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P. GARUTI & R. POMPILI.

VOLTAMETER FOR THE ELECTROLYSIS OF WATER.

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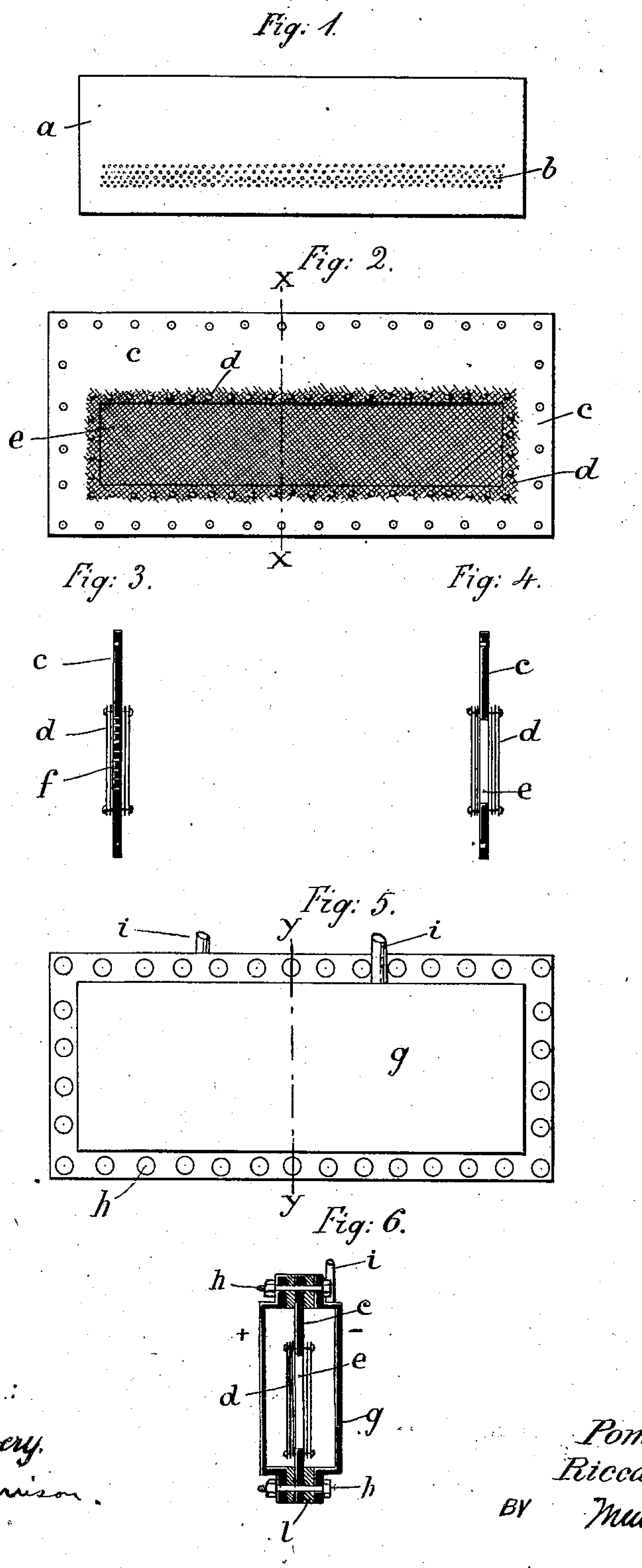
NO MODEL.

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# UNITED STATES PATENT OFFICE.

POMPEO GARUTI AND RICCARDO POMPILI, OF TIVOLI, ITALY.

## VOLTAMETER FOR THE ELECTROLYSIS OF WATER.

SPECIFICATION forming part of Letters Patent No. 724,842, dated April 7, 1903.

Application filed April 11, 1902. Serial No. 102,490. (No model.)

*To all whom it may concern:*

Be it known that we, POMPEO GARUTI, professor, and RICCARDO POMPILI, proprietor, of 11 Via Vesta, Tivoli, near Rome, in the Kingdom of Italy, have invented certain new and useful Improvements in Voltameters for the Electrolysis of Water, of which the following is a specification.

The invention has for its object a new and radical improvement in our voltameters, United States Patent No. 629,070, dated July 18, 1899, for electrolysis of water; and it consists, chiefly, in a modified form of the metallic diaphragm used in connection therewith.

In order to understand clearly the invention, reference is had to the accompanying drawings, in which—

Figure 1 shows the diaphragm now in use. Fig. 2 shows the improved diaphragm according to the present invention. Figs. 3 and 4 are vertical cross-sections on line X X of Fig. 2. Fig. 5 is a side view of an improved voltameter according to the present invention. Fig. 6 is a cross vertical section on line Y Y of Fig. 5.

In the electrolytic cells of the voltameters as originally patented a metallic diaphragm *a* was inserted between the two electrodes to prevent the mixing of the oxygen and of the hydrogen. Said diaphragm in order to facilitate the passage of the ions from an electrode to another was pierced with small holes for a limited zone extending in longitudinal direction near its lower edge, as appears in Fig. 1; but in order to avoid a mixing of the gases, which would render ineffective the diaphragm, the height of the said perforated zone must be a very small one in comparison with the height of the electrode, as shown in Fig. 1, and practically not much more than one inch and that of the electrode not more than five inches. Because of the limited extension of the perforated zone the diaphragm opposes a notable resistance to the passage of the current and the transport of the ions, and this circumstance necessitates the use of electrodes of little height and maintains the intensity of the current under fourteen amperes per square foot of the electrodes. Of course a considerable number of cells arranged in parallel was required for attaining a notable efficiency. The present invention has for its object the elimination of such inconveniences by an improved construction of diaphragm which will permit the use of larger electrodes without increasing the internal resistance.

