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L. PELATAN & F. CLERICI.

ELECTROLYTIC PROCESS OF OBTAINING PRECIOUS METALS.

No. 551,648. Patented Dec. 17, 1895.

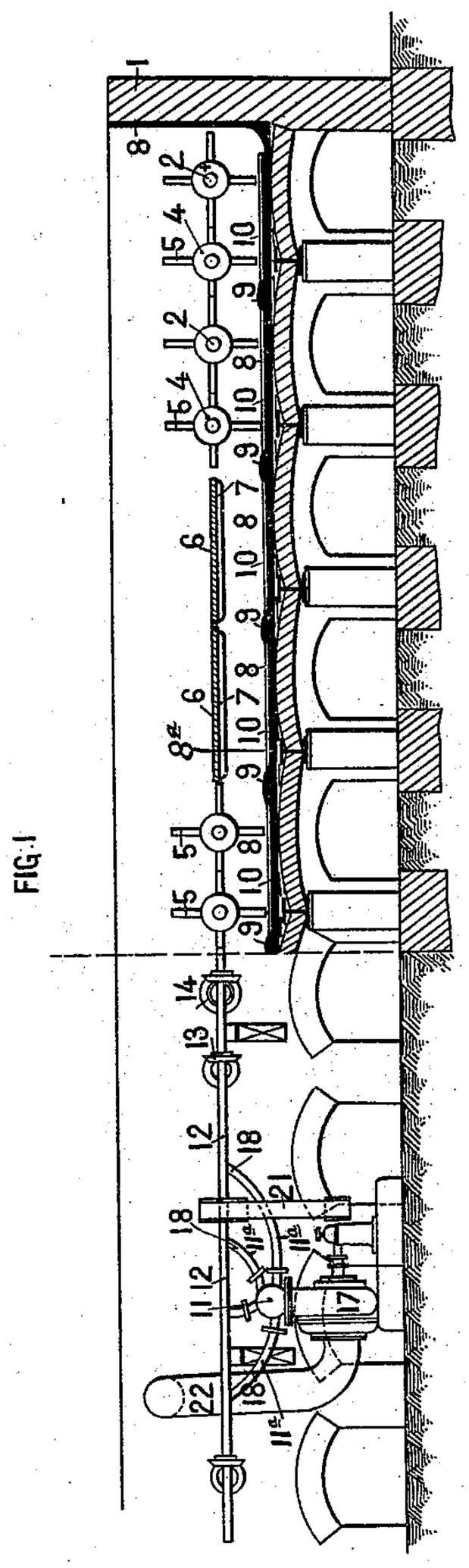

FIG. 1

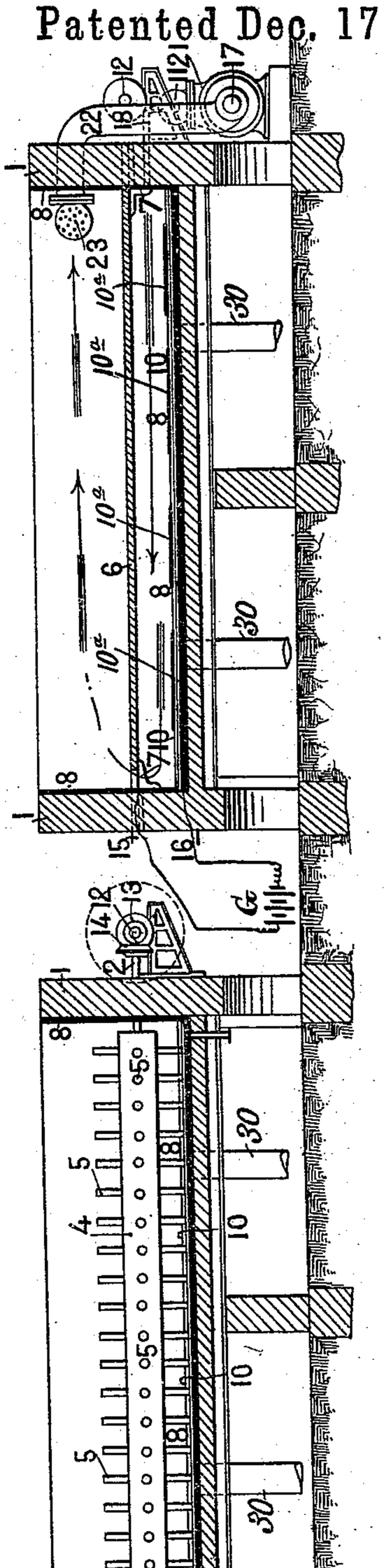

