(No Model.) 3 Sheets—Sheet 1.

C. B. SCHOENMEHL.

APPARATUS FOR ELECTROLYZING COPPER.

No. 494,232. Patented Mar. 28, 1893.

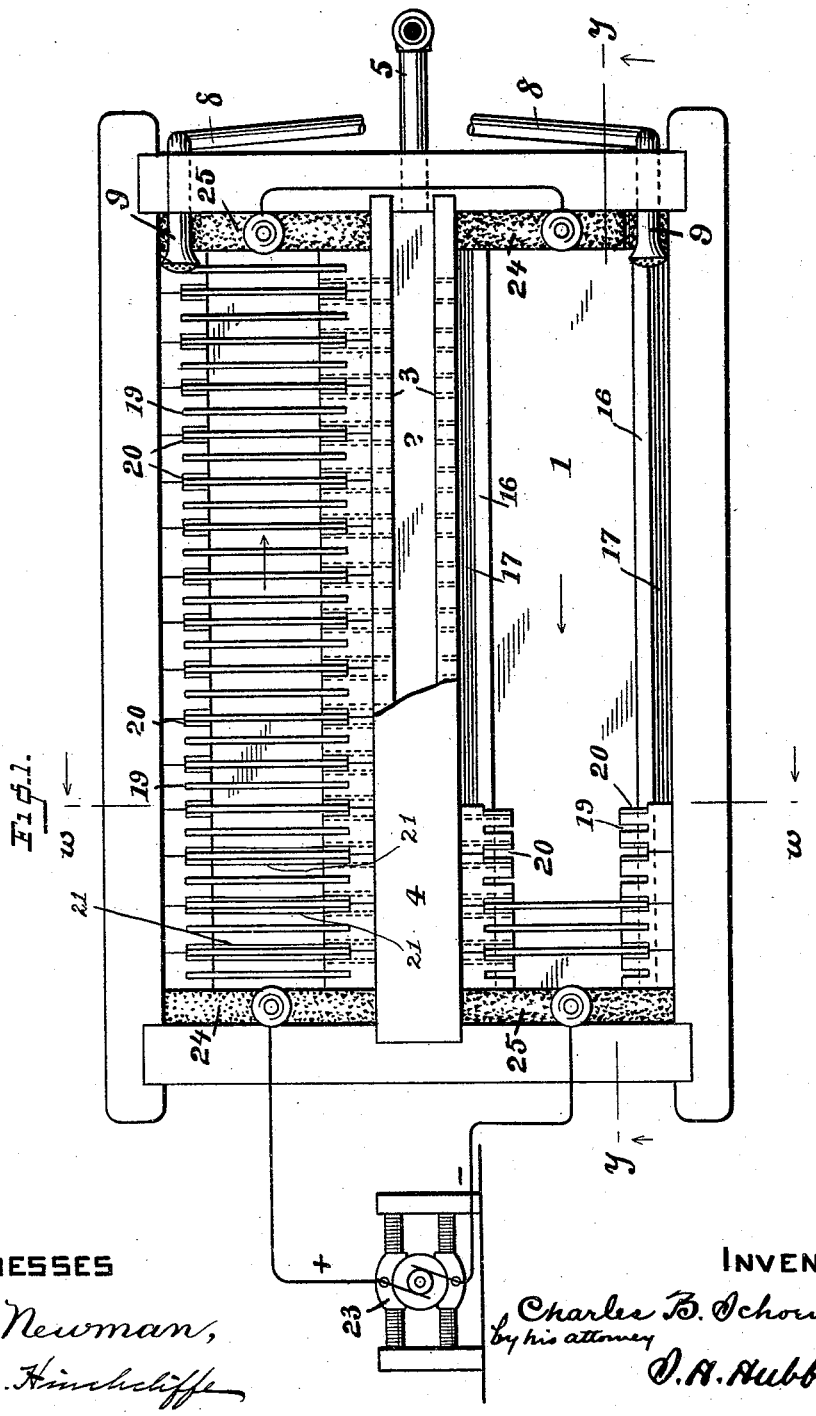

Fig. 1.

