E. FRIEDHEIM.

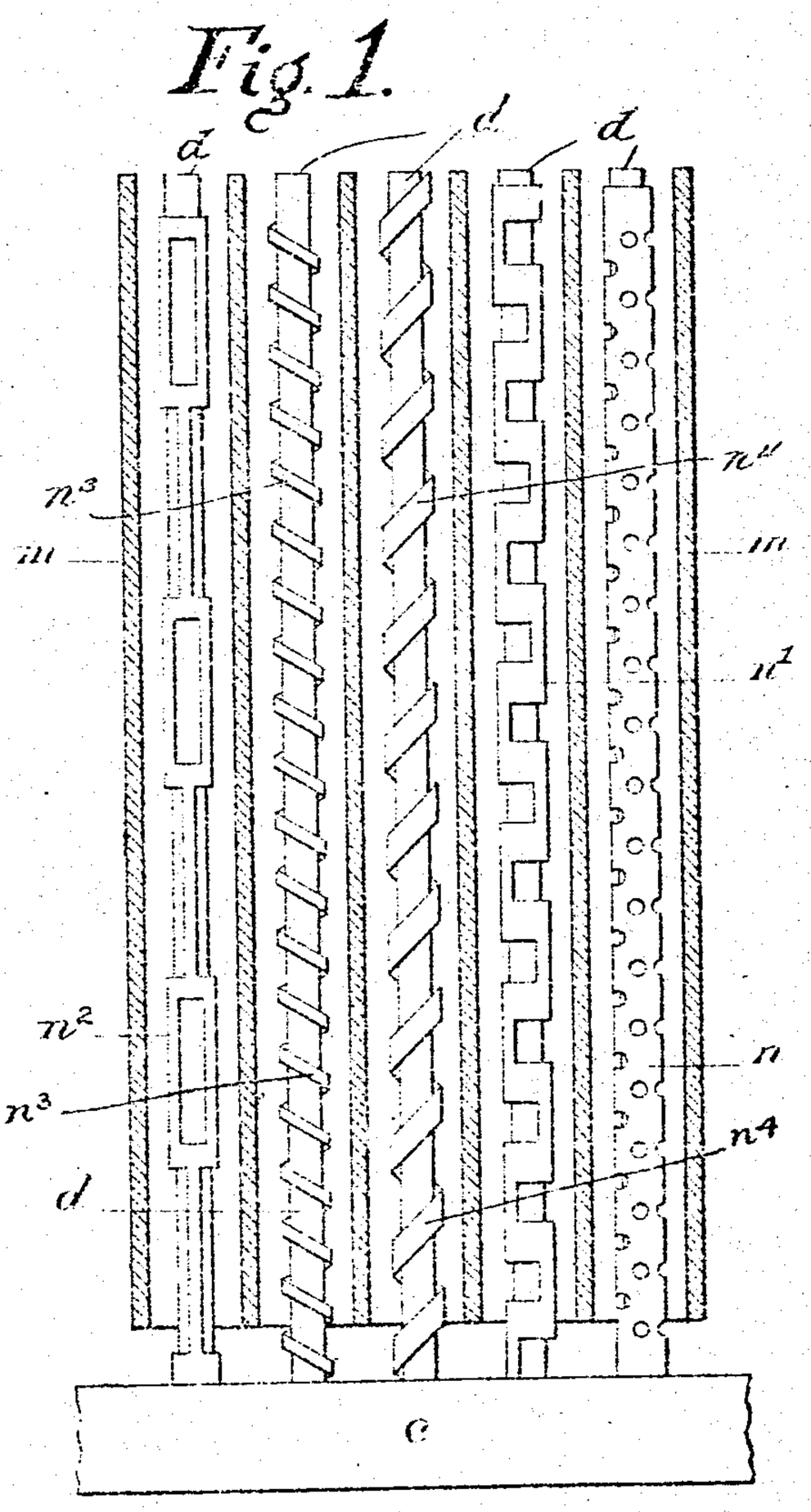
ELECTRODEPOSITION OF METAL ON HOLLOW ARTICLES.

APPLICATION FILED MAR. 26, 1907.

915,846. Patented Mar. 23, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
W. H. Berrigan.
F. Holgan.

INVENTOR,
ERNEST FRIEDHEIM,
by van Oldenneel & Schoenbank
Attorneys.

