

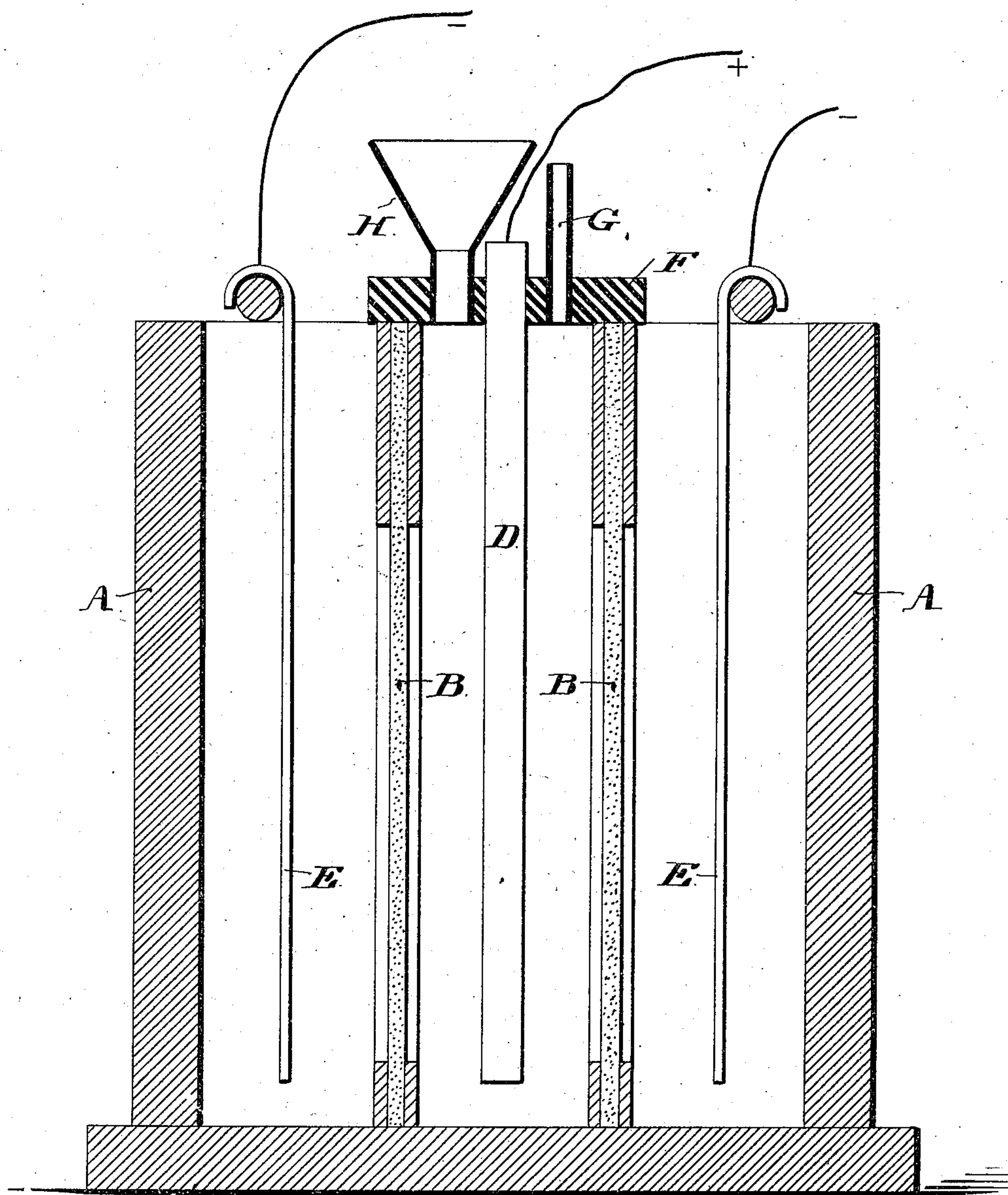
(No Model.)

J. D. DARLING.

PROCESS OF UTILIZING NITER CAKE OR OTHER ACID SULFATES.

No. 541,598.

Patented June 25, 1895.



WITNESSES:  
*James Bell*  
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# UNITED STATES PATENT OFFICE.

JAMES D. DARLING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO  
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PROCESS OF UTILIZING NITER-CAKE OR OTHER ACID SULFATES.

SPECIFICATION forming part of Letters Patent No. 541,598, dated June 25, 1895.

Application filed January 8, 1895. Serial No. 534,198. (No specimens.)

*To all whom it may concern:*

Be it known that I, JAMES D. DARLING, of the city of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Process for Utilizing Niter-Cake or other Acid Sulfates and Obtaining Valuable By-Products Therefrom, of which the following is a specification.

