No. 614,633. Patented Nov. 22, 1898.

F. A. THUM.

ELECTROLYTIC APPARATUS.

(Application filed Feb. 8, 1898.)

(No Model.)

Fig. 1.

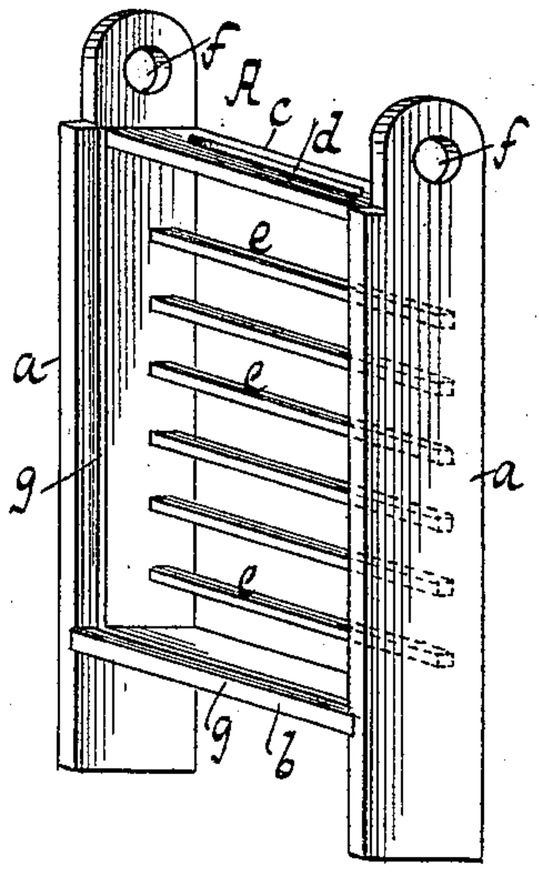


Fig. 2.

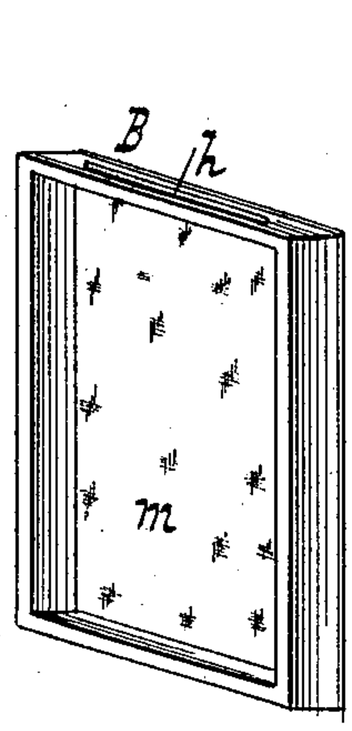


Fig. 3.

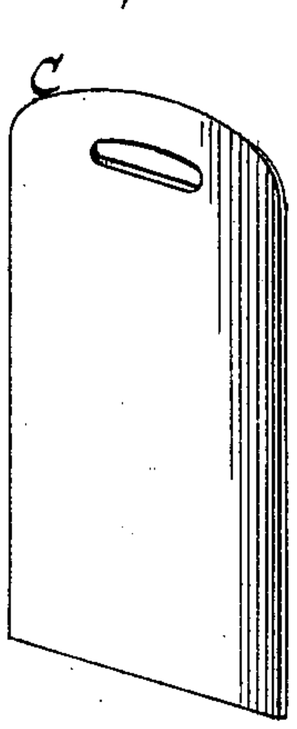


Fig. 5.

