(No Model.) 2 Sheets—Sheet 1.

C. PAYEN.

PROCESS OF PRODUCING POROUS CRYSTALLIZED METAL PLATES.

No. 415,683. Patented Nov. 19, 1889.

Fig. 1.

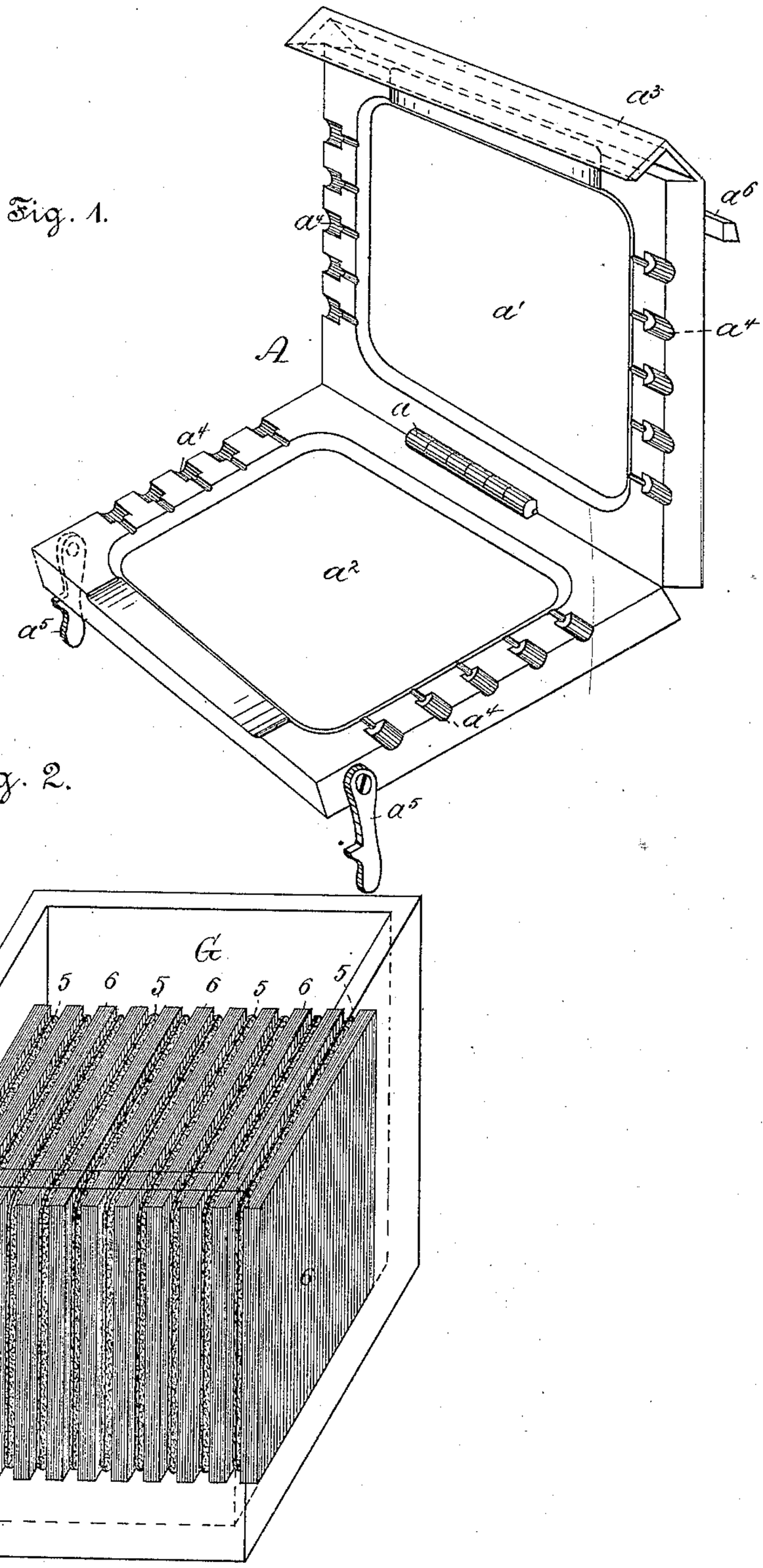

