

# UNITED STATES PATENT OFFICE.

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## PROCESS OF MANUFACTURING CARBON CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 247,085, dated September 13, 1881.

Application filed May 12, 1881. (No model.)

*To all whom it may concern :*

Be it known that I, HIRAM S. MAXIM, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in the Process of Manufacturing Carbon Conductors for Incandescent Lamps, of which the following is a specification.

In the usual method of manufacturing incandescent lamps the conductors are formed from blanks cut out from sheets of paper, wood, or equivalent material, which are carbonized at a high temperature in a closed muffle. The resulting carbons, while possessing in other respects many of those qualities which render them especially adapted for incandescent lighting, vary considerably in resistance, so that when included in an electric circuit they emit widely-varying intensities of light. To bring them all to the same resistance a current of electricity is caused to pass through them while surrounded by an attenuated atmosphere of hydrocarbon or other vapor, thus producing a deposit of carbon on the heated portions of the strips, which is kept up until the resistance of each individual strip is brought to a predetermined standard.

It is very necessary that all parts of the carbon conductors should be treated alike, so as to be as nearly homogeneous as possible; but with all the previously-adopted methods of manufacture this prerequisite is only partially attained, for the reason that the enlarged or widened ends retained by the clamps in the carbon-depositing receiver are not heated as much as the slender portion of the conductor, besides being nearly, if not quite, covered by the clamps. The narrow portion alone, then, of the strip receives the deposit of carbon, while the ends are left in their original condition. Now, it is very essential that the enlargements at the ends should be of considerable length, in order that the retaining-clamps may be protected from heat, and it is equally essential that these ends should be of the same quality of carbon as the remainder of the strip.

To produce a carbon in which these conditions are fulfilled is, then, the object of my present invention, which consists of the following steps, performed in the order indicated.

I first cut out from sheets of wood, paper, or other proper fibrous material, straight, narrow strips, which are packed in a muffle and carbonized in the same manner in which the blanks are commonly treated. After being thoroughly charred the strips are placed in a closed receiver from whence the air has been exhausted and an attenuated atmosphere of hydrocarbon or similar vapor substituted, and an electric current passed through them sufficient to heat them to a bright red. In this condition they are allowed to remain until, by the deposition of the surrounding particles of carbon, their resistance, as indicated by a galvanometer, is reduced to a predetermined standard. From the strips thus prepared the conductors are cut in a variety of ways—as, for instance, one or more of the sheets may be confined between gage-plates and the projecting portions of the carbon cut or filed away. This may be done without injury to the strips, from the peculiar nature of the carbon, which is hard and tough when prepared by the above-described process. It is evident that in this way a conductor is obtained in which all portions have been subjected to the same treatment and possess the same relative resistance, resilience, and tenacity. The broadened ends may be cut as long as is necessary to protect the clamps from heat, so that copper and other metals than platinum may be used for the supporting-wires of the carbons.

If the character of the lamp for which the conductors are designed be such as to make a loop or arch shaped carbon desirable, they may be bent to this form after being prepared by the process described, and then given a permanent set by passing a strong current through them while bent.

In a previous application I have described a method of producing the carbon conductors of incandescent lamps, in which the said conductors were cut from sheets of carbonized wood or paper and then treated in the usual manner by a current of electricity passed through them while surrounded by an attenuated atmosphere of hydrocarbon vapor. This method, however, differs essentially from the present, and I lay no claim to it in this application.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

5 The process of manufacturing carbon conductors for incandescent lamps by first carbonizing thin sheets or strips of fibrous material, then heating the same in a carbonaceous gas or vapor until their electrical resistance is reduced to a predetermined standard, and,

lastly, cutting or otherwise forming from the 10 said sheets the conductors of the desired shape, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand this 10th day of May, 1881.

HIRAM S. MAXIM.

Witnesses:

W. M. ALLAIRE,  
PARKER W. PAGE.