FIG. 3

FIG. 2

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FIG. 4

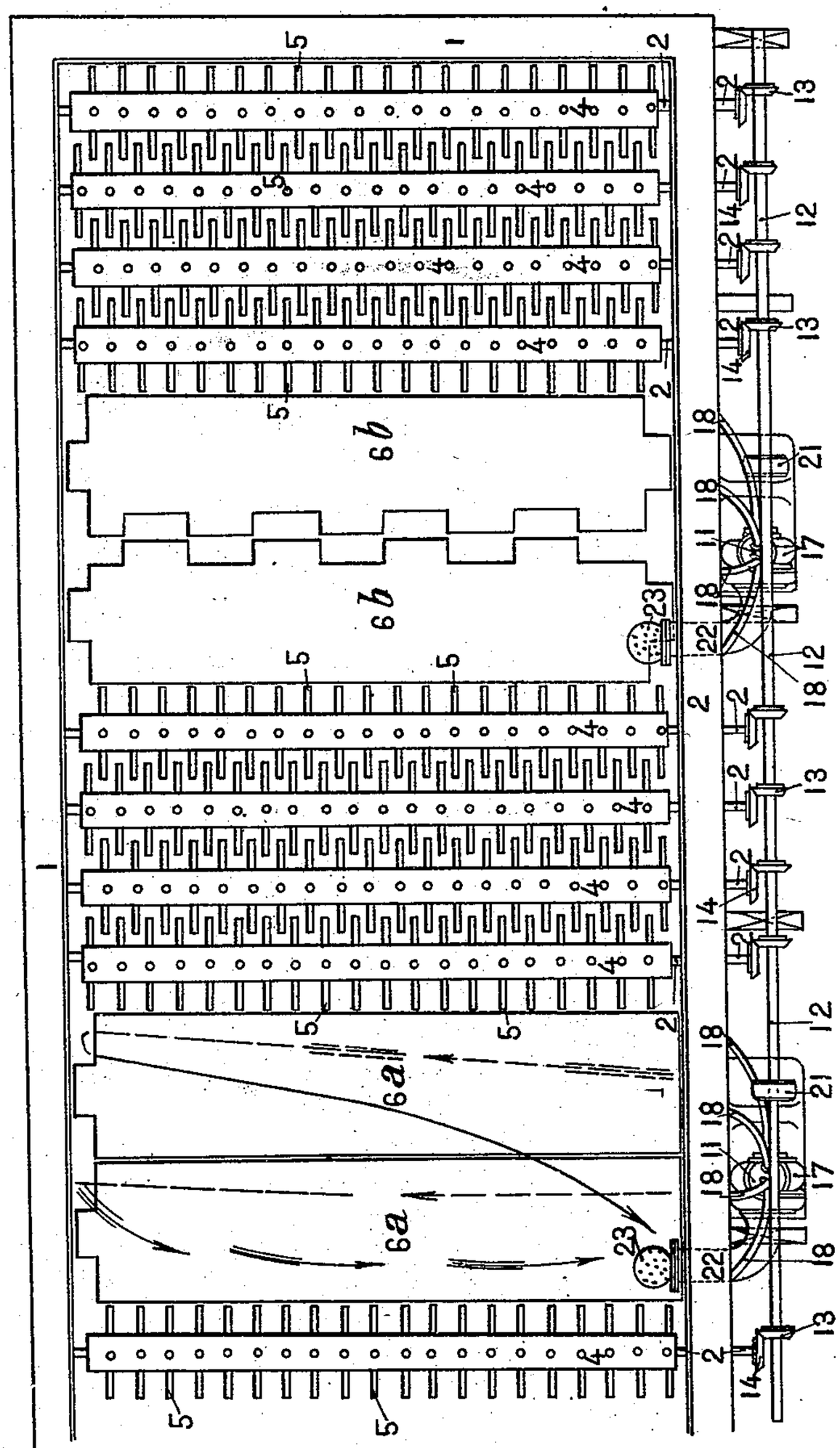

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FIG 6

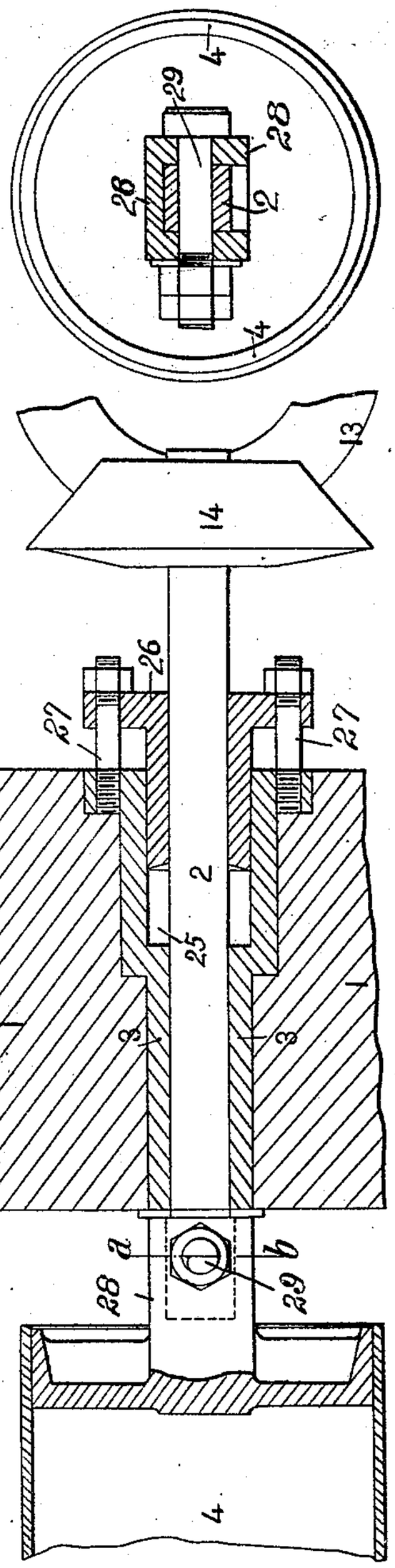

FIG 5

FIG 7