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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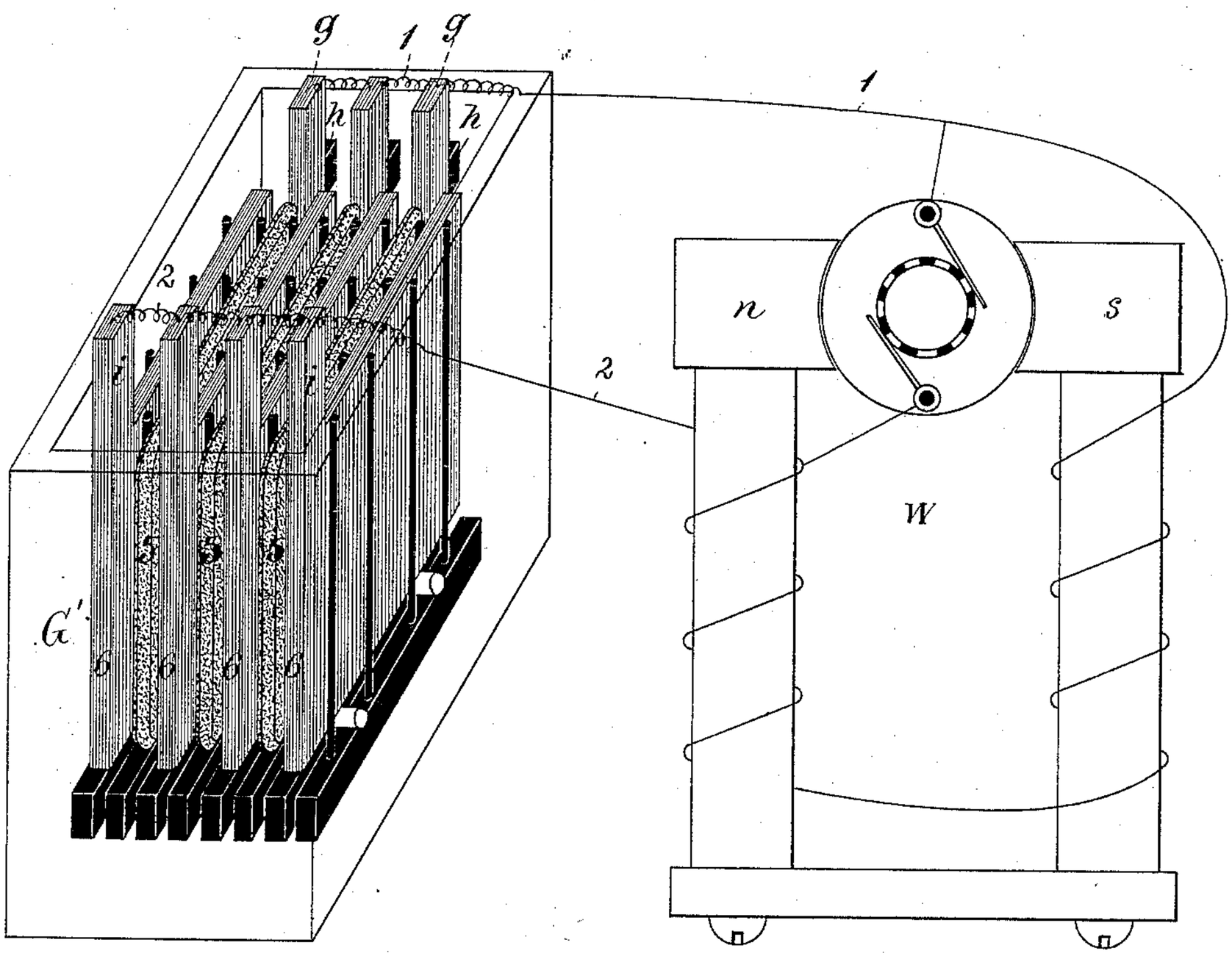
Fig. 3.