E. FRIEDHEIM.

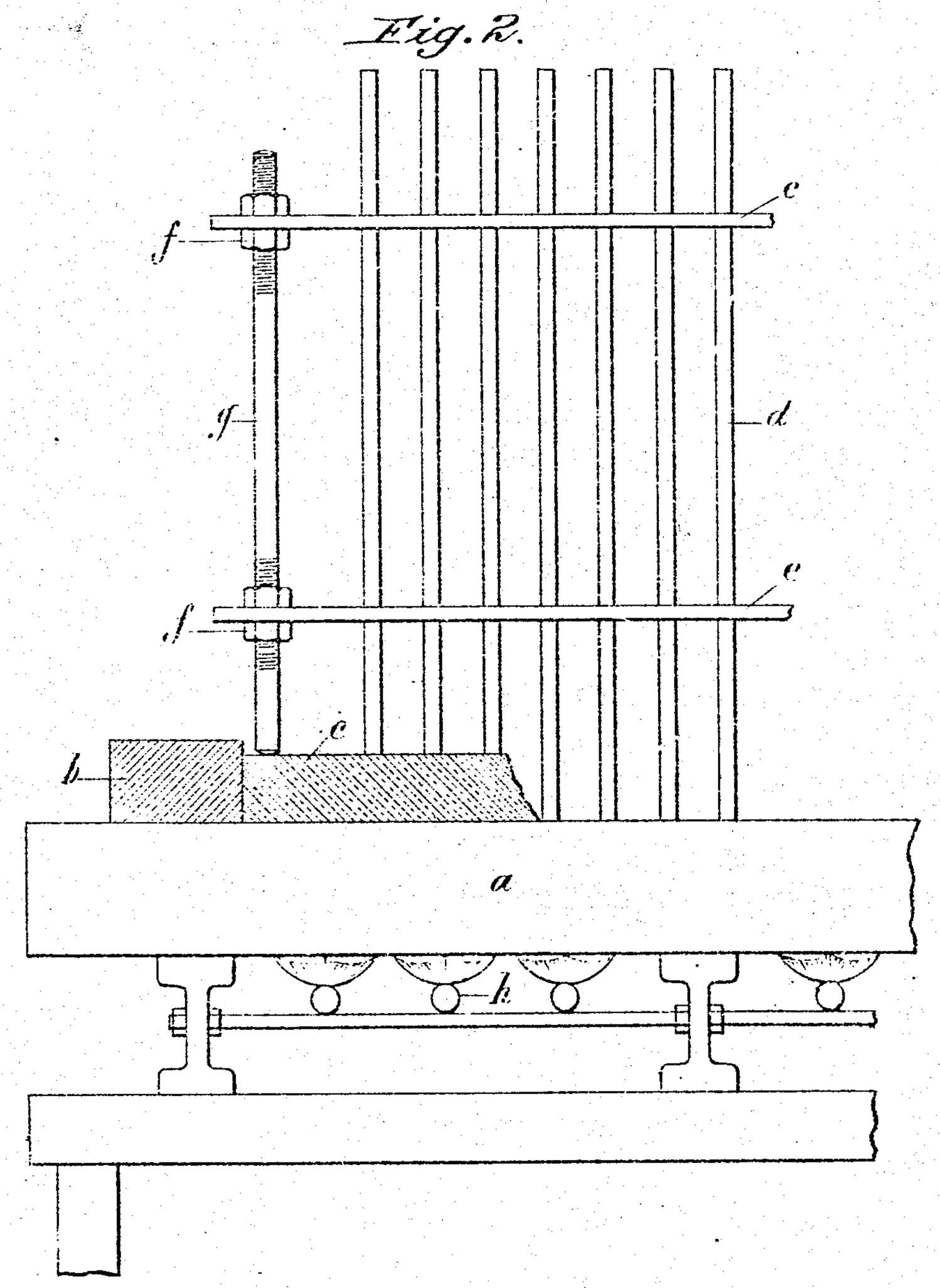
ELECTRODEPOSITION OF METAL ON HOLLOW ARTICLES.

APPLICATION FILED MAR. 26, 1907.

915,846. Patented Mar. 23, 1909.

2 SHEETS—SHEET 2.

Fig. 2.



WITNESSES;

W. H. Berrigan.

F. G. Hogan.

INVENTOR,
ERNEST FRIEDHEIM,
BY Howson & Howson
Attorney.

UNITED STATES PATENT OFFICE.

ERNEST FRIEDHEIM, OF PARIS, FRANCE.

ELECTRODEPOSITION OF METAL ON HOLLOW ARTICLES.

No. 915,346. Specification of Letters Patent. Patented March 23, 1909.

Application filed March 26, 1907. Serial No. 364,696.

To all whom it may concern:

Be it known that I, ERNEST FRIEDHEIM, a subject of the King of Great Britain and Ireland, residing at Paris, in the Republic of France, have invented new and useful Improvements in Electrodeposition of Metal on Hollow Articles, (for which a French patent, No. 364,737, of March 30, 1906, has been obtained;) and I do hereby declare the following to be a full, clear, and exact description of the same.