WITNESSES

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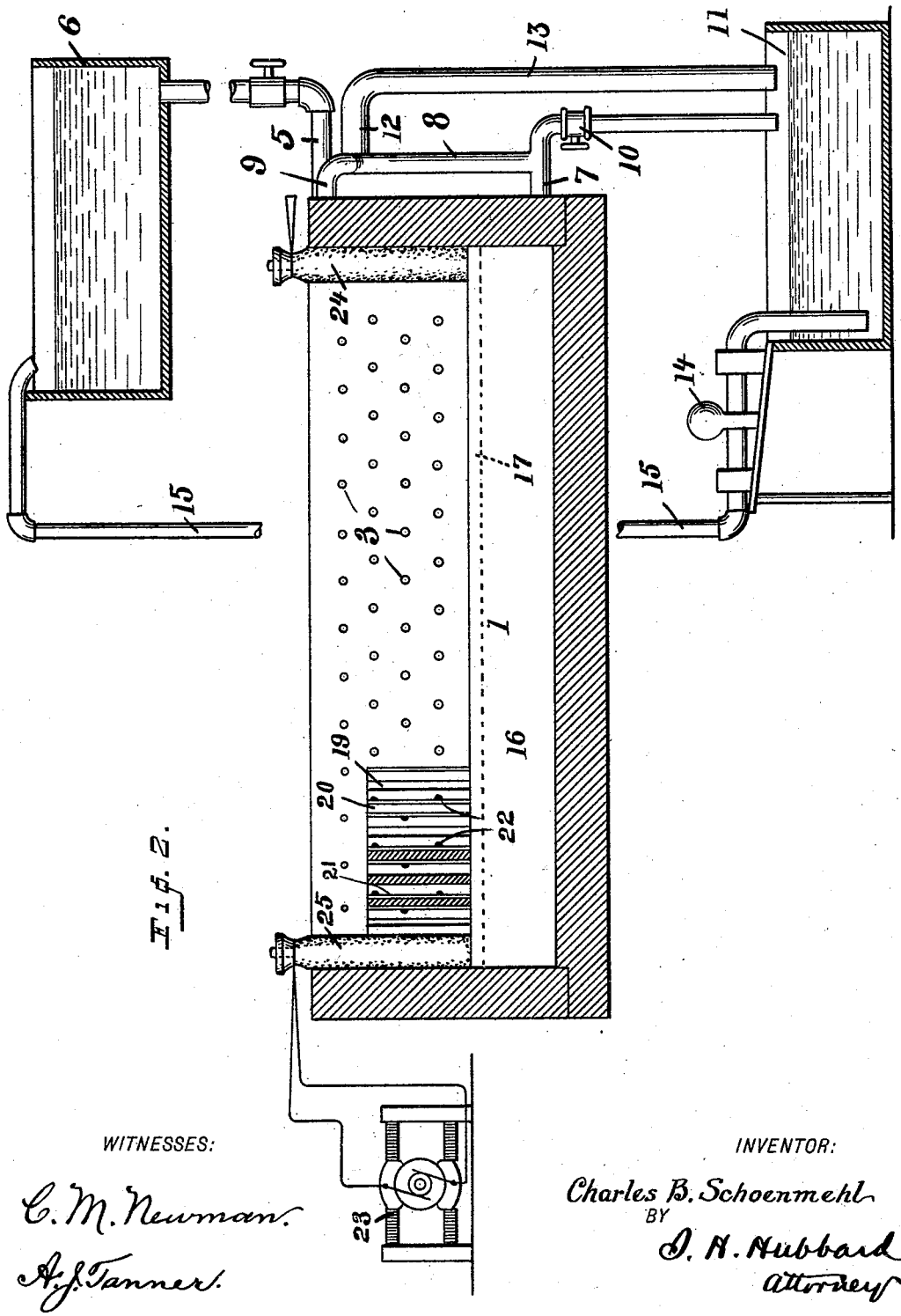

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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APPARATUS FOR ELECTROLYZING COPPER.

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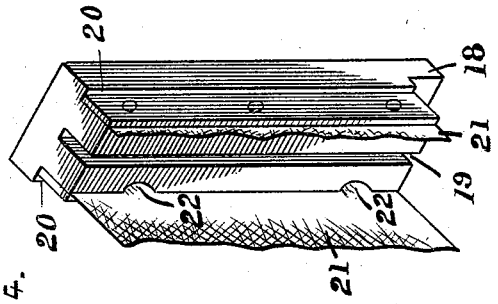

Fig. 4.

