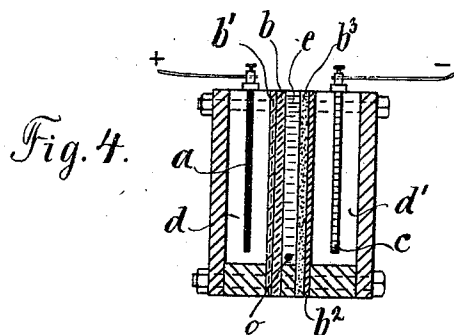
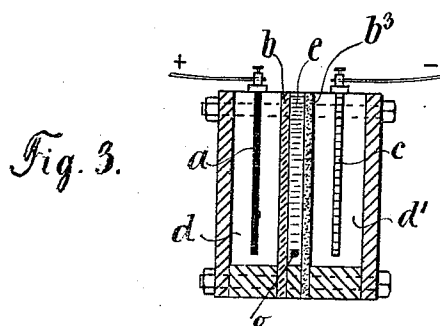
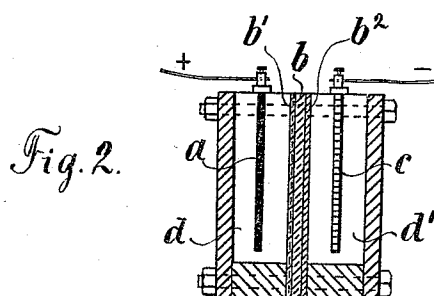
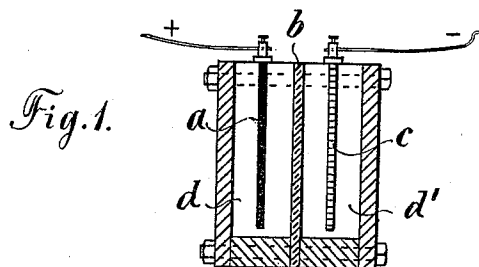


(No Model.)

C. HOEPFNER.
ELECTROLYTICAL APPARATUS.

No. 518,065.

Patented Apr. 10, 1894.



Witnesses.

Wm. B. Sebastian.
H. I. Dieterich

Inventor.

Carl Hoepfner.
By Henry M. [Signature]

UNITED STATES PATENT OFFICE.

CARL HOEPFNER, OF GIESSEN, GERMANY.

ELECTROLYTICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 518,065, dated April 10, 1894.

Application filed February 8, 1892. Serial No. 420,774. (No model.) Patented in Germany February 22, 1889, No. 58,133; in Norway September 1, 1890, No. 1,967; in England September 1, 1890, No. 13,735; in Italy September 30, 1890, XXIV, 28,112, LV, 196; in Spain November 11, 1890, No. 11,205, and in Austria-Hungary December 12, 1890, No. 39,156 and No. 66,246.

To all whom it may concern:

Be it known that I, CARL HOEPFNER, a subject of the King of Prussia, residing at Gies-
sen, Germany, have invented certain new and
5 useful Improvements in and Relating to Elec-
trolytical Apparatus and to the Diaphragms
Employed Therewith, (for which Letters Pat-
ent have been obtained in Germany, No.
58,133, dated February 22, 1889; in Norway,
10 No. 1,967, dated September 1, 1890; in Aus-
tria-Hungary, No. 39,156 and No. 66,246, dated
December 12, 1890; in Great Britain, No.
13,735, dated September 1, 1890; in Italy, Vol.
XXIV, No. 28,112, and Vol. LV, No. 196, dated
15 September 30, 1890, and in Spain, Libro XI,
fol. 516, No. 11,205, dated November 11, 1890;) and I do hereby declare the following to be a
full, clear, and exact description of the inven-
20 tion, such as will enable others skilled in the
art to which it appertains to make and use the
same.

My present invention relates to electrolyti-
cal apparatus, and more especially to the dia-
phragms employed therewith.

25 In electrolysis, and more especially in the
electrolytical treatment of chlorides, haloid
salts, haloid acids and the like, it is necessary
that the cell diaphragms should be constructed
of a material capable of resisting the action
30 of the electrolyte, or a component or compo-
nents thereof, or that of the products of de-
composition. Not only are the materials here-
tofore employed comparatively costly, but the
diaphragms are more or less defective in that
35 they do not possess the necessary power of re-
sistance to pressure in apparatus in which
said diaphragms are subjected to the pressure
of the electrolyte, while the diaphragms for
apparatus designed for the electrolytical treat-
40 ment of substances such as described, had to
be constructed of materials capable of resist-
ing the deleterious action of the electrolyte
or its components or the products of decom-
position.

