UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF ENGLEWOOD, AND EDWARD P. THOMPSON, OF ELIZABETH, N. J.; SAID THOMPSON ASSIGNOR TO SAID STANLEY.

CARBON FOR INCANDESCENT LAMPS.

SPECIFICATION forming part of Letters Patent No. 323,372, dated July 28, 1885.

Application filed May 12, 1883. Renewed April 17, 1885. (No specimens.)

To all whom it may concern:

Be it known that we, WILLIAM STANLEY, Jr., a resident of Englewood, in the county of Bergen and State of New Jersey, and EDWARD P. THOMPSON, a resident of the city of Elizabeth, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Carbons for Incandescent Electric Lamps, of which the following is a full and exact specification.

The object of our improvements is to provide for incandescent electric lamps a flexible carbon of high specific resistance which can be cheaply and easily produced. We accomplish this object by so treating animal fiber as to remove the nitrogen from it, and then carbonizing the resulting product in the manner hereinafter shown.

Heretofore carbons for incandescent electric lamps have been made from woody fiber, paper, card-board, or other non-nitrogenous substances, and it has been found impossible to reduce animal matter or fiber to a carbon fit for use as the incandescing conductor in such lamps, because of the presence of nitrogen in it, causing complete or partial combustion to take place before carbonization could be effected. We obviate this difficulty and convert animal fiber into a flexible carbon, dense and uniform in its structure, and peculiarly adapted for use in incandescent electric lamps, in the following manner: We use, preferably, bleached silk thread as the form of animal fiber to be treated; but other forms of animal fiber may be used, as hereinafter specified. We first form a mixture of about ninety parts, by volume, of water and ten parts, by volume, of sulphuric acid, and add to this so much sugar or other saccharine matter as the liquid will dissolve and hold in suspension. In this place the thread or other fiber to be carbonized, and let it remain for twenty-four hours, or until it becomes thoroughly saturated with the mixture. Remove the fiber from the mixture and wipe off the moisture clinging to its surface by passing it lightly between two pieces of cloth, or in any other suitable manner, care being taken that none of the solution within the fiber shall be pressed out. The thread or other fiber is then wound upon forms of such shape as it is desired the completed carbon shall be; or they may be bent into the desired shape and held in position by a suitable device. The forms upon which the fiber is wound should be made of carbon or other suitable non-combustible material. The forms with the fiber upon them are then placed in a drying-oven, which is slowly raised to a temperature of not less than about 100° and not more than about 300° centigrade, so as not to reach the point at which sulphuric acid is vaporized. The water in the fiber is evaporated by the heat, and the sulphuric acid remaining in the fiber, and growing stronger through the withdrawal of the water, attacks and carbonizes the sugar which has been taken into the fiber; as the process is gradual the sugar is not swelled in the process of carbonization. The carbonized sugar is distributed evenly throughout the filament and acts as a carbonaceous cement, making the structure more dense and compact. At the same time with the carbonization of the sugar the fiber itself undergoes a chemical change through the action of the now strengthened acid upon it. It is not necessary to state precisely the chemical transformations that take place; but it is sufficient to say that the nitrogen of the fiber is almost entirely removed from it, and the fibrine it contains is converted into new chemical combinations closely resembling one another, and all extremely poor in nitrogen—such as leucine, ($C_6H_{13}NO_2$,) glycocine, ($C_2H_5NO_2$,) and tyrosine, ($C_9H_{11}NO_3$.) In this way the hitherto nitrogenous animal fiber is converted into an essentially non-nitrogenous substance, which will not be destroyed during carbonization, as would be the case if the nitrogen originally present in the fiber were allowed to remain, but can be readily converted into a tough elastic carbon of high specific resistance. If the fiber were exposed directly to the action of pure sulphuric acid or of dilute sulphurine acid strong enough to attack it, it would be dissolved and destroyed before becoming fit for carbonization. In our process, however, as the acid is taken into the fiber in an extremely diluted form and then gradually becomes stronger, the action takes place slowly and throughout the fiber, and as there is no free liquid present in which the resulting chemical products can be dissolved they are retained in the form of the fiber. After the sugar is carbonized and the nitrogen is removed from the fiber the product is removed from the drying-oven and placed in a closed retort and subjected in a furnace to a temperature considerably higher than that necessary to carbonize woody fiber—say 3,000° Fahrenheit—till completely carbonized.

In the process of carbonization the sulphuric acid in the fiber is evaporated, and any nitrogen that may have remained in the fiber is driven off, and the result is a purely non-nitrogenous carbon. Carbons thus made are flexible, elastic, and dense, and uniform in their structure, and will withstand a very high degree of heat before combustion.

As before stated, we prefer to use manufactured bleached silk thread as the form of animal fiber from which to make our carbons, because of the great length of its component fibers, the ease with which it can be wound upon forms, that it can be obtained of the proper dimensions for carbons without mechanical treatment, and that its component fibers are amorphous in their structure. Other animal matter or fiber may, however, be carbonized after treatment in the manner specified—such as wool or woolen threads, horn, hoof, &c.

It is not essential to our process that animal matter should be saturated with the solution in the fibrous form; but it may be saturated in mass and afterward cut into the proper form for use in the lamp, and then dried and carbonized in the manner shown. We prefer, however, to saturate it in fibers of the size proper for the completed carbon.

We are aware that attempts have heretofore been made to form carbons of animal matter or fiber; but in none of these has the fiber been chemically changed to remove the nitrogen from it, or otherwise, before carbonization, as in our process.

The above described filament is not herein claimed, *per se*, as it forms the subject-matter of a separate pending application.

What we claim as new, and desire to secure by Letters Patent, is—

The hereinbefore-described process of manufacturing carbon conductors for incandescent lamps, which consists in first saturating silk thread, or other animal matter or fiber, with a solution of dilute sulphuric acid and sugar, then heating the saturated material, so as to evaporate the water and leave the acid of the solution in the fiber, and finally carbonizing suitably-formed strips or filaments thereof, substantially as and for the purposes set forth.

In testimony whereof we have hereto subscribed our names, in the presence of two witnesses, this 8th day of May, 1883.

WILLIAM STANLEY, JR.
E. P. THOMPSON.

Witnesses:
HENRY S. DEWEY,
EDW. F. MCLAUGHLIN.