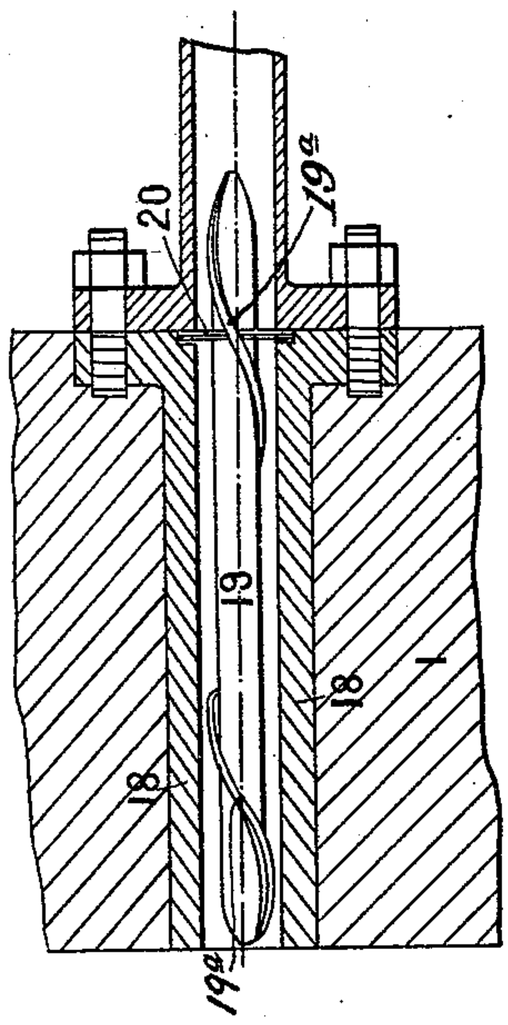

FIG 8

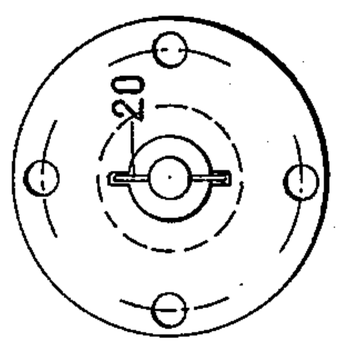

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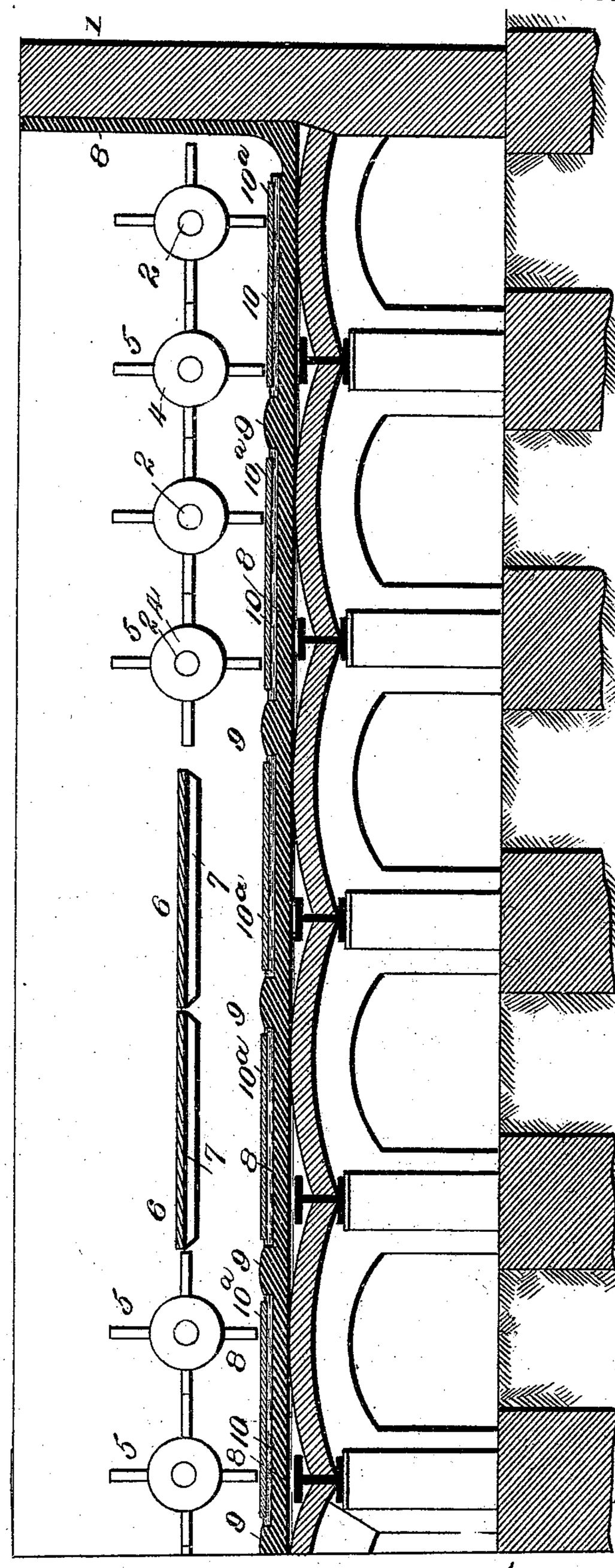
Fig. 9.



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UNITED STATES PATENT OFFICE.

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ELECTROLYTIC PROCESS OF OBTAINING PRECIOUS METALS.

SPECIFICATION forming part of Letters Patent No. 551,648, dated December 17, 1895.

Application filed June 25, 1895. Serial No. 554,013. (No specimens.)