The improved diaphragm *c* according to the present invention is shown in Fig. 2. Its central portion *e*, corresponding to the perforated zone of the old diaphragms, is much wider than was formerly the case and can extend throughout the whole electrode, except a little zone near the upper edge corresponding to the gas-chamber; but from an excessive extension of the perforated zone would follow a mixing of the gases, and to prevent this we have found that it will suffice to cover the perforated zone *f*, Fig. 3, with one, two, or more metallic webs *d* of thick texture, fastened on both sides of the diaphragm, or instead of the perforated zone a larger opening *e* can be formed in the diaphragm, as shown in Fig. 4, and a greater number of metallic webs applied, so as to cover the said opening.

Obviously it is not altogether necessary to use metallic webs. They can also be substituted by metallic fabrics or perforated metallic sheets, the invention consisting, essentially, in the application of a compound diaphragm, which is obtained by disposing a certain number of simple elementary diaphragms the one against the other on both faces of the original diaphragm.

The number of the elementary diaphragms employed will depend upon their height, or rather the height of the perforated zone covered by the diaphragms, because the greater the height of the perforated zone the greater must be the number of the elementary diaphragms to insure a perfect separation of the gases. The elementary diaphragms placed one against the other are not electrically insulated from each other, and therefore the whole diaphragm forms with regard to the current a single insulated body. Consequently the whole diaphragm remains neutral. The diaphragm made of a plurality of webs prevents the gas-bubbles from passing through the diaphragm, because such bubbles are kept by the web meshes. On further bubbles arriving they agglomerate and rise to the surface without passing through the diaphragm. The perforated zone can therefore be extended in height without any fear of its being traversed by the gases, and as such perforated zone has the weakest resistance to the passage of the ions it follows that as such zone increases the electrical resistance of the circuit diminishes.

Our system permits the use of higher electrodes having a larger active surface, and, furthermore, the resistance being much diminished they allow the use of a current having a strength of more than thirty-six amperes per square foot of the electrodes.

From the above description it will be seen that it is possible to construct very simple voltameters, consisting of a single cell, Figs. 5 and 6, and of considerable power, capable of supporting a current of four hundred amperes and more. In these voltameters the walls *g* of the cells act as electrodes, and the central diaphragm *c*, which prevents the mixing of the gases, is insulated by means of an insulating-packing *l*, of india-rubber, asbestos, or the like, from the side walls of the cell. These several parts are maintained together by means of screw-bolts *h*, coated with a layer of india-rubber or the like. The gas escapes from two little pipes *i i*, adapted on the upper walls of the cell.

The voltameter is made preferably of iron sheets, and the electrolyte is an alkaline solution of water.

A certain number of the cells above described, disposed the one against the other, as the books in the shelves of a library, form powerful batteries of voltameters, connected in series, acting as a single apparatus, and by this arrangement high-tension currents can also be used.

We claim—

1. In a voltameter for the electrolysis of water, an apertured metallic diaphragm and pervious metallic coverings on both faces of the apertured portion of the diaphragm, as set forth.

2. In a voltameter for the electrolysis of water, an apertured metallic diaphragm, and a plurality of foraminated metallic coverings on both faces of the apertured portion of the diaphragm, the said coverings on each face being arranged close together and serving to diminish the internal resistance of the voltameter, the said coverings also preventing the mixing of the gases, substantially as described.

3. A voltameter, comprising a hollow chamber provided with conducting-walls capable of serving as electrodes, an insulated conducting-diaphragm dividing said hollow chamber into insulated compartments and mutilated to allow communication between said compartments, and a plurality of metallic webs disposed upon opposite sides of said diaphragm, for the purpose of presenting large conducting-surfaces.

4. A voltameter, comprising a hollow chamber provided with conducting-walls capable of serving as electrodes, an insulated conducting-diaphragm dividing said chamber into insulated compartments, said diaphragm being provided with mutilations, and a plurality of elementary diaphragms disposed immediately adjacent to the main diaphragm, so as to practically obstruct said mutilations.

5. A voltameter, comprising a hollow chamber provided with conducting-walls capable of serving as electrodes, an insulated conducting-diaphragm dividing said chamber into insulated compartments, said diaphragm being provided with mutilations and mounted centrally within said chamber, and a plurality of metallic webs arranged together as laminæ and disposed upon opposite sides of said mutilations.

6. A voltameter, comprising a hollow chamber with conducting-walls acting as electrodes, an insulated conducting-diaphragm dividing said chamber into insulated compartments, said diaphragm being provided with mutilations, and a plurality of metallic webs or thin perforated metallic sheets, said webs or sheets being disposed immediately adjacent to said diaphragm, so as to practically obstruct said mutilations while permitting the passage of the ions through the holes or the network.

7. A voltameter, comprising a chamber having conducting-walls acting as electrodes, an apertured diaphragm dividing said chamber into two compartments insulated from each other and from the diaphragm, and pervious metallic coverings on both faces of the apertured portion of the diaphragm, as set forth.

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Witnesses:
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