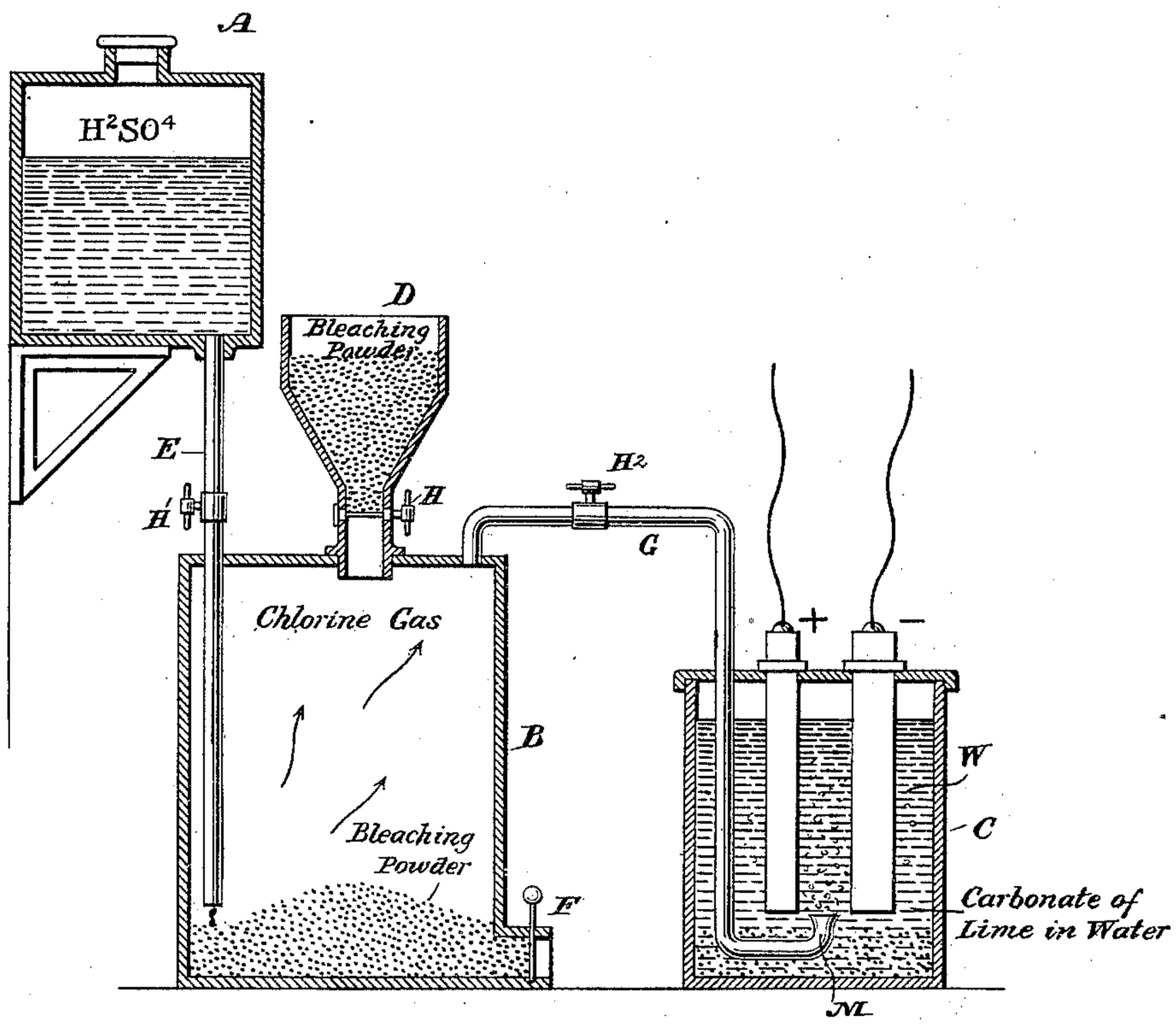
(No Model.)

# L. PAGET.

## PRODUCTION OF ZINC CHLORIDE, &c.

No. 393,578. Patented Nov. 27, 1888.

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# UNITED STATES PATENT OFFICE.