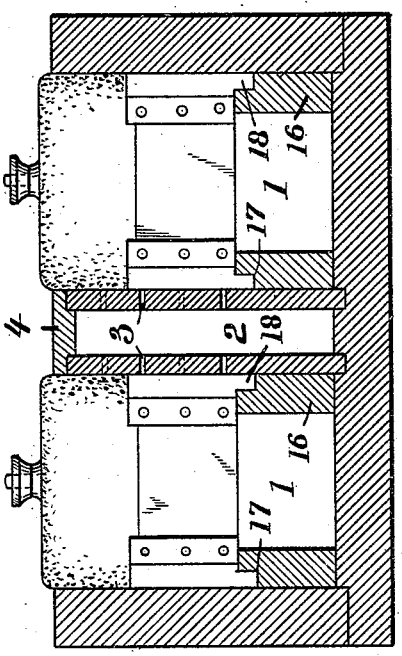

Fig. 3.

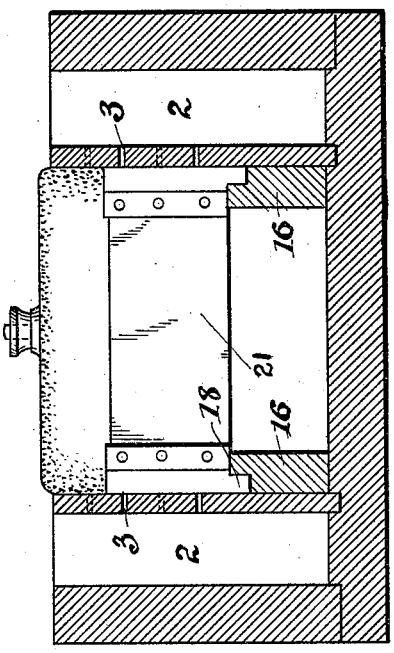

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES B. SCHOENMEHL, OF WATERBURY, CONNECTICUT, ASSIGNOR OF ONE-HALF TO ALDEN M. YOUNG, OF SAME PLACE.

APPARATUS FOR ELECTROLYZING COPPER.

SPECIFICATION forming part of Letters Patent No. 494,232, dated March 28, 1893.

Application filed April 11, 1892. Serial No. 428,638. (No model.)

To all whom it may concern:

Be it known that I, CHARLES B. SCHOENMEHL, a citizen of the United States, residing at Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Apparatus for Electrolyzing Copper; 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.

This invention relates to certain novel and useful improvements in apparatus for the purification of copper and other metals by electrolysis.

The object of my invention is to furnish a bath having improved means for effecting the thorough and equal circulation of the electrolyte; also to provide means for holding the plates, which shall in no wise interfere with the circulation; also to provide means whereby the foreign matters set free from the plates as they dissolve shall be prevented from attaching themselves to adjacent plates, and shall be guided toward the bottom of the bath; also to provide in connection with the means for effecting circulation, a novel form of overflow.

With the ends hereinbefore set forth in view my invention consists and resides in the construction and combination of elements hereinafter to be fully and in detail explained and the recited in the claims.

In order that those skilled in the art to which my invention appertains may fully understand its construction and method of operation I will describe the same in detail, reference being had to the accompanying drawings which form a part of this specification, and in which,

Figure 1, shows my apparatus in plan view, but with a number of the screens omitted to more clearly show the construction. Fig. 2, is a longitudinal vertical section on the line *y—y* of Fig. 1; Fig. 3, a vertical section on the line *w—w* of Fig. 1; Fig. 4, a perspective of one of the plate supports; Fig. 5, a transverse vertical section showing a single vat having two feeding chambers one upon either side.

The double bath shown in the first three figures consists of two vats or tanks 1. These in practice may be profitably made about ten or twelve feet in length, one foot eight inches in depth, and two feet in width, inside measurement. Between these vats is a chamber 2 corresponding to the vat in length and depth, but having a width which may be three inches more or less. This chamber communicates with each of the vats through flow openings or holes 3 preferably arranged in regular order, as seen at Fig. 2, although their specific arrangement is immaterial. The lowest horizontal row of holes, however, should not be nearer to the bottom of the vat than say six or eight inches, so that the inflowing liquid shall not disturb the mud or sediment which is deposited in the bottom of the tank. This central chamber is furnished with a fluid-tight cover 4 so that any pressure exerted from the supply upon the fluid in the chamber will constantly force the electrolyte outward through the holes into the vats. The supply pipe 5 enters the chamber preferably near its top and conveys the solution constituting the electrolyte thereto from an elevated supply tank 6 which furnishes the head or pressure for the entering fluid.

