

# UNITED STATES PATENT OFFICE.

ROBERT DICK, OF GLASGOW, SCOTLAND.

## MANUFACTURE OF INCANDESCENTS.

SPECIFICATION forming part of Letters Patent No. 349,572, dated September 21, 1886.

Application filed April 30, 1886. Serial No. 200,748. (No specimens.) Patented in England March 10, 1885, No. 3,115.

*To all whom it may concern:*

Be it known that I, ROBERT DICK, a subject of the Queen of Great Britain and Ireland, and residing at Glasgow, Scotland, have invented certain Improvements in the Manufacture of Carbon Filaments for Incandescent Lamps, and of which the following is a specification.

In the manufacture of carbon filaments for incandescent lamps a large proportion of the filaments are damaged or destroyed in the process of carbonization, and by manipulation during the operation of preparing and connecting or fixing them in place in the lamps.

The object of my invention is to produce these carbon filaments of so much greater strength and density that they will not only withstand the necessary handling in their preparation and securing them in the glass globes of the lamps and to their conducting-wire better than the filaments prepared in the ordinary way, but this will also enable them to be made so much less in diameter for equal durability, and have less resistance, that an electric current of less intensity will be required to give an equal light, which will also save considerable loss of energy in power or electricity.

According to my invention I form carbon filaments from strands of silk, cotton, or other fibrous substances, or from strips of paper or parchment, or of woven fabrics, or of other materials employed for the purpose. I find also some of the natural grasses and the fibers of the bass-tree to answer well, and, by preference, use the fibers of the kitool plant. In using this (or any other of the natural vegetable or grass fibers) I first draw the fibers through fine steel drawing plates or dies, as wire is usually drawn, only with sharp cutting-edges, to a uniform parallel size. These prepared or sized fibrous strands, threads, or strips I introduce or pass into or inclose within fine tubes of copper or other soft or ductile metal, prepared or drawn as such tubes are usually made for watch-makers, jewelers, opticians, and others, preferably first drawn on fine polished wires of a size that when these are withdrawn the fibers could easily be inserted, and all to the desired sizes and length to suit the prepared strands or fibers, the

fibers being much longer than the copper at this stage, to allow of the copper tube being drawn over the fiber. I afterward draw down these tubes, with the fibrous material in them, through dies, compressing-rolls, or otherwise, to reduce their diameter, and thereby compress the materials within the tubes to the desired density. The compressed tubes, with the filaments thus formed in them, are then cut into suitable lengths and bent or shaped approximately to the desired form the carbons are intended to retain in the lamps, which admits of their being rolled into spirals or other shapes not possible in the manufacture of carbons as heretofore made, in which state they are carbonized within the tubes under pressure by heating them to bright redness in a crucible or muffle of ground plumbago or other carbonaceous matter, in the ordinary way. After this carbonization of the filaments the copper tubes or other metallic coating is removed from the greater part of their length, or wholly removed by immersion in nitric acid, or by electrolysis, or by other well-known means, such as by melting. Part of the metallic coating may, however, be left at the ends to serve as a convenient means of connecting the filaments to the conducting-wires of the lamp by soldering, screwing, or clamping; or the filaments may be connected in the usual manner by carbon cement.

The employment of the metallic tube serves the purposes of compressing the material forming the filament placed within it, and of maintaining the pressure and shape during the carbonizing process. The advantages obtained by this compression of the carbon-forming material during its formation and carbonization are many: First, it strengthens the filament mechanically; second, it enables the carbon to give a high specific amount of luminosity per unit of energy expended on it in the lamp, thus rendering this carbon filament a very durable and economical medium in incandescent lamps for electric lighting.

I am aware of the Wollaston experiment for drawing down platinum wire by inclosing the wire before the drawing process within a thicker silver wire, and, after the drawing process, dissolving the silver away by nitric acid, as described in Ure's Dictionary, vol. 3, page 1040, published 1860. An important

feature of my process, however, is the carbonizing of the material while in the tubes.

What I claim is—

1. The mode herein described of making carbon filaments for incandescent electric lamps, said mode consisting in compressing the fibrous or other material within ductile tubes, carbonizing the material within the tubes, and finally removing the latter, substantially as set forth.

2. As an improvement in the manufacture of carbon filaments for incandescent electric lamps, the mode of preparing the filaments by compressing the fibrous or other material within metal tubes and carbonizing the said material within the tubes under compression, as set forth.

3. The mode herein described of making carbon filaments for incandescent electric lamps, said mode consisting in drawing ductile metal

tubes over the fibrous or other material to compress the latter, carbonizing the material within the tubes while under compression, and finally removing the tubes after carbonization by acids, electrolysis, or melting, substantially as specified.

4. The herein-described article for the manufacture of carbon filaments for incandescent lamps, consisting of carbonized fibrous or similar material compressed within a ductile metal tube, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT DICK.

Witnesses:

W. R. M. THOMSON,

JOHN SIME,

*Both of 96 Buchanan Street, Glasgow, Scotland.*