(Model.) 2 Sheets—Sheet 1.

A. BERNSTEIN.

CARBON FOR INCANDESCENT ELECTRIC LAMPS.

No. 280,341. Patented July 3, 1883.

Fig. 1ª.

Fig. 2.

Fig. 3.

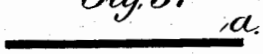

Fig. 4.

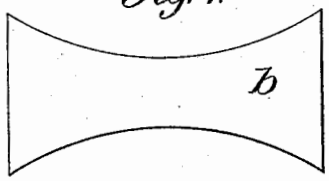

Fig. 1.

Witnesses.
J. H. Cheever.
Geo. Willis Pierce

Inventor
Alex. Bernstein,
by his Attorney,
Thos. D. Lockwood

(Model.) 2 Sheets—Sheet 2.

A. BERNSTEIN.

CARBON FOR INCANDESCENT ELECTRIC LAMPS.

No. 280,341. Patented July 3, 1883.

Fig. 5.

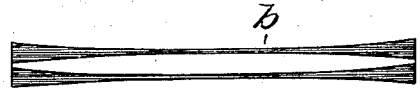

Fig. 6.

Witnesses.
Geo. Willis Pierce
D. E. Richards

Inventor:
Alex. Bernstein,
By his Attorney,
Thos. D. Lockwood

UNITED STATES PATENT OFFICE.

ALEXANDER BERNSTEIN, OF BOSTON, MASS., ASSIGNOR TO THE BERNSTEIN ELECTRIC LIGHT MANUFACTURING COMPANY, OF SAME PLACE.

CARBON FOR INCANDESCENT ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 280,341, dated July 3, 1883.

Application filed February 14, 1883. (Specimens.)

To all whom it may concern:

Be it known that I, ALEX. BERNSTEIN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Processes of Manufacturing Carbons for Electric Lamps, of which the following is a specification.

My invention relates to the process of manufacture of suitable light-giving conductors for use in the class of electric lamps known as "incandescent" lamps, in which light is produced by the incandescence of a continuous conductor.

In Letters Patent issued to me January 30, 1883, I have described and claimed the construction of incandescent electric lamps, in which a carbon tube is used as the light-giving body, and I have explained therein the conditions under which such tubes can be made to operate successfully and be satisfactorily maintained in incandescent lamps. The subject-matter of my present application is a suitable and improved process for the manufacture of such tubes. It is self-evident that organic substances which are naturally of the shape of a hollow cylinder—such, for example, as the different varieties of straw—may for this purpose be carbonized; or a metal or carbon cylinder may be taken as a nucleus and carbon deposited thereon by means of the decomposition of carbon compounds, after which the metal cylinder may be dissolved in acid or the carbon cylinder bored out. None of these methods of manufacture, however, have proved to be completely successful or have given entire satisfaction.

By the improved method which I am about to describe, and which is illustrated by the accompanying drawings, this is attainable. I take a fibrous organic substance, which may be obtained in different ways—in the case of textile fabric, for example, by weaving or by compression, as in the case of paper or similar substances. This I cut into sheets of suitable size and shape, the latter being preferably rectangular, as shown in Fig. 1. Inasmuch as I have by practical experience demonstrated that a certain kind of paper is best adapted for this purpose, I shall hereinafter speak of paper. The sheets of paper are cut into suitable shape, after which I roll them on a cylindrical mandrel, as represented in Fig. 1ª, which shows the sheet of paper partly rolled up, making one or more layers of paper, according to the thickness desired in the walls of the tube. The inner side of the paper is covered with gum, solution of starch, sirup, or similar substances, by which the layers of paper are cemented together, and which readily carbonizes when heated in a furnace. I then withdraw the mandrel and obtain a cylinder of paper having a longitudinal cross-section similar in form to that shown by Fig. 6. Inasmuch as my object is to provide a carbon which has a large light-giving or radiating surface and a small cross-section, it is by no means essential that the carbon should have an even diameter, although I consider the cylindrical form to be preferable. I now carbonize the paper cylinder in a furnace in the usual way—*i. e.*, by embedding it in a closed vessel of suitable material filled with plumbago, powdered charcoal, or other air-excluding powder, and subjecting the whole to a white heat. In this way I am enabled to obtain the desired result—a hollow carbon cylinder of very homogeneous character and of great density, which has the appearance represented by Fig. 3. I may make such cylinders of any desired length, and break or cut them up to size readily, since they have no tendency to split or fracture longitudinally at the point of separation. The amount of contraction or shrinkage under the process of carbonizing is considerable. A paper cylinder two inches and a quarter long and one-eighth of an inch in diameter will contract in length to one inch and three-quarters and in diameter to five sixty-fourths of an inch. If it appears desirable to have the ends of the carbon tube thicker than the intermediate portion, small layers of paper may be used and rolled over the ends in order to increase the thickness thereof; or I may form a carbon cylinder with ends which have thickened walls from a single sheet of paper or such textile fabric as silk by cutting the crude material into a sheet shaped as in Fig. 4, and rolling it lengthwise upon the mandrel. It will when

so rolled assume externally an approximately cylindrical form, and its longitudinal section would present an appearance similar to Fig. 5, which, however, is drawn upon an enlarged scale, the walls at the ends being thicker than at the middle of the cylinder, the additional end layers being added partly to the external surface. As hereinbefore indicated, the cylinder thus formed is carbonized, retaining its form, but being by such carbonization greatly reduced in size. The different stages of the cylinder of uniform thickness are all for distinction designated by the letter *a*, those with thickened end walls by the letter *b*.

In Figs 5 and 6 the size and thickness of the prepared cylinder are considerably magnified; but this is merely for greater clearness in illustration, and is not material.

I do not herein broadly claim a tubular conductor for an electric light, as I am aware that such a conductor has heretofore been proposed, and is referred to in English Patent No. 4,405 of 1881.

Having now fully described my invention, I claim—

1. The method or process of manufacturing hollow carbons for incandescent electric lamps by cutting suitable organic substances—such as paper—into sheets of suitable size, rolling the same into the desired form, and then carbonizing the paper cylinders thus produced.

2. The hereinbefore-described method of manufacturing hollow carbons for use in incandescent electric lamps, consisting in rolling sheets of paper into a cylindrical form by means of suitable cores or mandrels, and then withdrawing the mandrels and carbonizing the paper cylinders, substantially as specified.

3. The hereinbefore-described process of forming or manufacturing hollow carbons for incandescent electric lamps, which consists in cutting textile fabrics or paper into sheets of the desired shape and size, covering one side of the said sheets with suitable carbonaceous cement, and then rolling the said sheets into the desired form, and then carbonizing them, whereby a hollow carbon of great density and homogeneity is produced, substantially as specified.

4. A tubular light-giving conductor for an incandescent electric lamp made of a carbonized paper or carbonized textile fabric.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 31st day of January, 1883.

ALEX. BERNSTEIN.

Witnesses:
GEO. WILLIS PIERCE,
J. H. CHEEVER.