45 My invention has for its object the provis-
ion of means whereby diaphragms of sufficient
strength to resist any pressure to which they
may be subjected are obtained, and whereby
said diaphragms are made proof against the
50 deleterious action of the electrolyte or its com-

ponents or the products of decomposition, and
this I attain by the use of simple or compound
diaphragms rendered proof against the dele-
terious influences referred to by nitrating the
same or by nitrating the side thereof that faces 55
the anode cell.

The invention consists therefore in the con-
struction and nitration of the diaphragms, as
will now be fully described, reference being
had to the accompanying drawings in which 60
a simple form of electrolytical apparatus is
illustrated by cross-sectional views.

Figure 1 shows a diaphragm composed of a
material containing a nitrated organic sub-
stance. Fig. 2 shows a diaphragm that is me- 65
chanically braced or supported on opposite
sides by a textile material, that side facing the
anode being nitrated or containing nitrated
organic substances. Fig. 3 shows a dia-
phragm in which the nitrated membrane or 70
that part that faces the anode is so arranged
relatively to the diaphragm proper as to form
a cell between the two for the reception of a
liquid or semi-liquid that will more or less
75 hinder diffusion between the anode and cath-
ode cells, and Fig. 4 shows a similar diaphragm
in which the membranes are reinforced by ad-
ditional membranes.

In carrying out my invention I construct
the diaphragm, *b*, of an organic substance, 80
animal or vegetable, as for instance, paper,
or parchment paper, felt, leather, textiles, ve-
neer, or the like, which is nitrated by satur-
ating the material in a solution of nitric acid,
or equivalent solution, or by subjecting the 85
material to the action of a nitrating gas or
gases. On the other hand, the nitration may
be effected by combining an organic or inor-
ganic material, such as wood or paper pulp or
asbestos, with nitro-cellulose, and forming the 90
diaphragm from the compound by molding or
pressure, as shown in Fig. 1; the same result
may be attained by coating an organic or in-
organic material with a nitro-cellulose or
equivalent material to protect the same 95
against the action of the electrolyte.

In Fig. 2, the diaphragm, *b*, made of any of
the materials hereinabove referred to, is rein-
forced on both sides by a textile material, *b'*,
and *b''*, respectively, one of which, namely the 100

reinforcing sheet, b' , facing the anode, a , only, is nitrated as described. The object of reinforcing the diaphragm as described, is to enable it to withstand much higher pressures than would be the case otherwise. On the other hand, to prevent diffusion as much as possible, I construct the diaphragm in the form of a cell for the reception of a semi-fluid or a solid substance, two or a greater number of diaphragms being employed in the construction and arranged to form a cell for the reception of the interposed material. The individual diaphragms may be constructed of a material and treated as above set forth.

15 In Fig. 3 the cell, e , is formed between two diaphragms, b, b^3 , the one, b , facing the anode, a , or forming one of the walls of the anode cell, d , is nitrated as set forth. In order to impart to these cell diaphragms the necessary strength to resist pressure when they are made of paper or paper parchment, I reinforce both by means of a strong textile fabric or several layers thereof, or with equivalent materials, as leather, gelatine, veneer, asbestos, felt, or the like applied to the outer face of the diaphragms, b , and b^3 , as shown at b', b^2 , Fig. 4, such reinforcing material or at least the material, b' , facing the anode, a , being nitrated as described.

30 In the electrolytical treatment of the chlorides of the alkalies, carbonic acid, for instance, may be introduced into the cell, e , between the diaphragms by means of a suitable pipe connected with said cell near the bottom thereof as shown at c , Figs. 3 and 4, or by means of a pipe projecting into the cell to

near the bottom thereof, as may be found most convenient for the purpose of preventing any deleterious action of the electrolyte in the cell, e , upon the diaphragms by the formation of carbonates or bi-carbonates.

Of course it will be understood that the diaphragms herein referred to are supported in the electrolytical apparatus in suitable frames between which they are clamped, as is well known.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In an electrolytic apparatus having adjacent cells of unlike name, a partition between said cells comprising a diaphragm constructed of a nitrated textile material, substantially as and for the purpose set forth.

2. In an electrolytic apparatus having adjacent cells of unlike name, a partition between said cells comprising a diaphragm constructed of a nitrated textile material and one or more auxiliary diaphragms, said nitrated diaphragm facing the insoluble electrode, substantially as and for the purpose set forth.

3. An electrolytic apparatus having adjacent cells of unlike name, and a chambered partition dividing said cells having its wall facing the insoluble electrode constructed of a nitrated organic substance as a nitrated textile material, substantially as and for the purpose set forth.

CARL HOEPFNER.

Witnesses:

GEORGE LOUBIER,
RICHARD SCHMIDT.