No. 641,438. Patented Jan. 16, 1900.

J. D. DARLING.

ELECTROLYTIC APPARATUS.

(Application filed Mar. 27, 1899.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

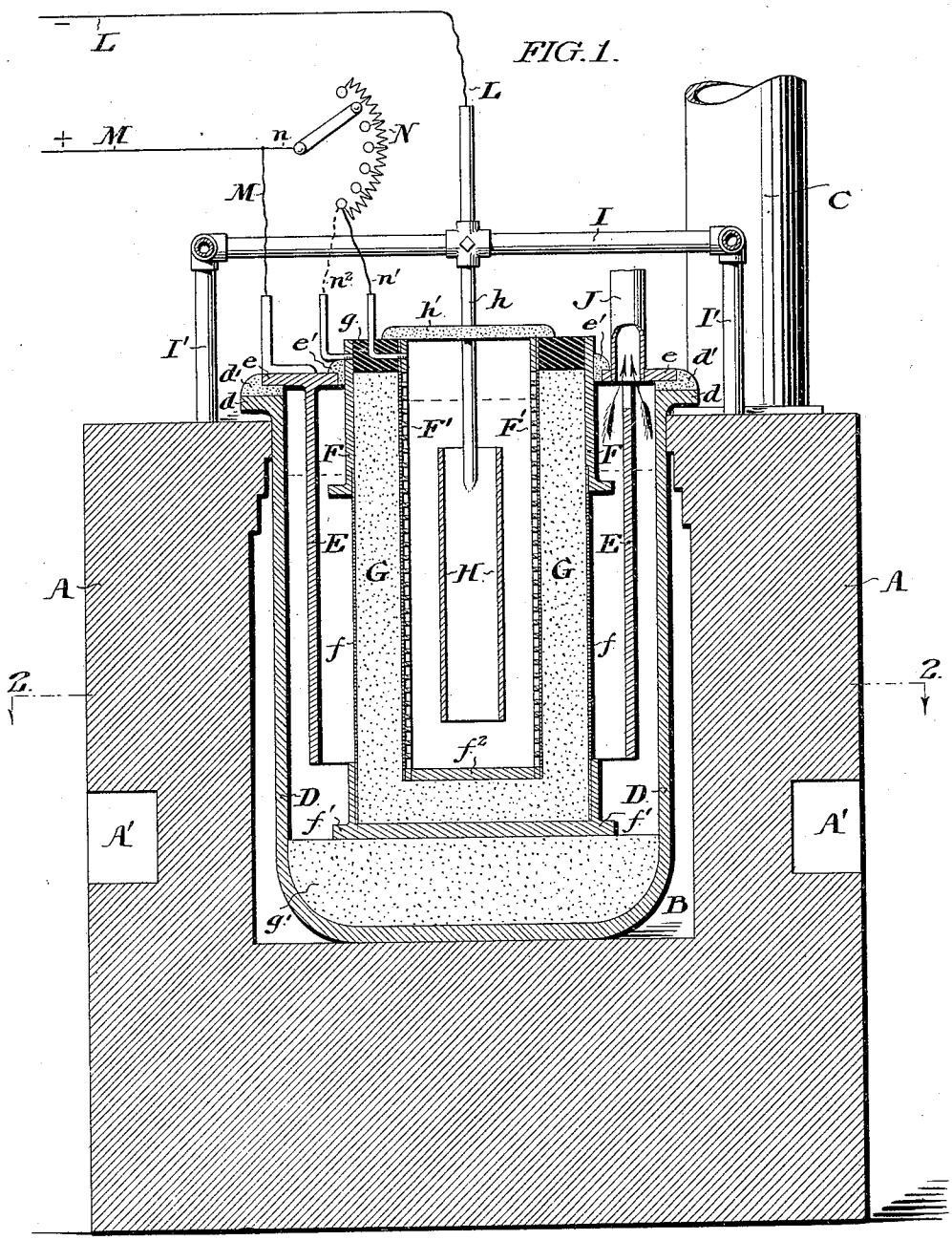

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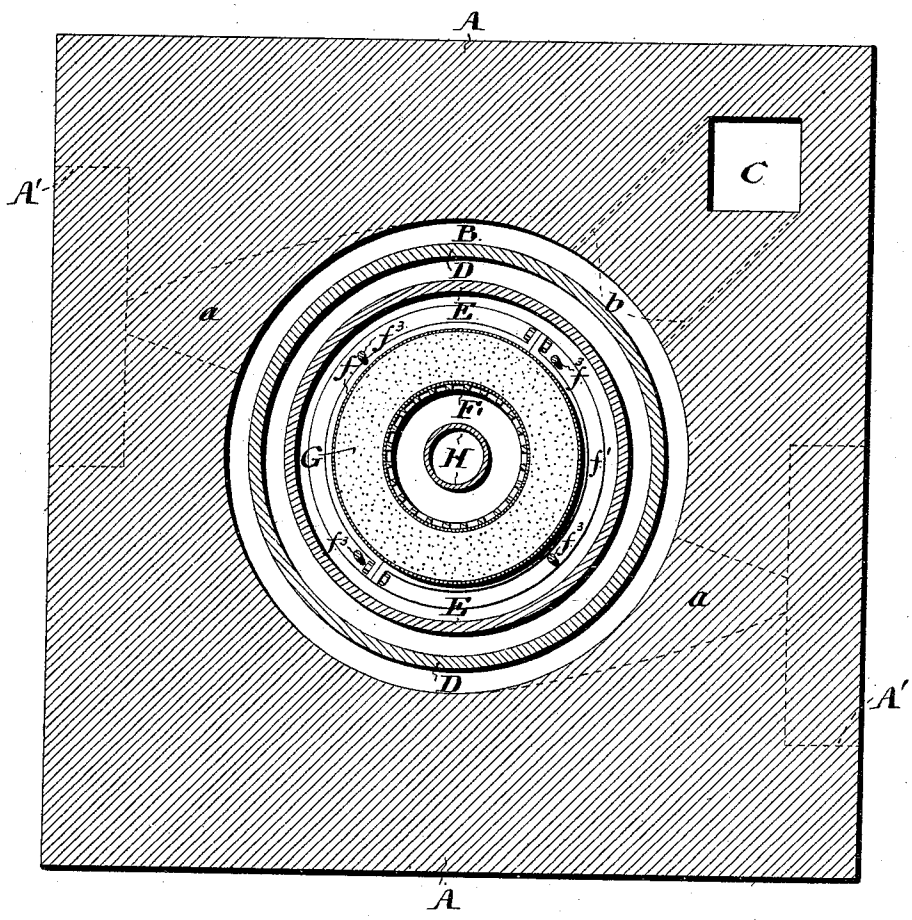
FIG. 2.



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UNITED STATES PATENT OFFICE.

JAMES D. DARLING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE HARRISON BROS. & COMPANY, INCORPORATED, OF SAME PLACE.

ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 641,438, dated January 16, 1900.

Application filed March 27, 1899. Serial No. 710,571. (No model.)

To all whom it may concern:

Be it known that I, JAMES D. DARLING, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Electrolytic Apparatus, whereof the following is a specification, reference being had to the accompanying drawings.

In said drawings, Figure 1 represents a vertical central section through an apparatus embodying my invention, and Fig. 2 is a horizontal section on the line 2 2 of Fig. 1.

My invention is adapted for use in connection with fused electrolytes, typical illustrations being hydroxids of alkaline metals or alkaline-earth metals or the nitrates of such metals. In my Letters Patent No. 590,826, dated September 28, 1897, I have described a porous diaphragm peculiarly adapted for use in an electrolytic apparatus of this type. It is found that where porous diaphragms are employed, the porous material or body proper of the diaphragm being supported by metallic walls, the interposition of such metallic portions between the anode and cathode results in local action, which tends to destroy the wall, and thus shorten the life of the diaphragm considered as a whole. My present invention is intended to obviate or minimize this difficulty, and also comprises certain minor improvements of detail, which will be hereinafter more particularly mentioned.