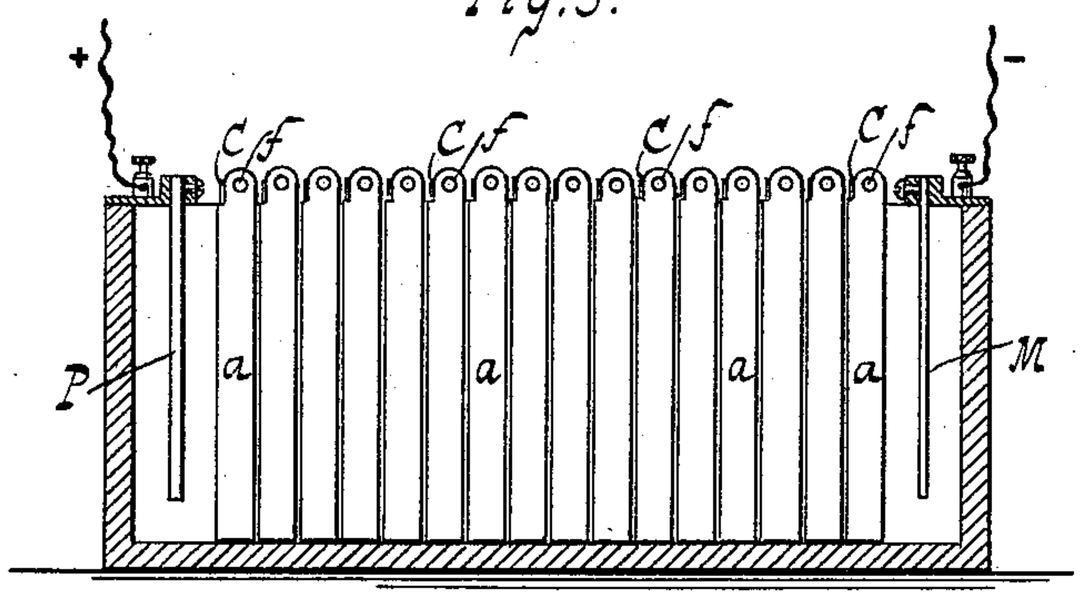
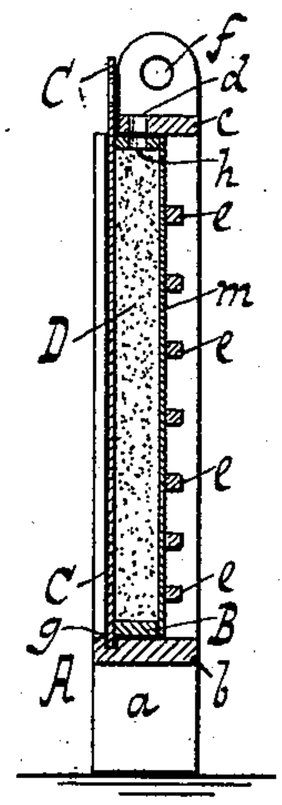


Fig. 4.



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ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 614,633, dated November 22, 1898.

Application filed February 8, 1898. Serial No. 669,501. (No model.)

To all whom it may concern:

Be it known that I, FRIEDRICH A. THUM, a citizen of the German Empire, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electrolytic Apparatus, of which the following is a specification.

My invention relates to improvements in electrolytic apparatus, in particular to apparatus of the series system, for depositing metals from materials in a finely-powdered or granular state; and it consists, essentially, in constructing the elements of a series apparatus in the form of hollow casings, each casing closed at or near the end facing the positive pole by a plate of conducting material, such as metal or carbon, and at the opposite end by a non-conducting foraminous structure, such as a frame covered by muslin properly supported, the elements being completed by filling the casings with the loose metallic material to be treated.

By the ordinary metallurgical processes some metals can scarcely be produced pure in a solid state, owing to their great affinity at the high temperature required to the elements of the necessary fluxes and of the materials of the furnaces or crucibles. Such metals, especially if the reduction of their oxids takes place at a comparatively low temperature, are obtained almost chemically pure by treating in my apparatus the metals reduced from the oxids in a powdered, loose, or granular state.

My invention will be best understood by reference to the annexed drawings, in which—

Figure 1 is a perspective view of one part of the casing. Fig. 2 is a perspective view of another part of the casing. Fig. 3 is a perspective view of a conductor to be inserted into the part shown in Fig. 1. Fig. 4 is a vertical section of a complete element. Fig. 5 shows the complete apparatus in side elevation, the tank being in section.

Similar letters refer to similar parts throughout the several views.

The frame of the elements, as shown in Figs. 1, 2, 3, and 4, consists of the two parts A and B. The part A, Fig. 1, is made of wood or other suitable non-conducting material, and, as shown, it consists of two side pieces *a a*, a series of cross-bars *e e*, a bottom piece *b*, and a top piece *c*, provided with an opening *d*. The side pieces *a a* and the bottom *b* have grooves *g*. The part B of the frame, Fig. 2, is closed at one end by a diaphragm *m*, of muslin or other suitable material. Its top is provided with an opening *h*, corresponding to the opening *d* in the top *c* of the part A, Fig. 1. C, Fig. 3, is a plate of conducting material, such as metal or carbon, to be placed into the grooves *g* of the part A of the frame near the end opposite the cross-bars *c*.

