UNITED STATES PATENT OFFICE.

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MANUFACTURE OF ELECTRICAL CONDUCTORS.

1,114,665. Specification of Letters Patent. Patented Oct. 20, 1914.

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117-169

To all whom it may concern:

Be it known that we, THOMAS B. ALLEN and LEONARD B. COULTER, residents of Niagara Falls, in the county of Niagara and State of New York, have invented a new and useful Improvement in the Manufacture of Electrical Conductors, of which the following is a full, clear, and exact description.

Our invention is designed to improve the manufacture of electrical conductors, particularly those of the ceramic type, formed, for example, by a mixture of silicon carbid, crystalline alumina, or similar materials combined with ceramic or other binder and graphite or other conducting material. Such mixtures have been formed into shape and then heated to vitrify the ceramic binder; but conductors of this class have been found to have very uneven or unequal electrical conductivities. It has also been found very difficult to produce an article having a high conductivity, since the high percentage of graphite or other conductive material seriously affects the mechanical strength of the article. Conductors formed of graphite and clay have also been tried, but are found unsatisfactory since they shatter and are otherwise destroyed when subjected to a high voltage electrical discharge. We have found that we can overcome these difficulties and produce electrical conductors having quite uniform conductivities which do not shatter under the discharge of high voltage current, by impregnating a suitable porous article with a very finely divided form of material such as graphite.

For carrying out our process we can use a large number of porous articles; and may use different forms of finely divided conductive material, such, for example, as the colloidal solution of graphite in water, commonly known as "aquadag", or the colloidal solution of graphite in oil, commonly known as "oildag", or the colloidal solution of metals which are electrical conductors. This grade of graphite is also known as "deflocculated" graphite, and is described in the United States patents of E. C. Acheson, Nos. 843,426 and 844,989. We may also use other conductive material suspended in water or other liquid vehicle.

We will now describe one specific method of manufacture which we prefer in connection with impregnating the silicon carbid articles with graphite. We take a rod consisting of 70 per cent. by weight of silicon carbid and 30 per cent. by weight of a ceramic binder, consisting preferably of feldspar and kaolin. This rod is then immersed in a colloidal solution of graphite in water containing 10 per cent. by weight of graphite. It is advisable to subject the vessel containing the rod and the "aquadag" to a vacuum or pressure or both alternately, as under these conditions a much greater degree of impregnation takes place. After standing in the solution for a certain length of time, preferably two to three hours, the rod is removed and heated to a temperature of from 350° to 400° C., in order to completely dehydrate it. The rod is then ground on its surfaces to remove the surface deposit of graphite and is then in a finished condition. As a concrete example, a rod 8 inches long, one inch diameter, treated in the manner described will be found to have an electrical resistance of substantially one hundred ohms.

The electrical resistance of the product will vary according to the porosity of the article, since the degree of impregnation is proportional to the porosity of the article. This porosity may be varied by altering the coarseness of the silicon carbid, the porosity increasing with the coarseness of the carbid. The porosity is also increased by increasing the proportion of silicon carbid to that of the binder. We have further found that the electrical conductivity of the article may be increased still further by repeating the impregnation with graphite a second or even a third or more times. In this way an article may be obtained having a very low electrical resistance. We have also found it is advantageous to coat the article with a glaze of any well known composition in order to prevent oxidation thereof by the air when raised to high temperatures.

A preferable methed of glazing the articles is as follows: The thoroughly dried article is coated with a glaze which has a composition as follows: SiO_2 120 parts by weight, Na_2O 18.6 parts by weight, MgO 6.2 parts by weight, K_2O 28.2 parts by

weight, BaO 19.9 parts by weight. The article is now heated preferably in a muffle type furnace to a temperature of approximately 700° C., which is the vitrification temperature of the glaze.

The advantages of our invention will be obvious to those skilled in the art since the difficulties with synthetic conductors of this character are obviated and a practical commercial method provided by which a conductor of high efficiency may be obtained. The articles so made have a very uniform electrical conductivity and do not shatter under the discharge of high voltage current. They are found to retain their conductivity even under continual discharge and while heated to red heats. They are therefore highly useful in, for example, the lightning arrester industry, on account of high carrying capacity.

Many variations may be made in the materials employed for the article and for impregnating it, without departing from our invention. The method of impregnating may be varied and the conducting material may be suspended in air or gases instead of in liquids.

The novel article produced by the foregoing method forms the subject matter of a divisional application.

We claim:

1. In the manufacture of electrical conductors, the steps consisting of impregnating a porous article with a colloidal solution of graphite and heating said article.

2. In the manufacture of electrical conductors, the step consisting of impregnating a silicon carbid article with a colloidal solution of an electrical conductor.

3. In the manufacture of electrical conductors, the step consisting of impregnating a silicon carbid article with a colloidal solution of graphite.

In testimony whereof, we have hereunto set our hands.

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Witnesses:
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