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UNITED STATES PATENT OFFICE.

CLÉMENT PAYEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE ELECTRIC STORAGE BATTERY COMPANY, OF GLOUCESTER CITY, NEW JERSEY.

PROCESS OF PRODUCING POROUS CRYSTALLIZED METAL PLATES.

SPECIFICATION forming part of Letters Patent No. 415,683, dated November 19, 1889.

Application filed March 7, 1889. Serial No. 302,327. (No model.)

To all whom it may concern:

Be it known that I, CLÉMENT PAYEN, a citizen of the Republic of France, but now residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Producing Porous Crystallized Metal Plates, of which the following is a specification.

My invention relates to the production of a porous crystallized metal plate or other structure having its atomic aggregation preserved with geometrical regularity in columns therein.

My invention consists in subjecting a nitrate or nitrates of a metal or metals to fusion, then pouring the mass into a mold and allowing it to crystallize therein, and then reducing the plate or structure to a metallic state.

In the accompanying drawings I have illustrated apparatus for casting a plate and of reducing the same to a metallic state, in which—

Figure 1 is a perspective view of a two-part mold in which a fused mass assumes a crystallized form. Fig. 2 is a perspective view of a vase containing a fluid with a series of crystallized plates in contact with a series of metal plates, and the said view illustrating the manner of reducing said plates to a metallic state by chemical action; and Fig. 3 is a diagrammatic view showing the mode of reducing the crystallized plates by electrolytic action to a metallic state.

In order that my invention may be fully understood, I will now proceed to describe the manner of conducting the process for the production of a porous crystallized metal silver plate or other structure.

A charge of nitrate of silver is melted or fused in a suitable furnace and then discharged into the two-part mold A, wherein the mass in cooling assumes a crystallized form. The selection of material for the mold A is of some importance, and the interior surface thereof should be perfectly smooth. Preference is given to brass or bronze for the formation of the mold. Molds made of malleable or cast iron are subject to disintegration in a short time. Those made of lead require the exercise of care, owing to their tendency to melt when a fused mass is poured into them. The mold may be constructed of either equal or unequal thicknesses of metal, as desired.

In pouring a fused mass into a mold having the two parts of equal thicknesses of metal such mass will commence to cool from each side, and the individual crystals will meet or unite with each other at their summits, sides, or facets, forming columns with geometrical regularity—that is, the crystals assuming such geometrical regularity in columns parallel to each other, or substantially so, from one side of the mold will meet or unite with the crystals forming columns with similar regularity from the opposite side of the mold at the median line of the crystallized plate or structure.

In pouring a fused mass into a mold having the two parts of unequal thicknesses of metal such mass will commence to cool from each side, but the crystals will assume a fixed position in the structure faster from the side of the mold having the greater thickness of metal than the crystals assuming a fixed position in the structure from the opposite side of the mold of a less thickness of metal—that is, the crystals from one side of the mold will meet or unite with each other, forming columns with those meeting or uniting with each other and forming columns from the opposite side of the mold; but these columns of crystals thus formed will unite with each other from both sides of the mold beyond the median line of the plate or other structure.

The two-part metal mold A, Fig. 1, hinged together at a, is provided with matrices a' and a^2 for the reception of the fused mass introduced through the conical-shaped trough a^3, formed with or secured to one of the parts of the mold. At suitable distances apart in the surface of the mold are formed vent-holes a^4, and the two parts of the mold are clamped together by means of pawls or latches a^5, formed with one of the parts and engaging with a strip a^6, formed with the opposite part of the mold.

