UNITED STATES PATENT OFFICE.

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METHOD OF TREATING POROUS MATERIAL USED FOR ELECTRICAL PURPOSES.

SPECIFICATION forming part of Letters Patent No. 656,651, dated August 28, 1900.

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To all whom it may concern:

Be it known that I, WILLIAM A. MARKEY, a citizen of the United States, and a resident of Saginaw, county of Saginaw, and State of Michigan, have invented a new and useful Improvement in Methods of Treatment of Porous Materials for Electrical Purposes, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The following description sets forth in detail one mode of carrying out the invention, such disclosed mode constituting but one of various ways in which the principle of the invention may be used.

My improved process consists in the method of treatment of porous substances used for electrical purposes whereby they are made more firm, durable, electrically more conductive, and may be caused to embody zones of varying conductivity; and it consists of a series of steps hereinafter fully described.

The porous material to be treated by my improved process is first impregnated or coated with silver nitrate, such treatment being effected by soaking the material in an aqueous solution of the nitrate or by applying pulverized silver nitrate to the material. When the aqueous solution of silver nitrate is used, the carbons are thoroughly dried at a moderate heat (below 100° centigrade) before being subjected to the subsequent steps in the process. After having been treated with the silver nitrate the material is then heated sufficiently to reduce the silver nitrate to metallic silver, the radical NO_3 being driven off. The metallic silver coats the particles of carbon, uniting them mechanically and electrically, the depth to which the silver penetrates varying with the length of time the carbons are subjected to the first step in the process.

In order to obtain a material having zones of varying conductivity, either of the following modes of procedure is adopted:

In the first mode of procedure the material is treated as above described, whereby zones of high conductivity are formed upon the outer portion of such material, the intensity of the silver impregnation produced varying inversely as the distance from the surface. The material is then divided longitudinally, such division being made through the zone of least impregnation. The two sections so obtained hence each embody a layer on one side of low and a layer on the other side of high conductivity.

The second mode of procedure is carried out as follows: The material is treated as above described to produce a structure of high conductivity, one face of such treated material being cleared of silver by floating it upon melted metal or other suitable substance. Untreated material or material of lower conductivity may then be cemented to such cleared face by means of a suitable carbonaceous substance, such as coal-tar or syrup, and the composite structure thus produced is then heated to carbonize such cementing substance. The entire structure is then treated as in the first steps in the process to obtain a thin external deposit of silver sufficient to render the outer surface highly conductive.

The process above described is particularly adapted to the manufacture of carbon brushes, such brushes being thereby made highly conductive in certain parts while retaining the high resistivity of ordinary carbons in other parts, such features resulting in economical effects hereinafter described.

The term "carbon" as herein used may designate any one of the various forms in which the element carbon occurs.

A carbon brush constructed in the above-described manner is suitable for use in a non-reversing dynamo-electric machine and is placed in the brush-holder in a manner such that the commutator of the machine will travel upon the brush-surface from the portion of high conductivity toward the portion of low conductivity—that is, the highly-conductive portion of the brush is at the heel and the highly-resisting portion of the brush is at the toe. In use the toe is cleared of the silver coating for a short distance from the commutator, as is customary with copper-plated brushes the silver coating at the heel being left intact. The breaking of the circuit or the forming of the difference of potential occurs at a point of high resistance, resulting in less sparking at such point and in a reduction of heat in the brush in the commutator and in the brush-holder attended by a corresponding gain in the efficiency of a machine using such improved brushes. The increased conductivity of brushes manufactured as above described permits of a reduction in the size of commutators and brushes, resulting in a further economical advantage in the construction of dynamo-electric machines.

For a reversing dynamo-electric machine a low-conductivity carbon would be cemented to both faces of the treated carbons, such faces having been previously cleared of the coating of silver. The brush is then coated externally with silver to obviate brush-holder contact resistance. A three-part brush having a layer or zone of high conductivity through the center is thus obtained. Such composite brush may also be constructed by treating the carbon as in the first method described, dividing same through the zone of low conductivity, and then binding the portions together with the silvered high-conductivity faces toward each other, producing, as before, a two-part brush having a zone of high conductivity through the center and zones of low conductivity on either side.

In addition to the electrical advantages arising from my improved process of manufacturing carbon brushes such brushes become more firm, durable, compact, and less friable than the ordinary graphite or carbon brush.

My improved process may be applied in the manufacture of resistances used in electrical work and in improving the connections to resistance materials.

In order to prepare the porous material so as to enable it to be soldered, I add an external coating or deposit of silver, as per description, and then I electroplate with copper. Ordinary soldering methods are then used when attaching other metals or materials.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the steps herein disclosed, provided the method or means covered by any one of the following claims be employed.

I therefore particularly point out and distinctly claim as my invention—

1. The step in a method of treating porous material used for electrical purposes which consists in uniting the particles of material with silver.

2. The method of treating porous material used for electrical purposes which consists in cementing the material particles with silver and applying an external coat of silver.

3. The method of treating porous material used for electrical purposes which consists in immersing the material in an aqueous solution of silver nitrate, then drying at a moderate heat and subsequently heating the material to a temperature sufficient to reduce the silver nitrate to metallic silver.

4. The method of treating porous material used for electric purposes, which consists in uniting the particles of such material with silver and adding an external deposit of other metal or metals.

Signed by me this 11th day of January, 1900.

WILLIAM A. MARKEY.

Attest:
EDWARD T. LINDSAY,
ROBERT K. RICHARDSON.