This invention relates to the electro-deposition of metal on hollow articles.

It is well known that electrolytic deposits cannot be obtained, or can only be poorly obtained, on hollow cathodes, and particularly on tubular cathodes of small section, owing to the fact that the electrolyte which cannot be stirred or agitated inside the tubes, becomes weaker and weaker as the process continues, and, moreover, the decomposition does not occur in the same proportions as in the body of the electrolytic bath, whence it follows that the electrolyte very soon ceases to be capable of effecting a satisfactory metallic deposit, the deposit becoming *nil* inside the tube and only being produced at the extremities of the latter. This disadvantage has been partly met by arranging parts corresponding to the tubular parts of the articles to be manufactured, vertically in the electrolytic bath and inserting into said bodies, anodes in the form of rods, conforming—as regards length and section—to said tubular parts. By this method an electrolytic deposit may be obtained throughout the whole length of the tube; but it is very often found that, owing to the anode and cathode being very close to each other, short circuits occur between them and obviously prevent metallic deposits, the deposit on the whole being so irregular as to render this method unfit for industrial purposes.

The object of the present invention is to avoid the production of these short circuits, and the desired result is attained by surrounding the anode with a perforated insulating layer which renders a direct contact between the anode and cathode impossible, effective depolarization being maintained by the openings provided in the layer surrounding the anode.

Referring to the accompanying drawings, Figure 1 is a view, showing the relative arrangement of the individual anodes with the main anode, the insulating material thereon, and (in section) the tubular bodies to be plated; and Fig. 2 is a view, partly sectional, of the means for relatively securing the individual anodes to the main anode.

In the arrangement illustrated, *a* represents a hot table, maintained at the desired temperature—when required to be heated—by a gas burner, *h*, placed beneath it.

b is a frame for limiting the space in which the easily melted metal *c* is to be poured, *d* being the rods or anodes which are supported and adjusted by means of perforated plates *e* spaced apart, at the desired distance, by means of nuts *f* on adjusting screws *g*. When the rods *d* are thus supported in an exact vertical position, the metal *c* is poured onto the table *a*, and, after it has become sufficiently cool to support the rods *d*, the adjusting screws *g*, together with the plates *e*, are withdrawn.

The process of this invention is for the purpose of producing a cake having a great number of holes, of an average section of (say) ten millimeters and spaced by eleven millimeters from center to center, leaving between them a wall of a medium section of one millimeter. The layer of copper to be obtained will average not less than one-fifth of a millimeter. For this purpose, a desired number of anodes is vertically arranged on a common conducting support and within a corresponding number of hollow cathodes, also arranged vertically. The exterior surface of each anode is covered, in the usual manner, with an insulating layer intended to prevent short circuits and having suitable openings which permit the metal of the anode to be freely and evenly passed to the walls of the cathode.

In practice the operation is as follows: When the parts upon which the electrolytic deposit is to be effected are placed vertically as shown at *m* Fig. 1, there are introduced thereinto the rod-shaped anodes *d* which are made to bear on the principal anode *c* placed at the bottom of the vat, so that there will be a perfect electric contact between this anode and the rod-shaped anodes *d*, which have been enveloped by means of an insulated surface arranged, either in the form of a continuous surface in which suitable openings are formed, said openings being small as in surface n or larger as in surface n^1 or quite large as in surface n^2, or the surface may be in the form (n^3) of a

narrow ribbon or of a wide ribbon (a^4) wound spirally around the anode. The principal lower anode *e* can be made either of soluble metal, similar to that of the small anodes, or of insoluble metal (antimoniated lead); in that case the small anodes alone supply the metal constituting the electrolytic deposit. The parts *w*, to be plated, are to be maintained out of contact with the anode *e*.

As it is of the highest importance that the anode rods *d* shall have a perfect contact with the part *e* constituting the bottom anode and that they be maintained perfectly vertical, principally where it is a question of plating tubes of small section, the foregoing arrangement may be put into operation to obtain this result, by making use of perforated plates constituting guides which are placed at the desired height by means of adjusting screws, after which the anode rods are fixed in position by casting, at their bases, a desired thickness of lead or other metal easily fusible and susceptible of being attacked by the current of electrolysis and which presents the advantages of giving a further contact to the anodes.

What I claim is:

An improved apparatus for making electrolytic deposits on the interior of hollow straight tubes, composed of a plurality of conducting rods mechanically and electrically connected to a common supporting anode, and insulating sleeves for said anodes, adapted to prevent short-circuiting during electrolysis, in combination with hollow cathodes encircling the said anodes.

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

ERNEST FRIEDHEIM.

Witnesses:
JULES FAYOLLET,
EUGENE PICHON.