It is desirable to provide means whereby the overflow of the vats may be prevented in case the electrolyte is fed too fast, but at the same time it is preferable that the amount of fluid displaced by the inflow and drawn off, shall be taken from the bottom of the vat where the specific gravity of the electrolyte is highest. For this purpose I provide an outflow pipe 7 near the bottom of the vat to which on the outside is connected a vertical pipe 8 whose upper end is bent inwardly at 9 and enters the tank at a point higher than the normal level of the fluid. The downwardly turned end of the pipe 7 is provided with a cock or valve 10 interposed between the tank or vat and the drainage tank, which is shown at Fig. 2 and denoted by 11. This cock is to be opened only when it is desired to empty the tank. Connecting with the pipe 8 at about the level at which the electrolyte is normally to stand is an overflow 12 which through a pipe 13 connects either directly with the drainage

tank or with the pipe 7 just below the cock 8 and thence to the tank. From the drainage tank the pump 14 takes the fluid and raises it through a pipe 15 and discharges it into the supply tank 6. The circulation just described is designed to keep the electrolyte homogeneous and of uniform density by continually mixing it and keeping it in motion.

Along each of their sides both vats are provided with wooden, rubber, or other non-conductive ledges or supports 16, say six or eight inches in height, each preferably having upon its inner edge a groove or continuous mortise 17 designed to engage and hold tenons 18 upon the plate supports now to be described. Each plate support, which is preferably made of wood, has a central groove 19 and two half grooves 20 at its edges, which latter combine with the similar half grooves in the adjacent supports to form a groove capable of holding a plate, as may be readily understood by reference to Figs. 2 and 4. The plate supports are arranged in opposed pairs, and between the members of each pair, so as to lie adjacent to the cathode side of each of the plates when in position, is stretched a pervious screen or strainer 21 which may be of any fabric suitable for the purpose. Each of the supports has openings 22 formed therein to any suitable number, and so arranged as to coincide with the holes 3, whereby the direct ingress of the fluid from the chamber is in no wise impeded. A dynamo 23, or other electric generator, has its positive pole connected with the plate 24 which is preferably, though not necessarily, made of carbon, and is located at one end of the vat in contact with the electrolyte, and its negative pole connected to a similar plate 25 at the other end of the tank. In plan view Fig. 1 the circuit is made continuous through both vats, which will of course be understood.

Assuming now that the apparatus is to be applied to the process of refining copper with which are combined precious metals, or foreign matters, or both, the electrolyte will preferably be a saturated solution of sulphate of copper. The electrolyte enters the vats through the central chamber and fills them, and at the same time the fluid rises in the pipe 8 until it runs off through the overflow 12 in a stream whose bulk is equal to the inflow. The pipe 9 is provided to furnish an additional safeguard against the overflow of the vat, but the pipes 7 and 8 and 12 are designed to automatically keep the fluid at its proper level. When it is desired to completely drain the tank for purposes of cleaning and the like, this may be done by opening the valve 10, as heretofore explained. The tanks 6 and 11 shown, as also the pump 14, are disproportionate and are shown for purposes of illustration merely. The plates to be treated, which I number 25, may be either of cast or rolled copper, although the rolled metal is to be preferred. They are of such size as will fit within the grooves in the plate supports with their lower edges resting upon the ledges 16. For the size of bath above set forth these plates may well be, say one foot eight or ten inches wide by one foot high and from an eighth to a half an inch or more in thickness. In another application filed simultaneously with this and serially numbered 428,637 I have shown, described and claimed a method of treatment to which I prefer to subject the plates prior to their introduction to the bath, but this forms no part of my present invention. When the current is turned on so that it passes directly through the electrolyte, the plates, having no electrical connection established between them except through the medium of the electrolyte, begin to dissolve as to one side and to take on copper on the other side by deposit from the solution, as is old and well known in this art. The copper is dissolved from the anode sides of the plates, that is, from the sides which are turned away from the positive pole, and the copper so dissolved is deposited upon the cathode surfaces of the plates, that is, upon those surfaces which are toward the positive pole. This process continues until the whole amount of copper has been dissolved and re-deposited. This process of dissolution sets free the precious metals combined with the copper and also any foreign substances. The precious metals on account of their superior specific gravity descend to the bottom of the bath, and there remain as a sediment to be removed from time to time when found expedient, then to be treated in any suitable manner. The lighter matters, however are to some extent held in suspension in the electrolyte and are apt to attach themselves mechanically to the cathode surfaces of the adjacent plates, forming spurs or knobs thereon which, if they become of sufficient length, may establish direct metallic connection between adjacent plates. In any event they form impurities in the copper. The constant circulation of the electrolyte plays an important part in conveying these particles of foreign matter into contact with the plates, and this I propose to prevent by the use of the screens or filters heretofore referred to, since these, though quite pervious to the electrolyte, and interfering to no great degree with the circulation, will arrest the foreign matters and either retain them or guide them toward the bottom of the bath. While they may be arranged in any way between the plates, I prefer to hang them quite close to the cathode side, so that any foreign matter in order to reach the plate must practically rise from the bottom, or else pass through the filter. The specific gravity of the deposit prevents the former, and the close mesh of the screen prevents the latter.