When the mass has assumed a solid crys-

tallized form in the two-part mold A and the plate or other structure has cooled off therein, it may then be removed for reduction to a metallic state by either chemical or electrolytic action, or both, in the following manner: In a vase G, containing a solution of a salt or a chloride and water—such as dilute sal-ammoniac—in the proportion of five to ten per cent., more or less, a series of crystallized plates 5 is arranged alternately in contact with a series of metallic zinc or other plates 6 of equal dimensions. It is well to exercise some care in the selection of the solution to immerse the plates in, and preference is given to a salt for the solution belonging to the same family or class as the salt or nitrate composing the crystallized plates. A series of the crystallized plates 5, arranged in contact with a series of metallic zinc or other plates 6, of equal dimensions, having been immersed in a vase in a solution of sal-ammoniac and water for from twelve to fifteen hours, (more or less,) the effect produced by the chemical action taking place will be to eliminate whatever gases the crystallized plates contain, thereby leaving them in a porous metallic state. The plates treated in the manner described may then be removed from the vase and washed and then dried by a gentle heat, whereby they will be brought to a chemically-pure state of perfection, with substantial strength for various purposes.

Another mode of reducing the crystallized plates to a metallic state by electrolytic action may be carried out in the following manner: A series of crystallized nitrate plates 5 is mounted in a vase G′, containing sulphuric acid and water in the proportion of ten per cent., (more or less.) The crystallized nitrate plates 5 are alternated with charcoal, lead, or other plates 6, of equal dimensions, provided with lugs. Care should be taken in the mounting of the two systems of plates 5 and 6 in the vase G′ to see that each is properly insulated from each other and also from the vase, and, moreover, that the plates are firmly held therein, in order that all wabbling may be avoided, whereby bulging, bending, or warping of the plates in their reduction to a metallic state will be prevented. The two systems of plates 5 and 6, each properly insulated from the other, having been mounted in the vase G′, containing a solution, a bar of metal, lead, or other material *g* is fitted snugly up against one of the edges of each nitrate plate 5 and held in position by means of an insulating-strip *h*, introduced between said bar and the vase G′. A wire I is then connected with each of the bars *g*, in contact with the system of crystallized nitrate plates 5, and another wire 2 is connected with the lugs *i* of the system of charcoal, lead, or other metal plates 6, and the two wires connected, respectively, with the positive and negative electrodes *n* and *s* of a dynamo W, the positive electrode connected by means of wire 2 with the system of charcoal, lead, or other metal plates 6, while the negative electrode is connected by means of the wire I with the system of crystallized-nitrate plates 5, and in the electrolytic action which takes place the nitrate is decomposed into its two gases—nitrogen and oxygen—and these two gases escape into the open air, thereby leaving the crystallized plates in a porous metallic state. The crystallized metal plates, treated as described, may then be removed from the vase G′, washed, and then dried by a gentle heat, whereby they will be brought to a chemically-pure state, with substantial strength for use as filters and other purposes.

While I have described the use of nitrate of silver for the production of a metallic plate or other structure, still I do not wish to be understood as limiting myself to the use of such nitrate, as, among others, nitrate of copper may be availed of for the production of a porous crystallized plate, having the characteristic features hereinbefore fully described.

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

1. The method of producing a porous crystallized metal plate or other structure, which consists in subjecting one or more nitrates of a metal or metals to fusion, then pouring the mass into a mold and allowing it to crystallize therein, and then reducing the structure to a metallic state, substantially as and for the purposes set forth.

2. The method of producing a porous crystallized metal plate or other structure, which consists in subjecting one or more nitrates of a metal or metals to fusion, then pouring the mass into a mold and allowing it to cool and crystallize therein, and then reducing electrolytically the structure to a metallic state, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

CLÉMENT PAYEN.

Witnesses:
GEO. W. REED,
FRANK C. LEWIN.