

UNITED STATES PATENT OFFICE.

HUBERT HENRY GRUBBE, OF LONDON, ENGLAND, ASSIGNOR OF ONE-HALF
TO CHARLES HORACE BENTON, OF SAME PLACE.

PROCESS OF MAKING INCANDESCENTS.

SPECIFICATION forming part of Letters Patent No. 323,319, dated July 28, 1885.

Application filed December 12, 1883. (No specimens.)

To all whom it may concern:

Be it known that I, HUBERT HENRY GRUBBE, of London, England, have invented certain new and useful Improvements in the Manufacture of Incandescent Electric Lamps, of which the following is a specification.

Before describing my invention I will briefly review the state of the art as most nearly related to it.

Carbon filaments for incandescent lamps have been heretofore made both from inorganic substances—as retort-carbon, carbon deposited from a hydrocarbon vapor on a heated conductor, and the like—and by carbonizing organic or structural substances. The organic substances may be divided into two classes—those of a fibrous character, or wherein the original organic structure is preserved, and those of a non-fibrous or homogeneous character, or in which the original organic structure is destroyed by chemical treatment. With both classes of organic substances it has been customary to employ to a greater or less extent the process of parchmentizing—that is, the treatment of the organic substances with acid, usually sulphuric acid, which softens the cellulose and converts it into a substance which, on being dried, resembles parchment.

In preparing the incandescing conductor of fibrous organic substances, various methods have been followed. According to one method, bibulous paper has been parchmentized by dipping in sulphuric acid, and then being cut into strips, carbonized by placing it in a closed refractory vessel, covering it with carbon-powder or other oxygen-excluding powder, and subjecting it to an intense heat. According to another method, cotton thread has been used, which, after being dipped in acid, has been thickened at the clamping ends of the filament by wrapping them with paper or thread, and then dipping these enlarged ends in the acid, and finally carbonizing as before. Substantially the same processes have been followed with various other fibrous substances of vegetable origin, among others wood, rat-tan, and certain vegetable fibers.

In preparing the incandescing conductor of non-fibrous or homogeneous organic substance, several different methods have been followed,

mainly based upon the action of acids upon cellulose, whereby the vegetable structure or fiber is dissolved. By one method vegetable fiber (cellulose) is treated with nitric and sulphuric acids, forming nitro-cellulose. This is dissolved by nitro-benzole, naphtha, or camphor, forming celluloid, and this is deoxidized or deprived of its nitrous elements, and thereby rendered a non-structural cellulose, which is formed into sheets, from which sheets the filaments are cut, and the latter are then carbonized. Another method consists in pressing a pasty mass of dissolved cellulose through a small orifice, thereby forming it into a slender filament which is subsequently carbonized. The enlarged ends on this filament are formed by softening the ends by dipping in a solvent and then molding to them pieces of cellulose. Sheets of dissolved cellulose, or compounds of which cellulose forms a part, have been dried and cut into filaments which have then been carbonized, being sometimes first parchmentized. When the sheets have been inaccurate, it has been proposed to scrape them by passing them through scraping or shaving dies.

My present invention relates to the processes of preparing the incandescing conductor, wherein the fibrous or structural cellulose is employed, the vegetable fiber remaining intact during the operation and existing in the completed filament. My improved method is characterized by the softening of the vegetable fibers, or of the portion thereof destined to form the luminous filament by means of a suitable solvent, and then reducing and compacting the softened fibers by drawing the same through a die or dies. The fibers so treated are then carbonized by the usual baking process, and have carbon deposited on them in the usual manner.

In carrying out my invention I employ, by preference, the fiber known as "Mexican fiber;" but many other vegetable fibers will answer the purpose, as will be well understood. I immerse such portion of the length of the fiber as is required to form the filament in some suitable solvent or softening liquid, in order to soften or partially dissolve the fibers. I prefer an acid solution consisting of two parts of sulphuric acid to one part of water. The dura-

tion of the immersion will vary according to the character and strength of the solution and the character and thickness of the fiber. The effect of this immersion is to dissolve away or
 5 destroy a portion of the outer texture of the fiber and render it soft and capable of being compressed or compacted. On removing the fiber from the solvent I wash it in water. I
 10 next proceed to draw the softened fiber through dies, in order to compact it and reduce it to a uniform diameter and density. It is best to grasp the fiber by those portions of its length which have not been immersed in the solvent, and which are therefore still hard, and, using
 15 a divided die, place the fiber in the die, bring the opposite portions thereof together, confining the fiber between them, and then draw the fiber through the die after the manner of wire drawing. The action of the die is to compress
 20 and compact the portion of the fiber which has been softened by the acid solution, removing any irregularities that may exist. If necessary, two or more dies of different gages may be employed, the fiber being passed through
 25 them successively, the smallest die corresponding to the diameter required in the filament.

The fiber thus prepared is very dense and very uniform in texture and diameter. It is completed to form the filament by baking or
 30 carbonizing in the well-known manner, and then, by preference, has a deposit of carbon formed upon it by being heated in a hydrocarbon vapor. The finished filament is dense, tough, and elastic, retains the fibrous structure of the fiber from which it was made, and
 35 possesses a uniform electric conductivity and a high specific resistance, the particular resistance desired being readily obtained by the use of a larger or smaller die for the final drawing.
 40 ing.

It will be observed that in using sulphuric acid for softening the fiber the outer or surface portion of the cellulose constituting the vegetable fiber is parchmentized; but this result, while advantageous, is not essential to my
 45 invention, as any solvent or softening substance or solution may be used which will act sufficiently upon the harsher outer portions of the fiber and soften the same preparatory to

drawing through dies without so weakening or injuring the fibrous structure as to cause it to give way during the drawing operation.

My method of drawing a softened vegetable fiber through dies is to be clearly distinguished from the method of forcing a pasty mass of
 55 unstructural cellulose through a small perforation, whereby it is pressed out into a slender thread, substantially as in making "vermicelli." It is also to be distinguished from another method which has been proposed
 60 in the manufacture of incandescing filaments, and which consists in the drawing of fibers (not previously softened) through a round hole, in order to remove from them a superfluity of oil and lamp-black, with which they
 65 have been coated.

I make no claim to a flexible carbon filament formed of carbonized parchmentized cellulose; nor do I claim the method of forming such a filament by carbonizing parchmentized cellulose and reducing the material to the proper size and shape, as these features were known prior to my invention; but

What I do claim, and desire to secure by Letters Patent, is—

1. The improved method of preparing carbon filaments for incandescent electric lamps, which consists in softening vegetable fibers by immersing in a solvent liquid, then drawing the softened fiber through a die or dies until
 80 reduced to the desired diameter, and then carbonizing the same, substantially as specified.

2. The improved method of preparing carbon filaments for incandescent electric lamps, which consists in softening vegetable fibers by
 85 immersing in a solvent liquid, then drawing the softened fiber through a succession of dies until reduced to the desired diameter, then carbonizing the same, and finally depositing carbon thereon, substantially as set forth.
 90

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HUBERT H. GRUBBE.

Witnesses:

JOHN C. NEWBURN,
 GEORGE C. BACON.