LEONARD PAGET, OF NEW YORK, N. Y., ASSIGNOR TO THE MACRAEON STORAGE BATTERY COMPANY, OF SAME PLACE.

## PRODUCTION OF ZINC CHLORIDE, &c.

SPECIFICATION forming part of Letters Patent No. 393,578, dated November 27, 1888.

Application filed November 3, 1888. Serial No. 289,892. (No model.)

*To all whom it may concern:*

Be it known that I, LEONARD PAGET, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented a new and useful improvement in connection with the art of generating electricity, of which the following is a specification.

My invention relates to improvements in the art of generating electricity by voltaic means; and its object is to cheapen the production thereof. I accomplish this object by the processes hereinafter described of creating valuable by-products, which by-products may be placed upon the market and sold as merchantable articles.

Prior to my invention it was old to attempt the reduction of the cost of generating electricity in a voltaic battery by causing such battery to produce a merchantable article known as "zinc oxide." I assume that attempts in this direction have been more or less successful; but I will point out that I have found, as I believe, that the cost of consumption of zinc in comparison with the cost of the oxidizing or other hydrogen-destroying chemical agent consumed in destroying the hydrogen formed on the negative plate of the voltaic combination is small. Seeking to reduce the cost of the hydrogen-combining agent, I have discovered that it is possible to do so by obtaining a valuable product during the production of such agent, as well as to much increase the electrical power developed by the voltaic combination by employing such agent nascent or as freshly produced. Further, I have found that it is possible to effect still greater reduction of the cost by so arranging that in the production of the agent aforesaid a chemical compound, (a+c,) should be acted upon by another, (b,) to produce the said agent (c) and a compound, (a+b,) when if a+b is more valuable commercially than a+c then the agent c is produced at a profit which can be charged against the debit of other losses in the production of electricity. If, also, the metallic salt or oxide produced by the consumption of the electro-positive electrode is commercially available, either at a profit or at par, the resulting production of electricity is effected at a minimum cost. In a certain sense this might be considered as an extension of the principle of the Daniell cell, in which the copper reduced by the hydrogen evolved at the negative plate may be considered a valuable product; but this is not at all the essence of my invention, nor does the practical result available with such a cell admit of comparison with my invention, partly for the reason that the production of the valuable material copper is carried on in the cell in such a way as to need the ultimate removal of the negative electrode, and partly because the deposit of copper upon the zinc and other reactions well known to electro-chemists present almost insurmountable practical difficulties, which my invention wholly avoids.

To carry my invention into effect, I employ several variations of procedure embodying the principle; but that which I deem the best I now immediately describe.

The drawing illustrates such apparatus as may be found in any well-equipped chemical laboratory, the same being adapted to carry out the processes hereinafter described and claimed. This apparatus, however, constitutes no part of the present invention, it being limited to such processes *per se*.

The apparatus consists of a gas-generator, B, and a voltaic cell, C, hermetically closed, except where it is connected to the gas-generator by a pipe, G. The gas-generator B is connected by a pipe, E, with a chamber or vessel, A, containing sulphuric acid.

D is a vessel, also connected with the gas-generator chamber B, and adapted to contain bleaching-powder.

H H′ H² are cocks for connecting the several vessels.

F is an outlet adapted for the removal of such matter as remains in the bottom of the chamber B after the gas has been generated. The battery-cell C has the usual positive and negative plates. The lower end, M, of the gas-conveying pipe G extends up between these positive and negative plates of the battery into the electrolyte W.

The operation is as follows: The cock H having been turned so as to admit a sufficient quantity of bleaching-powder into the chamber B, the cock H′ is then turned so as to permit sulphuric acid to flow drop by drop upon said bleaching-powder, and chlorine gas is thereby evolved in a well-known manner in