As shown in Fig. 4, the complete element is formed by inserting the part B, Fig. 2, into the part A, Fig. 1, so that the muslin *m* bears against the cross-bars *e e* and the opening *h* is beneath the opening *d*, and by inserting the plate C, Fig. 3, into the grooves *g* of the side pieces *a a*. Thus the frame is closed at one end by the removable plates C and at the other end by the muslin *m*. To complete the elements, the space between the muslin *m* and the plate C is filled with the loose material to be treated through the openings *d* and *h*. When first starting or when coarse metallic material is used, the frame may be filled while in a horizontal position, then the plate C inserted, and the thus completed element placed into the tank.

In Fig. 5 an electrolytic tank T is shown in cross-section, with a number of complete elements placed in series, the figure showing the parts A in elevation as well as conductors P and M and their connections. The elements are placed close together in such a manner that the plate of the first element faces the conductor of the positive pole P and the muslin of the last element faces the conductor M, connected to the negative pole of the source of electricity. The current passes through the elements from the conductor P to the conductor M, and in the direction of this current the casings of the elements are closed by metallic plates C on the ends facing the positive conductor and by muslin diaphragms *m* on the opposite ends. When the current is turned on, the material is dissolved on the muslin side and the metal deposited upon the outer faces of the metal plates C, which are slightly greased, so that the deposit is easily removed. Whenever there is a settlement of

the material in the casing, fresh materials may be charged through the openings *d h*. From time to time the elements are in rotation removed from the tank, the deposits removed from the plates C, the residue within the casing emptied, and the casing refilled.

By the use of my improved apparatus I am enabled to submit metals in almost any loose form (such as powders, granules, or irregular lumps) to the electrolytic treatment by the series process. Metals of a high melting-point, like platinum, are readily transformed from a finely-divided form into solid sheets. Pure oxid of iron, after being reduced to the metallic state at a dark-red heat, is transformed into solid sheets of pure iron. Anodes of pure nickel are produced in my apparatus from the reduced nickel oxid without requiring melting.

Argentiferous granulated copper may be refined in my apparatus. Anode scraps, such as obtained by the electrolytic process of refining copper, when properly cut up may be used in my apparatus, thereby saving remelting.

My invention is not restricted to any specific details of the construction of the casings, and the charging-openings *d h* may in many cases be omitted. The ends of the casings facing the negative pole may be formed simply of bars *e*, placed more or less closely together, or of a grating or any other suitable foraminous structure of material. For fine material, however, and for the purpose of confining the slimes within the casings I prefer to close the said ends by muslin properly held and supported, as shown and described.

What I claim as new is—

1. An element of an electrolytic series plant, consisting of a non-conducting frame adapted to hold the material to be treated, said frame being closed at one side by a removable plate of conducting material, and at the opposite side by a non-conducting foraminous material, such as muslin, substantially as and for the purpose specified.

2. An element of an electrolytic series plant, consisting of a non-conducting frame adapted to hold the material to be treated, said frame being closed at one side by a removable plate of conducting material, such as metal or carbon, and at the opposite side by a non-conducting foraminous material, such as muslin, and also being provided with a charging-opening at the top, substantially as and for the purpose specified.

3. A casing for an electrolytic series plant, adapted to receive and hold the material to be treated, and consisting of a frame A formed of side pieces *a a* and bottom *b* with grooves *g;* top *c* with opening *d* and cross-bars *e e;* frame B with opening *h* at the top and closed at the outer end by a diaphragm of muslin *m;* said frame B inserted into the frame A so that the muslin *m* is supported by the cross-bars *e e* and that the opening *h* is beneath the opening *d;* and a plate C of metal or carbon removably inserted into the grooves *g*, substantially as and for the purpose specified.

4. An electrolytic apparatus embodying a tank adapted to receive and hold the electrolytic liquid; terminal conductors and suitable connections; elements arranged in series between the conductors, each element consisting of a casing closed at the end facing the positive pole by a plate of metal or carbon and at the opposite end by foraminous non-conducting material, such as muslin properly supported, said casings adapted to receive and hold the material to be treated, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRIEDRICH A. THUM.

Witnesses:

F. W. THUM,

A. H. SENIOR.