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GRAPHITE ARTICLE AND PROCESS OF MAKING THE SAME.

935,180.

Specification of Letters Patent. Patented Sept. 28, 1909.

No Drawing.

Application filed July 19, 1909. Serial No. 508,465.

*To all whom it may concern:*

Be it known that I, ARTHUR M. WILLIAMSON, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Graphite Articles and Processes of Making Same, of which the following is a specification.

10 This invention relates to the manufacture of electrodes or other articles consisting essentially of graphite, the object of the invention being the preparation of such articles of reduced porosity and increased electrical conductivity as compared with similar articles prepared by the graphitization of raw carbons or carbonaceous mixtures. According to the present invention these results are accomplished, without introducing into the completed article any extraneous material or foreign substance which might prove objectionable in electrolytic or electrometallurgical work, by impregnating the articles to be graphitized with a material which is itself capable of transformation into graphite, or which yields a residue capable of such transformation.

In the manufacture of graphite articles as heretofore practiced it has been customary to subject articles of carbon to extremely high temperatures in the so-called graphitizing furnace, such for example as is described in Patent No. 702,758, granted June 17, 1902, to E. G. Acheson. These articles of carbon to be graphitized have usually been prepared by molding or otherwise forming into the desired shape a mixture of ground coke, petroleum coke or other form of carbon with a suitable hydrocarbon binder, as tar or pitch, and baking the article to drive off volatile matters. Articles so prepared are necessarily quite porous, as much volatile matter has been eliminated during the baking, and this porosity persists after graphitization. It has been heretofore proposed to reduce the porosity of graphite electrodes by filling or impregnating them with paraffin, tar or the like, but this procedure has not been satisfactory in practice as such fillers are far less resistant than graphite under the usual conditions of use.

According to the present invention the carbon electrodes or other articles, prepared in any usual or approved manner and baked

to drive off volatile matters, are then impregnated throughout their mass with a carbonaceous material or a material yielding a carbonaceous residue when heated, and are thereafter graphitized, whereby not only the carbonaceous constituents of the original baked article, but the carbonaceous residue of the filling or impregnating material, is converted into graphite, such conversion being either complete or partial as may be desired. The impregnating materials are preferably such as are capable of yielding a high proportion of carbonaceous residue, as for example, coal tar pitch, coal tar, etc. Liquids containing carbohydrates, as molasses, may also be used.

As an example of the process, articles consisting of petroleum coke and a hydrocarbon binder, previously baked to drive off volatile matters, were immersed while heated in a bath of hot tar, and the tar allowed to cool. The bath was then again heated, and the articles removed and drained. These articles, together with check pieces of the same material which had not been impregnated, were then treated in a regular graphitizing furnace, with the following results:

(1) Unimpregnated carbons, after graphitizing:

Apparent density-----	1.575	
Real density-----	2.205	85
Porosity-----	28.6	

(2) Impregnated carbons, after graphitizing:

Apparent density-----	1.647	
Real density-----	2.166	90
Porosity-----	23.9	

By a more thorough and uniform impregnation of the article, as by the use of vacuum or pressure, or vacuum and pressure, as is well understood by those skilled in the art of effecting impregnation, even more pronounced results may be obtained. The resulting article or electrodes, when properly treated, consists entirely of graphite, resulting from the graphitization not only of the original carbonaceous material, but also of the carbonaceous residue of the impregnating or filling material. The article so prepared differs from graphitized electrodes or other articles hitherto manufactured in that it contains distributed throughout its mass, and in the interstices left by the expulsion by heat of the volatile constituents of the



original binder, particles of graphite derived from the carbonaceous residue of the impregnating material, this graphite conferring upon the article a decreased porosity and increased electrical conductivity as compared with articles resulting from the graphitization of unimpregnated carbons, or carbonaceous mixtures.

If desired, the impregnated carbons may be again baked to expel volatile matters before placing them in the graphitizing furnace; or the articles may be repeatedly impregnated and baked in order further to reduce their porosity.

I claim:—

1. The process of making graphite articles which consists in impregnating a previously formed carbon article with a material yielding a carbonaceous residue, and graphitizing the impregnated article.

2. The process of making graphite articles which consists in molding the article from carbonaceous materials, expelling volatile constituents by heat, impregnating the article with a material yielding a carbonaceous residue, and graphitizing the impregnated article.

3. The process of making graphite arti-

cles which consists in molding the article from powdered carbon and a carbonaceous binder, expelling volatile constituents by heat, impregnating the article with a material yielding a carbonaceous residue, and graphitizing the impregnated article.

4. A new article of manufacture, produced by graphitizing carbon articles impregnated with materials yielding a carbonaceous residue, said articles consisting essentially of graphite and characterized by decreased porosity as compared with graphitized articles prepared from unimpregnated carbons.

5. A new article of manufacture produced by graphitizing carbon articles impregnated with materials yielding a carbonaceous residue, said articles consisting essentially of graphite and characterized by decreasing porosity and increased electrical conductivity as compared with graphitized articles prepared from unimpregnated carbons.

In testimony whereof, I affix my signature in presence of two witnesses.

ARTHUR M. WILLIAMSON.

Witnesses:

ORRIN E. DUNLOP,  
WM. ACHESON SMITH.

Correction in Letters Patent No. 935,180.

is hereby certified that in Letters Patent No. 935,180, granted September 28, 1909, upon the application of Arthur M. Williamson, of Niagara Falls, New York, for an improvement in "Graphite Articles and Processes of Making the Same," an error appears in the printed specification requiring correction as follows: Page 2, line 47, the word "decreasing" should read *decreased*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of December, A. D., 1909.

[SEAL.]

E. B. MOORE,

*Commissioner of Patents.*