

UNITED STATES PATENT OFFICE.

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DEPOLARIZER FOR PRIMARY BATTERIES AND METHOD OF MAKING SAME.

SPECIFICATION forming part of Letters Patent No. 552,211, dated December 31, 1895.

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To all whom it may concern:

Be it known that we, GUSTAV W. THURNAUER, residing at Aurora, in the county of Kane, and MILTON M. KOHN, residing at Chicago, in the county of Cook, State of Illinois, citizens of the United States, have invented certain new and useful Improvements in Depolarizers for Primary Batteries and Methods of Making the Same, of which the following is a specification.

Heretofore it has been common to make use of copper oxide, either in the form of powder or in the form of a plate, in connection with primary batteries for the purpose of a depolarizer. The use of the depolarizer in the form of powder has, however, been found to be objectionable for many reasons, and therefore the plate form has been adopted to a large extent. In producing such plates it has been found necessary in order to hold the copper oxide in form either to use a bonding material or to bind the copper oxide together by partly fusing it until it assumes a more or less metallic condition. When bonding materials are used the practice has been to use either some organic material—such as asphalt, tar, &c.—or some inert material, such as fire-clay, magnesia, or other equivalent materials.

The above-described methods are very unsatisfactory, for the reason that when the copper oxide is bonded together by the use of organic matter it is necessary that such organic matter be burned out, requiring the heating of the oxide to a very high temperature, and consequently making it much more dense, thereby interfering with the efficiency of the plate. When dead material—such as fire-clay, &c.—is used, it of course remains in the plate, and prevents the complete reduction of the plate, thereby decreasing its efficiency. In cases where the plate is slightly fused, as above stated, the active surface of the plate is necessarily cut down in direct proportion to the extent of the fused surface, and the density of the plate is also increased, both of which are objectionable.

Our invention has for its object to produce a plate which will be free from the objections above stated by providing a depolarizing-

plate for batteries which will be much more porous than the plates heretofore used and which will be free from inert material.

To this end our invention consists in a depolarizing-plate for electric batteries consisting of copper oxide and a bonding material which is also a depolarizer, such as chloride of copper, sulphate of copper, nitrate of copper, or other equivalent material.

Our invention also comprises a method of producing such plates.

In the manufacture of our improved plates we take a certain amount of copper oxide, to which we add a certain amount of chloride of copper or equivalent salt, the proportion used being preferably about six parts of copper oxide to one part of the chloride. The proportion may vary greatly, however, depending largely upon the quality of the plate to be produced. We prefer to produce the copper salt by adding to the copper oxide a suitable acid—such as sulphuric, nitric, or hydrochloric—depending upon the salt to be produced; but, of course, the salts may be produced in any other suitable manner. The mixture of the copper oxide and the copper chloride or other salt is then put into a mold and compressed, the pressure varying with the density of the plate to be produced, in some cases pressure as low as eight hundred pounds to the square inch being used, and in other cases as great a pressure as five thousand pounds to the square inch; but we do not desire to limit ourselves to pressure within the limits given, as the pressure may be greatly varied if desired. While the mixture is under pressure it is subjected to a gentle heat, which is not sufficient to fuse the copper oxide. In our practice we have found a temperature of from 150° to 350° Fahrenheit to produce satisfactory results. By thus heating the mixture, and at the same time subjecting it to pressure, a plate is produced which is much more porous than any heretofore used, and which is also free from inert matter, as the copper chloride or other bonding material used acts also as a depolarizer, and increases the efficiency of the plate. The dissolving of the copper chloride by the excitant is also

almost entirely overcome by mixing it with copper oxide, the result being a plate much more efficient than any heretofore produced.

Our improved plate is designed for use in connection with primary batteries in which the excitant is an alkaline or saline solution, but almost any excitant may be used which is not acid in its nature.

We are aware that copper sulphate has heretofore been used in batteries, but in such instances it has been used in a soluble or gelatinous state, and not as a component part of a solid plate, as above described.

It is obvious that our improved plate can be made of any desired form, and we therefore do not limit ourselves to making them in the form of flat plates, or to any other particular form.

That which we claim as our invention, and desire to secure by Letters Patent, is—

1. As a new article of manufacture, a depolarizing plate for batteries consisting of copper oxide, and a bonding material capable of being reduced by gas liberated by the action of the battery, the whole being formed into a solid mass, substantially as described.

2. As a new article of manufacture, a depolarizing plate consisting of copper oxide intermixed with copper chloride, the whole forming a compact solid mass, substantially as described.

3. The method of producing a depolarizing plate which consists in intermixing copper oxide and copper chloride, compressing them, and simultaneously subjecting them to a high temperature which is below the fusing point of the copper oxide, substantially as described.

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