the chamber B, according to the following formula: $CaOCl+H_2SO_4=CaSO_4=HClO+HCl$, and $HClO+HCl=H_2OCl_2$. The resulting sulphate of lime, being precipitated as a fine powder, can be treated for the separation of any iron it may contain and sold as precipitated sulphate, or it may be burned at a low temperature to produce the finest Parian plaster, and is in either case a product more valuable than the material employed. The chlorine gas evolved is conducted to the voltaic cell C by a pipe, G, where it is led into the water W, containing carbonate of lime in suspension, this water being the electrolytic fluid. The electrodes of the voltaic cell are an electro-positive zinc or iron plate or mass and an electro-negative plate or mass of lead coated or containing lead peroxide or a lead salt. By the action of the hypochlorous acid (produced by the chlorine under the influence of the carbonate of lime suspended in the water) the lead salt or plate is peroxidized, or the peroxide, when reduced by the hydrogen evolved, is immediately again raised to the higher degree of oxidation. Zinc is dissolved and is found as zinc chloride. Iron is dissolved and is found as ferric chloride. Both the zinc and iron salts are easily salable as valuable by-products. This combination gives, with zinc, a very high electro motive force—about 2.3 volts—and is very constant. By immersing the zinc in a solution of caustic soda contained in a porous cell immersed in the water, as described, there is formed in the porous cell a zincate of soda, (from which pure oxide of zinc can be precipitated by the addition of water,) and in the surrounding liquid sodium hypochlorite. The electro-motive force of this combination is about 2.7 volts. One cell will charge a storage battery or accumulator.

The method I adopt in practice for obtaining when required finely-divided carbonate of lime in suspension in the water is to inject a current of carbonic-acid gas into the water containing a salt of lime or milk of lime. The internal resistance of this combination is at first high, but rapidly decreases. By causing a circulation of water in proportion to the formation of zinc chloride, so as to maintain a uniform solution, this voltaic combination will give an electric current for a time limited only by the supply of chlorine gas and the mass of electro-positive electrode.

Bromine water may be substituted for the bleaching-powder, in which case, sulphureted hydrogen being substituted for the sulphuric acid, hydrobromic acid gas is set free in the generator with a deposit of fine sulphur. In this case water slightly acidulated with sulphuric acid is substituted for the lime-water in the voltaic cell, and here the lead being not peroxidized by the hydrobromic acid, carbon or platinum plates must be substituted. The resulting bromide of zinc or iron is a valuable product. The electro-motive force of this combination is not so high (about 1.25 volt) as with the former, and the electro-positive metal is attacked on open circuit. It is preferable to arrange the voltaic cell without an exit tube for gas, so that the pressure developed while the cell is on open circuit may be used to operate in the generator to prevent the generation of gas in the way well known in chemical operations. When the cell is on closed circuit, the gases are absorbed, and as absorbed they may be made to be generated by so arranging that the release of back-pressure allows of the inflow of active material, as is well known in chemical laboratories. The cell in this manner becomes automatic.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. The within-described process of producing valuable by-products in a voltaic combination in which electro-motive force is set up, which consists, first, in generating a gas, as chlorine, and at the same time producing a by-product, as sulphate of lime, by the union of bleaching-powder and sulphuric acid, and then injecting the gas thus generated into an electrolyte composed of water holding calcium carbonate in suspension, said electrolytic compound being in contact with the electrodes of said voltaic combination, and finally, through the action of said gas upon this electrolytic compound and the disintegrated salt of the active electrode, producing a second by-product, as zinc chloride, substantially as described.

2. The within-described process of producing a valuable by-product in a voltaic combination in which electrical potential exists during the progress of said process, which consists, first, in generating a gas, as chlorine, and then producing sulphate of lime, then causing the chlorine gas thus produced to unite with the metallic salt of the active electrode and carbonate of lime suspended in the water of the electrolyte of the combination, whereby such valuable by-product as zinc chloride is produced, substantially as described.

3. The within-described process of producing a valuable by-product in a voltaic combination, which consists in causing a gas, as chlorine, to unite with the disintegrated salt of the active electrode of the voltaic combination, thereby producing a by-product, as zinc chloride, substantially as described.

4. The within-described process of producing a valuable by-product, as zinc-chloride, in a voltaic combination in which electrical potential exists, which consists in causing a gas, as chlorine, to unite with the disintegrated salt of the active electrode surrounded by an electrolyte of water holding carbonate of lime in suspension, substantially as described.

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Witnesses:
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