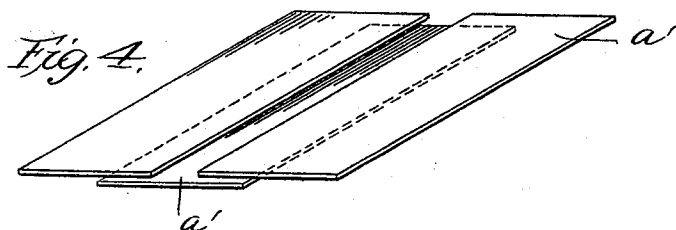
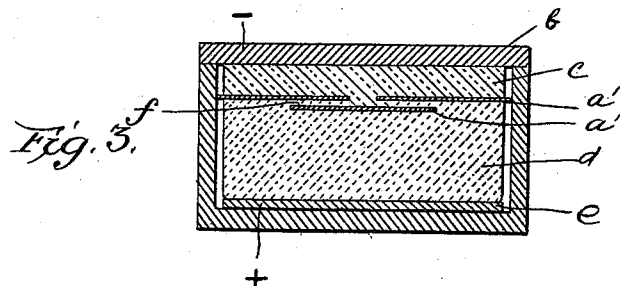
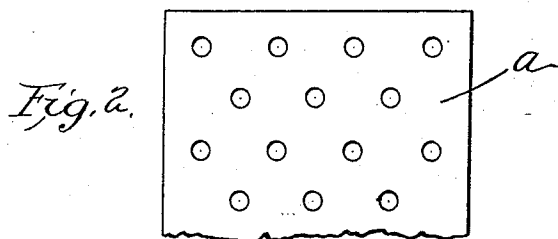
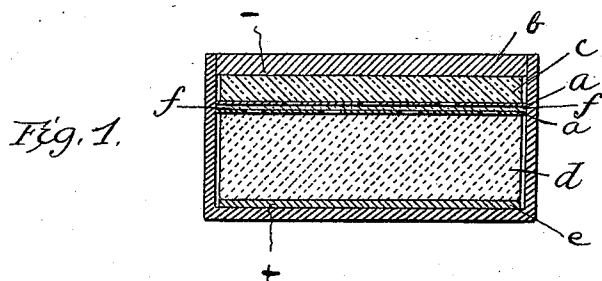


(No Model.)

H. KOLLER.
DRY BATTERY.

No. 496,228.

Patented Apr. 25, 1893.



Witnesses:
E. H. Bolton
E. H. Sturtevant.

Inventor:
Hugo Koller
By *Richard A.*
his Attorneys.

UNITED STATES PATENT OFFICE.

HUGO KOLLER, OF VIENNA, AUSTRIA-HUNGARY.

DRY BATTERY.

SPECIFICATION forming part of Letters Patent No. 496,228, dated April 25, 1893.

Application filed June 21, 1892. Serial No. 437,518. (No model.)

To all whom it may concern:

Be it known that I, HUGO KOLLER, a subject of the Emperor of Austria-Hungary, residing at Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Dry Elements; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a construction of dry cells in which exciting liquids are replaced by plates or masses of exciting material having a gelatinous consistency so that the cells when arranged to form a battery after the manner of a Zamboni pile will remain for a long time unaltered, and have the further advantages that they will not be injuriously affected even at a high temperature, have great conductivity, that clamps and glasses can be dispensed with, and that all parts can be readily removed and exchanged. The diaphragms employed in these dry cells consist of perforated sheets of waterproof insulating material such as gutta percha paper, paraffined paper or paper saturated with wax. The gelatinous plates or masses of exciting material (hereinafter called gelatinous plates) inserted between the electrodes or plates of the cells, consist of leaves of agar-agar, mixed with a metallic salt or salts suitable for causing electrical excitation, the said gelatinous plates being separated by the aforesaid diaphragms.

Figure 1, is a sectional view showing the use of perforated plates, the perforations being arranged alternating. Fig. 2, is a plan view of a part of one of the plates. Fig. 3, is a sectional view of a modification. Fig. 4, is a perspective view of the plates of Fig. 3.

To make the gelatinous plates agar-agar is soaked and boiled in from about sixteen to thirty times its weight of water until it has lost all structure. In order to diminish the subsequent drying up and shrinking of the mass from about one to six parts by weight of sugar sirup may advantageously be added to it. When the mass has been brought by evaporation to the desired density and just before it solidifies there is or are intimately mixed therewith by stirring or otherwise the desired metallic salt or salts for causing elec-

trical excitation. The salt or salts may be added in a dry state or in the form of a concentrated solution. Any salt suitable for use as an electrical excitant in a galvanic battery can be employed excepting those which prevent the agar-agar from coagulating.

Some metallic salts, as for example common salt, may be boiled with the agar-agar without injury; many salts however and particularly the most important of them from an electrical point of view as for instance sulphate of copper will prevent the agar-agar from coagulating if they are too long in contact with the liquid agar-agar mass. For this reason it is very important to introduce such metallic salts into the agar-agar mass only just before it solidifies as otherwise a crumbling sticky product will be the result.

The amount of the metallic salt or salts to be mixed with the agar-agar should be such as to impart to the gelatinous mass approximately that percentage of salt which is considered to be the most favorable when such salt is ordinarily used in the form of a solution. If this percentage of salt is to correspond to that of a concentrated solution, it is not always possible to introduce the requisite amount of salt into the agar-agar mass without interfering with the coagulation thereof. In this case after the mass has taken up a small quantity of the salt, the mass is allowed to solidify, and then by drying, preferably in heated air, the excess of water in the mass is removed until the separation of crystals indicates that the desired concentration has been effected.

The exciting material produced as described has a more or less firm gelatine-like consistency, according to the amount of agar-agar contained therein. It is cast into blocks, and after being cut into plates, is inserted between the electrodes or plates of the cells.

The diaphragms are so arranged that the diffusion can take place only through a long narrow slit. Figs. 1 and 2 show one form of the arrangement of the cell in which the diaphragms *a* are made perforated and disposed so that the perforations of one of the diaphragms stand against the full part of the second diaphragm and vice versa. Figs. 3 and 4 show the arrangement of the cell in which the diaphragms *a'* are made of full

non-perforated plates and arranged in an alternating way as shown. In these figures *b* is the zinc, *c* the mixture of sulphate of zinc with agar agar; *d* the mixture of sulphate of copper with agar agar; *e* is the copper; and *f* is the narrow space between the two diaphragms.

In order to retard as much as possible the diffusion which when agar-agar disks are employed takes place much more slowly than in an aqueous solution, the diaphragms inserted between the plates or disks of exciting materials, are arranged in such a manner that the openings in any two of such diaphragms will alternate with one another so that diffusion can take place only in the narrow space between the two diaphragms. This arrangement of the diaphragms serves to make the path through which the electrolyte has to travel

before it reaches the electrode at which it can produce injurious subsidiary reactions, very long. Two or more of such diaphragms may be arranged in one cell.

I claim—

1. Plates for dry cells composed of agar-agar mixed with a metallic salt.

2. Dry cells composed of plates made of agar-agar boiled in water and provided with metallic salt said plates being separated from each other by insulating perforated diaphragms, said diaphragms being impervious to water, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HUGO KOLLER.

Witnesses:

W. B. MURPHY,
PAUL BERGER.