I do not wish to be confined to the exact details of construction which I have shown and described, since these may be altered and varied without passing beyond the fair intent and scope of my invention. For instance, while the form of the plate supports and the

means of attaching the screens in position are convenient, I do not consider them essential, since other constructions having the same method of operation will readily suggest themselves to the skilled workman in this art. I show a double bath with central chamber, but this is immaterial and a single bath with a feed at each side is equally within my contemplation.

I claim—

1. The vat or bath provided with electrodes and having means for the support of the plates, in combination with the fluid supply chamber alongside said vat, said chamber being of substantially equal depth with said vat and connected thereto by a multiplicity of flow openings, an induct or supply pipe entering the chamber, and an outlet leading from the vat.

2. A vat or bath to contain the plates, and having suitable electrodes in combination with a chamber at one side thereof and communicating therewith through a multiplicity of openings, plate supports arranged in the bath for sustaining the plates between the flow openings a supply tank above the vat and a connection between said tank and the chamber, an outlet from the vat and a drain tank into which it empties, and a pump to return the electrolyte from the drain tank to the supply tank.

3. The vat or bath containing positive and negative electrodes and the chamber alongside and connected therewith as described, in combination with plate supports within the bath, having openings coinciding with the openings between the vat and chamber, substantially as specified.

4. In an apparatus of the character described, the combination with the vat provided with positive and negative electrodes and containing the electrolyte, of the chamber for the supply and circulation of the electrolyte arranged alongside the vat and having flow openings opening into it, a series of plate supports arranged at the sides of the vat and having openings corresponding with the flow openings, and screens attached to the plate supports and extending across the vat, the whole arranged substantially as and for the purpose set forth.

5. The vat to contain the electrolyte and plates and the chamber communicating therewith through a multiplicity of openings, in combination with the plate supports upon each side the vat, and having perforations corresponding with the holes into the chamber, positive and negative electrodes and screens or filters interposed between the plates and extending across the vat.

6. In an apparatus for electrolyzing copper, the combination with the vat and the positive and negative electrodes and plates arranged therein, of the pipe 7 adapted to draw off the fluid from a point near the bottom of the vat, the overflow pipe 9 entering the vat near its top, a connecting pipe 8 joining pipes 7 and 9, and a cock 10 located below the juncture of pipes 7 and 8, the whole arranged and adapted to operate substantially as specified.

7. In an apparatus for electrolyzing copper, the combination with the vat and the positive and negative electrodes and plates arranged therein, of the pipe 7 adapted to draw off the fluid from a point near the bottom of the vat, the overflow pipe 9 entering the vat near its top, a connecting pipe 8 joining pipes 7 and 9, the cock 10, and the additional pipe 13 having connection with pipe 9 near the top of the latter, the whole arranged substantially as specified.

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

CHARLES B. SCHOENMEHL.

Witnesses:

WILSON H. PIERCE,

CORA R. DEFENDORF.