To all whom it may concern:

Be it known that we, LOUIS PELATAN, a citizen of the Republic of France, and a resident of Paris, in the Department of the Seine, France, and FABRIZIO CLERICI, a subject of the King of Italy, and a resident of Milan, Italy, have invented a new and useful Improvement in Electrolytic Processes of Obtaining Precious Metals, of which the following is a specification.

Our invention has for its object to provide a means for effecting the direct extraction of the precious metals, such as gold and silver, from their minerals or from any other materials containing them. In this process the minerals or other materials which contain the precious metals are pulverized and mixed with a solvent in the same vat in which the metals are separated by means of a current of electricity and retained by mercury cathode. The solvent used is that which is best suited to the nature of the materials to be treated, those preferably employed being alkaline cyanides or chlorine, but any other suitable chemical agent may be used. The conductivity of the bath is insured by mixing with the electrolyte an alkaline salt, preferably chloride of sodium. Our invention, however, does not relate especially to these points which we have already described in our prior patents and which we only refer to here in order that our present invention may be better understood.

Our said invention consists in an electrolytic vat constructed for facilitating the reactions required by a particular arrangement of anodes and cathodes and by the manner in which the liquids are kept in circulation during the electrolytic action.

In order that our invention may be readily understood we will describe it with reference to the accompanying drawings, in whieh—

Figure 1 is an elevation, partly in vertical section, of the electrolytic vat. Fig. 2 is a transverse section showing the means by which the anodes are set in motion in order to secure the continuous agitation of the electrolyte. Fig. 3 is a transverse section showing modification of the apparatus in which the circulation of the electrolyte is caused to take place around fixed electrodes by the action of centrifugal pumps. Fig. 4 is a plan view of the vat, showing the different parts thereof in which the two devices for causing the circulation of the liquids being treated electrically are arranged alternately. Fig. 5 is a detail section showing one of the rotating anodes and the means by which it is packed through the wall of the vat. Fig. 6 is a section taken on the line *a b*, Fig. 5, showing the connection of an agitating-anode with its motor-shaft. Figs. 7 and 8 show in section and end view the means by which the liquid forced under the pressure of the circulation-pumps enters the vat. Fig. 9 is a longitudinal vertical section of a vat, showing cathodes of mercury and amalgamated plates.

The vat 1 is preferably raised from the ground so as to facilitate the withdrawal of the liquids therefrom and may be made of any suitable material. The ends of the horizontal shafts 2 rest on bearings 3 fixed in the walls of the vat at a certain uniform distance from the bottom thereof and support metal cylinders 4 provided with agitators 5. These cylinders are mounted preferably in sets. They are shown in sets of four, for example, in Figs. 1 and 4 of the drawings, and between the sets are two plates 6, Fig. 1, mounted on supports 7 fixed or not in the masonry of the vat 1. The shafts 2, the cylinder 4 and the plates 6 are formed of or are coated with a suitable metal—such as iron, steel, platinum or any other analogous metal—the cylinder and the plates being employed as anodes, while mercury or amalgamated plates or other suitable metallic plates, arranged, as hereinafter described, at the bottom of the vat, act as cathodes. The anodes which we employ by preference are made of cast-iron.

The walls and the bottom of the apparatus are usually provided with an insulating lining of cement, ebonite or other like material, as shown at 8 in Figs. 1 and 2. When the vat is constructed of brickwork or the like, a lining of cement is preferable. The bottom of the vat is provided with dips or depressions 8^a arranged horizontally, each dip extending across the whole breadth of the vat and occupying a certain portion of the length thereof. The cathodes 10 are in these

depressions which are separated from each other by low partitions or sills 9, formed of cement. When mercury cathodes are employed, which is in most cases preferable, they are formed by plates covered with mercury fixed at the bottom of each depression. If desired, the mercury may be spread right over the bottom of the vat, in which case, however, we should recommend that floating plates of amalgamated copper be arranged on the surface of the mercury, as shown at 10^a in Fig. 3. Suitable orifices for the discharge of the contents of the apparatus are arranged in the vat.