In the accompanying drawings, A represents the wall of a furnace, having burner-pockets A', which communicate, by inwardly-extending passages *a*, with a circular opening B, said opening in turn communicating by a transverse flue *b* with a chimney C. Within this opening is situated the electrolytic cell comprising the following elements: An outer vessel D, having an overhanging flange *d*, fits snugly within the top of the opening B and rests upon the bottom thereof. Adjacent to the inner surface of the vessel is the downwardly-depending annular metallic anode E, which may be of cast-iron, having an overhanging flange *e*, whose exterior periphery rests upon a cement rim *d'*, supported upon the flange *d* of the vessel D. The porous diaphragm is concentrically placed within the anode, and consists of inner and outer walls of metal, such as sheet-iron, with an intermediate filling. The outer wall comprises a solid upper portion F and base *f'*, connected by vertical rods f^3 and supporting an intermediate shell of wire-gauze *f*. A close joint between the upper portion F and the flange *e* of the anode is formed by means of a ring *e'* of non-conducting material, such as cement. The inner wall F' of the diaphragm is preferably heavier than the outer one and may be composite, consisting of two layers of perforated metal, as indicated in the sectional view. It is provided at its lower end with a solid bottom f^2. Intermediate between these two walls is the packing G, which may be of the material specified in my aforesaid Letters Patent or any other adapted for the purpose. The annular space between the two walls F F' above the upper limit of the filling G is preferably closed by a solid ring of cement *g*. The base *f'* of the diaphragm rests upon a mass of refractory non-conducting material *g'*, such as Portland cement.

Within the porous cup is the cathode H, of the usual character, supported by means of a rod *h*, which is arranged to slide vertically in an overhanging frame I I'. Said rod *h* passes through the cover *h'*, which closes the cathode-compartment. At a convenient point an escape-pipe J is provided in communication with the interior of the apparatus, outside of the porous diaphragm, to permit the discharge of the gaseous products of electrolytic action. L and M represent, respectively, the conductors leading to the cathode and anode. From the conductor M, however, I provide a shunt *n*, which leads through an adjustable rheostat N and thence to the wall or walls of the porous diaphragm. In the illustration shown I have indicated the inner wall F' as thus connected by means of the wire *n'*; but the outer wall F of the diaphragm may, if desired, also be connected by another wire n^2. (Indicated in dotted lines.)

I have found that by shunting a very small percentage of the current—say five per cent.—directly through the wall of the diaphragm destructive electrolytic action is practically prevented, and the loss of current required for the purpose is insignificant in comparison with the prolongation of the life of the walls. I have found also that where the outer wall

of the diaphragm is of wire-gauze, the perforations occupying relatively a large portion of its surface and the actual quantity of metal per unit of area being small, it is not always necessary to shunt any portion of the current to said wall, the main destructive action occurring at the relatively heavy inner wall F'.

Practical experience in the use of this device has shown that the destructive effect upon the metallic portion of the diaphragm can be almost entirely obviated and that the efficiency of the apparatus in other respects is not substantially affected.

Although I have indicated both the inner and outer walls in circuit with the shunt, I do not desire that my claims should be understood as absolutely requiring this arrangement, and therefore comprehend under the word "wall," which I use in my claims, either or both of the incasing supports of the porous material which constitutes the diaphragm proper.

Having thus described my invention, I claim—

1. In an electrolytic apparatus, the combination, with the anode and the cathode, of an intervening porous diaphragm having a metallic wall, said wall being electrically connected with the positive pole of the source of electricity, substantially as described.

2. In an electrolytic apparatus, the combination of a furnace-wall with an exterior vessel mounted in said wall; a downwardly-depending annular anode having an overhanging flange and supported thereby upon the top of said vessel; a porous diaphragm comprising inner and outer metallic walls with an intermediate filling of porous material, the outer wall being indirectly supported by the flange of the anode; an intervening packing of insulating material between said flanges and said wall; a cathode arranged within said porous cup; and an escape-pipe leading from an opening in the flange of the anode, substantially as and for the purposes described.

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