In the commercial manufacture of nitric acid, and also of sulphuric acid, when nitrate of soda is employed to furnish the nitrogen compounds required, the resulting by-product has approximately the composition of bisulphate of soda, although there is usually an excess of sulphuric acid present, even beyond the amount which would be due to the formula  $\text{NaHSO}_4$ . This by-product, termed "niter-cake," is of trifling commercial value, and various methods have been attempted to utilize it, but so far as I am aware, all of such methods are relatively costly and the commercial results therefrom have been neither satisfactory nor profitable.

My process is principally addressed to the economical and efficient treatment of niter-cake for the derivation of two by-products, viz: neutral sulphate of soda ( $\text{Na}_2\text{SO}_4$ ) and chlorine gas. It may, however, be applied to the utilization of other acid sulphates, with corresponding results.

To this end my process consists in electrically decomposing a solution which contains a base similar to that of the acid sulphate, and causing such base to travel (by electrical action) toward, and combine with, the acid sulphate, until the desired neutralization thereof has been effected. The other derivative of the electrolytic decomposition is conducted away under proper control, and recovered as a distinct by-product. For convenience of nomenclature, I term the solution which is to be thus decomposed, (in order to furnish an additional quantity of base to the acid sulphate,) the base-supplying electrolyte, and I term the transfer of the base from the region of its decomposition to the region of re-combination, the electrolytic travel thereof.

In the accompanying drawing I have represented in vertical section a typical apparatus adapted to the conduct of my process, but I

do not limit myself to the employment of this or of any particular form of apparatus.

I will now proceed to describe the process of treating niter-cake by means of the devices shown in said drawing.

A, represents a tank of wood or slate, divided into three compartments by means of the transverse partitions, B, B. These partitions should be in whole or in part porous, to an extent sufficient to allow of electrolytic travel, unaccompanied by any excessive increase in electrical resistance. In the central compartment (which is the decomposing cell) is placed a carbon electrode, D, which constitutes the positive pole, and in each of the other compartments is placed an electrode, E, which may be of sheet lead, constituting negative poles. The central or positive compartment is provided with a close fitting cover, F, having an outlet, G, and a feed orifice, H. The central compartment is filled with the base-supplying electrolyte, which is a saturated solution of sodium chloride, and the two adjacent compartments are filled to the same level with a solution of niter-cake. The physical intermingling of the two solutions, as such, is practically prevented by the partitions, B, but on passing a suitable current of electricity from the positive to the negative pole of the apparatus, the sodium chloride solution in the central compartment is decomposed and the sodium is caused to travel through the porous partition to the region of the niter-cake solution, where it combines with the surplus sulphuric acid and forms neutral sulphate of soda; while the liberated chlorine passes off through the outlet pipe, G, to any convenient receptacle, where it may be absorbed by lime, or condensed into liquid form directly, or utilized in any desired manner. As the process proceeds, chloride of sodium may be supplied through the feed orifice, H, in the cover, F, and the process may be thus continued until the entire charge of acid sulphate contained in the negative compartment has been neutralized and the desired product obtained. The solution of neutral sulphate is then drawn off and after filtering to free it from precipitated iron and other impurities, is allowed to crystallize. The



mother liquor, with the addition of a proper amount of water, may be again used to dissolve a fresh quantity of niter-cake and the process repeated as before.

5 For practical purposes, I deem it important to maintain a physical separation between the two solutions, since if they are allowed to commingle freely, decomposition to a certain extent of the sulphuric acid  
10 takes place and oxygen is liberated at the positive pole, which action tends to disintegrate the carbon electrode. There is also the further liability to a physical intermingling of the two solutions, so that at the close of  
15 the process the neutral sulphate would contain more or less of the sodium chloride diffused through it. These objections are, however, not vital, and hence I do not limit my claim to the employment of the specified type  
20 of apparatus.

I do not limit myself to the employment of this process in connection with niter-cake, as it may be applied to the treatment of other acid sulphates for the production of neutral  
25 salts. It is of course necessary that the base-

supplying electrolyte should in such case be of a character to correspond to the salt to be neutralized.

I claim—

1. The hereinbefore described process for 30 the treatment of acid sulphates, which consists in electrically decomposing an electrolyte containing a similar base to that of the sulphate, and transferring said base to the sulphate by electrolytic travel, substantially 35 as described.

2. The hereinbefore described process for the treatment of acid sulphates, which consists in electrically decomposing an electrolyte containing a similar base to that of the 40 sulphate, transferring said base to the sulphate by electrolytic travel, and recovering the gaseous product of said decomposition of the base-supplying electrolyte, substantially as described.

JAMES D. DARLING.

Witnesses:

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