is a power or band wheel 9, while the

other end is engaged by a brush 10, having a connection 11 with a dynamo or other source of electricity. The endless chain of metal bars is not only intended as an anode, but as a mixer, and in its movements it is designed to force the ore under treatment along the tank, so that it may be discharged into the next tank of the series, as will be hereinafter described. Therefore I provide some or all of the bars 5 with diagonally-disposed blocks 12, consisting of a non-conducting material—such as wood, rubber, or the like—which performs the office of keeping the ore thoroughly stirred or mixed, and they are so placed that there will be no piling up of material at one side of the tank.

Arranged below the upper stretch of the anode is a cathode 13, and arranged below the lower stretch of the anode is a cathode 14, these cathodes being connected through wires 15 with a source of electricity. The cathodes are made in the form of plates and rigidly fixed in the tank, and a uniform space is at all times maintained between the anodes and the cathodes by guide-strips 17, arranged in the tank and upon which the upper stretch of the anode moves, and guide-strips 18 in the lower portion of the tank and upon which the lower stretch of said anode moves.

The discharge end of each tank 2 3 is inclined upward, as at 19, and a plate 20 at the outlet end directs material from the tank into the next tank of the series. Operating over this inclined outlet portion is an endless conveyor consisting of bands or chains 21, which pass around sprocket-wheels 22 23, supported in a frame 24, arranged to move up and down, so that the conveyor may be raised more or less from said incline 19. As a means for raising the conveyor I have shown a cord connection 25 between the frame 24 and a swinging drum 26. Scraper-bars 27 are connected to the bands 21 and extend transversely of the tank.

The preliminary washing-tank 1 is constructed similar in shape to the tanks 2 3; but in this tank 1 is a continuous or endless conveyor 28, which extends around sprocket-wheels 29 and 30 in the lower portion of the tank and around a sprocket-wheel 31 at the

outlet of the tank. A similar endless conveyer 32 is arranged in the final and filtering tank 4 and extends around sprocket-wheels 33, 34, and 35. In the bottom of this tank 4, however, I place a filtering material 36, consisting of a layer of coarse gravel covered with a layer of sand, upon which is a covering 36^a, of burlap, suitably held in place.

In operation a suitable chemical solution which will counteract the acids in the ore and increase the conductivity of the solution used in the treatment-tanks, preferably caustic soda, is placed in tank 1, into which the ore discharges from a grinder or the like through a spout and is carried through the tank 1 and the solution contained therein by means of the conveyer 28 and discharged automatically into the first treatment-tank 2, and the surplus solution contained in the tank 1 is drawn off through an overflow-pipe 37 into a suitable tank, in which solution is added as required, and from this tank it is forced by means of a pump 38 into the washing-tank 1 to replenish the solution therein. By this arrangement the tank 1 will be full of the solution to the overflow-pipe 37 at all times. The ore which now contains or carries with it a small percentage of caustic soda or other solution is then taken from the tank 1 automatically and without removing the washing solution or stopping the amount of ore entering said tank 1 and is delivered to the first treatment-tank 2, which contains any suitable solution, which will dissolve the metal in the ore, preferably a dilute cyanid-of-potassium solution, and the caustic-soda or other solution which enters the tank 2 with the ore will increase the conductivity of the solution. The ore containing the metal after entering the treatment-tank 2 is continually stirred and gradually moved upward toward the discharge end of the tank, and a separation is made and the metal deposited on the cathodes by the electric current passing from the anodes to the cathodes and through the chemical solution contained in the tank. The ore is then delivered automatically to the tank 3 without removing the solution, and so on throughout the series of treatment-tanks, the strength of the current and solution being varied to suit the ore under treatment. The material then passes automatically to the filtering-tank 4, where it is washed free from caustic soda, potassium cyanid, and metal-liferous solutions with which it is associated by the water therein. The solution is filtered and passed off through a pipe 39 into a sump-tank 40, from which it is forced by means of a pump 41 through a pipe 42 back to the treatment-tanks to replenish the solution contained therein, so there is practically no so-

lution wasted, and obviously the strength of the solution may be kept up by adding chemicals continuously or at intervals, as desired.

It will be noticed that the several tanks are connected by pipes, so that they can be thoroughly washed out when required, the water passing through one tank to the other.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a machine for the automatic and continuous extraction and deposition of metal from ores at one and the same time, a treatment-tank, an endless anode traveling in said tank, the upper and lower stretches of the anode being in position to be immersed in the solution in the tank, diagonally-disposed blocks of insulating material attached to said anode, cathodes in the tank one under each stretch of the anode, and connections with a source of electricity, substantially as specified.

2. In a machine for the automatic and continuous extraction of metal from ore at one and the same time, a treatment-tank, an endless anode moving on guide-strips, means for causing the movement of said anode, diagonally-disposed blocks of insulating material attached to said anode, the said anode with said blocks serving as a mixer and also as a conveyer for material in the tank, and a cathode in said tank, substantially as specified.

3. In a machine for the automatic and continuous extraction of metal from ores, a treatment-tank, a cathode in said tank, an endless anode in said tank, diagonally-disposed blocks of insulating material mounted on said anode, guide-strips in said tank on which said anode moves, an endless conveyer operating over the inclined outlet end of said tank, and means for raising and lowering the conveyer more or less from said incline, substantially as specified.

4. In a machine for extracting metal from ore, a tank, an anode arranged in said tank and comprising a series of metal bars, endless chains on which said bars are mounted, blocks arranged on the bars, said blocks being of non-conducting material, sprocket-wheels around which the chains pass, means for rotating the sprocket-wheels, a cathode in the tank, and an endless conveyer at the outlet end of the tank, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALBERT ISAAH IRWIN.

Witnesses:

E. A. YELTON,
A. E. WELSH.