The horizontal shafts 2 may be rotated by any suitable means, those which we have shown consisting of a horizontal shaft 12 arranged near the outer face of one of the side walls and provided with beveled wheels 13, gearing with beveled wheels 14, fixed on the ends of the said shafts 2 which project through the side wall. The shafts 2 and the plates 6 are connected by means of a conductor 15 to one of the poles, say the positive pole, of a generator of electricity, such as a dynamo, a suitable generator being shown conventionally at G in Figs. 2 and 3. Another conductor 16 connects the other pole—that is, the negative pole—of the generator to the mercury cathodes.

The distance between the plates and the cylinders forming the anodes on the one hand and the bottom of the vat where the cathodes are fixed on the other hand should be such as to render short-circuiting impossible, which if it took place would prevent the satisfactory working of the apparatus.

In the arrangement shown the agitation is effected by means of the anode-cylinders provided with agitating-arms 5, the said arms being made of wood or any other suitable insulating material. The agitators on the adjacent cylinders are arranged to alternate with each other, as shown clearly in Fig. 4, so as to secure the proper agitation of the material under treatment. If this precaution were neglected the material under treatment would accumulate on the bottom of the vat, which, covering the cathodes, would obstruct the current of electricity and so prevent the proper electrolytic action. The cylinders constituting the anodes may be all rotated in the same direction or in opposite directions to each other.

Another means of agitation which may be employed in combination with that we have described consists in the employment of powerful liquid or gaseous currents. For this purpose a centrifugal pump 17 is provided. A pipe 22 passes from the pump into the vat and dips into the liquid contained therein. The pipe 11 of the said pump 17 communicates with several small pipes 11^a, by which the liquid is forced back into the vat, four of said small pipes being shown in the drawings, each fitted with an outlet-nozzle 11. These outlet-nozzles open into the vat beneath the anode-plates 6, so as to insure the perfect agitation of the material being treated.

The pump may be operated by a belt 21 passing over a pulley keyed upon the shaft 12. By this means the mass of liquid contained in the vat is drawn into the pump 17 by the pipe 22 and forced through the said vats by way of the pipes 11^a and the nozzles 18. The jets of liquid from these nozzles produce a thorough agitation and stirring through the whole liquid, insuring a perfect mixing of the materials and preventing them being deposited. In order to obtain a good effect from the jet of the liquid a rod 19 having a spiral rib or feather 19^a is mounted by means of a center pin 20 in each nozzle 18. (See Fig. 7.) The pipe 22 terminates in a rose 23, so as to intercept matter likely to clog the pump.

The action of the pumps may be so arranged that the anode-plates 6^a, Fig. 4, may be joined and rest at one end on the vat, while leaving at the other end of the said vat a space for the circulation of the liquids. The liquid will then be drawn in by the suction-pipe 22 of the pump and will circulate through the vat in the direction shown by the arrows in Fig. 3 and at the left hand of Fig. 4—that is to say, the liquid will be withdrawn from the vat at the upper part thereof and will be forced in by the nozzles 18 beneath the anodes 6. The liquid will thus be continually displaced from below between the two electrodes, and flowing around the ends of the anode-plates 6^a will pass over their upper faces back to the pipe 23. The anode-plates may also be disposed as shown at 6^b, Fig. 4, in which an easy passage is left for the liquid between the adjacent sides of two plates as well as at their ends. In this case a sort of eddy or whirlpool will be imparted to the liquid instead of the regular circulation we have described with reference to the plates shown at 6^a in Fig. 4.

We have shown in the drawings one pump employed for each pair of anode-plates and feeding four distributing pipes or nozzles 18; but we do not limit ourselves to the nature of the injection apparatus, which may be of any suitable kind, nor to the number of nozzles employed, or to their general arrangement, operation or mechanism for working them. The pump 17, for example, may be replaced by any other arrangement for injecting a liquid under pressure through the pipes or nozzles 18; or in place of the pump 17 we may employ a ventilator or fan or a compressed-air apparatus and force through the vat air or other suitable gas under pressure so as to produce the required agitation.

