UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE UNITED STATES ELECTRIC LIGHTING COMPANY, OF NEW YORK, N. Y.

CARBON CONDUCTOR FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 264,986, dated September 26, 1882.

Application filed March 7, 1882. (No specimens.)

To all whom it may concern:

Be it known that I, EDWARD WESTON, a subject of the Queen of Great Britain, and a resident of Newark, in the county of Essex and State of New Jersey, have invented a new and Improved Carbon Conductor for Electric Lamps, of which the following is a specification.

Carbon conductors for incandescent lamps have heretofore been made from substances or bodies which may be considered as belonging to one or the other of two classes or groups—viz., fibrous substances, such as paper, wood, textile fabric, and the like, and non-fibrous or inorganic substances, such as retort-carbon, carbon deposited by electrically heating a conductor in the presence of a carbon-bearing vapor, graphite, &c., either singly or mixed with amorphous compounds or bodies, such as asphalt, sugar, sirup, and the like. The fibrous class possesses certain advantages which have conduced to its more general use. Carbons made from fibrous substances are flexible, of relatively high resistance, and can be readily cut and shaped from the raw material and then carbonized. On the other hand, the fibrous or cellular structure of the material impairs and reduces the density of the carbon. This density is apt to be unequal in different parts of the same carbon, and the carbon does not possess uniform resistance. Substances of the non-fibrous class are, as a rule, difficult to handle in the manufacture of carbons, particularly those intended for the conductors of incandescent lamps. The carbon made therefrom is brittle, possessing little or no flexibility, and the amorphous forms of these substances produce soft porous carbon, which is practically unfitted for use in incandescent lamps.

The object of my invention is to produce a carbon conductor adapted particularly for incandescent electric lamps, which shall be open to none of the above objections, which shall possess flexibility in a high degree, and which shall be dense, solid, and of even resistance throughout. To this end there must be employed a structureless or amorphous and homogeneous substance; but this substance must be of such a nature that it will, unlike other amorphous bodies whose use has been heretofore essayed, preserve practically unimpaired its uniform density and solidity without appreciable change, so far as concerns this characteristic in the arrangement or disposition of its component elements. I have found that these conditions are realized in a substance or compound that can be produced readily and inexpensively from cellulose, such as is easily obtainable in the form of cotton waste, linen, paper, &c., and which may be termed "non-fibrous" or "amorphous" cellulose. This material is not here claimed *per se.* I have made it and processes of manufacture by which it may be produced the subject-matter of other applications for Letters Patent of even date herewith. Inasmuch, however, as it possesses in a marked degree all the qualities which fit it for the production of carbon conductors for incandescent lamps possessing the characteristics hereinbefore specified, and as I deem it to be the substance best adapted for that purpose, I shall, in describing the manner in which my invention can practically be carried into effect, also describe the best way known to me of producing the aforesaid non-fibrous or amorphous cellulose.

If cellulose—that is to say, cotton, cotton waste, linen, or paper—be subjected to the action of a mixture of nitric and sulphuric acid, the result is a substance which, though fibrous and possessing in some other respects nearly the same physical qualities as the pure cellulose, differs radically from it, being explosive and burning without appreciable residue when out of contact with the air. This substance is commonly known as "pyroxyline," "gun-cotton," or "nitro-cellulose." By dissolving this with a mixture of ether and alcohol collodion is produced. By treating it with various other solvents—such as nitro-benzole, naphtha, camphor, and other well-known solvents—the substance known as "celluloid" is produced. Both collodion and celluloid may be formed in thin sheets and dried; but so long as the characteristics of the nitro-cellulose remain they are both unfit for the production of carbons, for the reason that they burn without residue. In order, therefore, to render them suitable for my purpose, I deoxidize them, so to speak, or,

in other words, I treat them with such chemical agents as will deprive them of their nitrous qualities and bring them back to the chemical condition of cellulose. Among such reducing agents may be mentioned ammonium sulphide, protochloride of iron, sulphate of iron, and others. The sheets of collodion or celluloid are immersed in a solution containing one or the other of the above-named agents and allowed to remain therein until they are entirely reconverted to their original chemical condition. In many other respects they resemble closely the ordinary celluloid. They become transparent, very tenacious and flexible, and carbonize slightly less readily than ordinary cellulose. From these blanks or strips are cut or stamped having approximately the shape and size desired for the carbon conductors. They are then carbonized by being packed in a closed retort or muffle between plates of refractory material and exposed to a high temperature, the preparation of the carbons being in this respect substantially the same as that commonly followed in the production of carbon conductors from fibrous substances. After carbonization the strips may be mounted and inserted in the lamps in well-known ways, no further treatment being required.

I would state that the carbons may be cut directly from sheets of collodion or celluloid and then immersed in the proper solutions until brought to the condition of carbonizable cellulose, the further treatment being the same as that described. The carbon presents a highly-polished and lustrous appearance. It is extremely flexible and elastic—much more so than any form of carbon known to me—and is tough, and not so liable to break when subjected to sudden jar or shock. Its specific resistance is relatively much higher than other kinds of carbon generally used, so that I am enabled under the same conditions to use a larger or broader carbon strip. Under the microscope it differs from other carbons in the fact that it is structureless and amorphous, being free from the fibrous structure of ordinary incandescent carbons, and also from the nodulous appearance of the carbon deposited from a carbon-bearing vapor upon an electrically-heated surface.

I have described what I believe to be the best manner of carrying my invention into effect; but I do not desire to be understood as confining myself strictly to the particular substance hereinbefore specified from which to make the carbon, nor to the specific method of producing that substance.

What I claim as my invention is—

1. A carbon conductor for incandescent lamps, possessing the characteristics herein described.

2. A carbon conductor for electric lamps, made of carbonized, non-fibrous, or amorphous cellulose, and possessing the characteristics hereinbefore set forth.

3. The process of manufacturing carbon conductors for incandescent lamps, which consists in first converting cellulose into celluloid or collodion, then treating the latter with reducing or deoxidizing agents, so as to convert the the same into non-fibrous or amorphous and homogeneous cellulose, and finally forming therefrom the conducting-strips and carbonizing the same, substantially as hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 6th day of March, 1882.

EDWARD WESTON.

Witnesses:
HENRY A. BECKMEYER,
JOHN P. DENGLER.