The operation of the apparatus is as follows: The auriferous and argentiferous materials are introduced into the vat for which the mercury cathodes have been already prepared, as hereinbefore described. The necessary solvent—for example, alkaline cyanide—

is then added to the liquid, and sodium chloride or common salt is added for insuring the conductivity of the electrolyte. The cyanide solutions used are very diluted and as a rule their strength does not exceed three parts of cyanide for a thousand parts of water. The beveled gears 13 are then caused, through the beveled gears 14, to rotate the shafts 2 with the anodes 4, having agitators 5, and the centrifugal pumps 17 are also put into operation. The contents of the vats are thus thoroughly stirred up and a current of electricity is passed through by means of the conductors 15 16. When it has been proved by the examination of test portions removed from the vat that the electrical action is completed the said vat is emptied. The precious metals will then be found deposited on the mercury cathodes and may be then separated from this metal by the means usually employed. The vat may then be prepared for a fresh operation.

Each of the bearings 3 in the wall of the vat is provided with a stuffing-box 25, and a gland 26 enters said box and surrounds the outer portion of the shaft 2, bolts 27 being provided to draw the gland into the box and compress the stuffing. The end of the shaft 2, which projects from the inner end of the bearing 3, is squared and lies in a rectangular box 28 on the end of the cylinder 4. This box is open on one side, as shown in Fig. 6, to permit the insertion and removal of the squared end of the shaft 2, which is permanently fastened by a bolt 29, passing through the square end of the shaft and through two sides of the box 28.

The contents of the tank may be drawn off by means of pipes 30. (Shown in Figs. 2 and 3.)

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In an apparatus for the extraction of precious metals by direct electrolytic action, the combination with an electrolytic vat having cathodes arranged in its bottom, of a series of cylindrical anodes arranged in groups above and at a suitable distance from the cathodes, anode-plates arranged between and alternating with said groups, means for revolving the cylindrical anodes simultaneously, and a generator of electricity having its poles connected to the anode cylinders and plates and to the cathodes, respectively, substantially as described.

2. In an apparatus for the extraction of precious metals by direct electrolytic action, the combination with an electrolytic vat having cathodes at its bottom, of a series of anode cylinders arranged in groups above the cathodes and provided with agitators, anode plates arranged horizontally above and alternating with said groups, a generator of electricity having its poles connected to the anode cylinders and plates and to the cathodes, respectively, means for revolving the anode cylinders simultaneously, and a force-pump having pipes communicating with the vat above and below the anode-plates, by which a constant circulation and agitation of the electrolyte is maintained, substantially as described.

3. In an apparatus for the extraction of precious metals by direct electrolytic action, the combination with an electrolytic vat having a series of transverse depressions in its bottom, of cathodes arranged in said depressions and consisting of mercury and amalgamated plates, a series of anode-plates arranged above and at a suitable distance from said cathodes, a series of anode cylinders alternating with said plates, the cylinders being provided with agitators, means for rotating said cylinders, and a force-pump having its suction pipe entering the vat above the anode-plates and communicating with injection pipes which discharge below said anode-plates, substantially as described.

4. In an apparatus for the extraction of precious metals by direct electrolytic action, the combination with an electrolytic vat having a series of transverse dips, or depressions, in its bottom to receive mercury cathodes, of a series of groups of anode-cylinders and anode-plates alternating with the groups of cylinders, means for rotating the anode-cylinders which are provided with agitators of insulating material, a generator of electricity having its poles connected with said anode-cylinders and plates and to the mercury cathodes, respectively, and force-pumps having injection pipes to discharge beneath the cathode plates and a suction pipe having its mouth above said plates, substantially as described.

5. In an apparatus for the extraction of precious metals by direct electrolytic action, the combination with an electrolytic vat having cathodes arranged at its bottom, of anode-cylinders arranged above the said cathodes, anode-plates alternating with said cylinders, a generator of electricity having its poles connected to said anode cylinders and plates and to the cathodes, means for rotating the anode-cylinders which are provided with agitators, a force-pump having injection pipes to discharge beneath the anode-plates and cylinders, said pipes being provided at or near their mouths with interior, concentric rods having spiral ribs, or feathers, and suction pipes having their open ends arranged above the anode-plates, substantially as described.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

LOUIS PELATAN.
FABRIZIO CLERICI.

Witnesses:
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GEORGES DELANY.