(No Model.)

F. SCHAEFER.

MANUFACTURE OF FILAMENTS FOR INCANDESCENT LAMPS.

No. 320,297. Patented June 16, 1885.

Fig. 1.

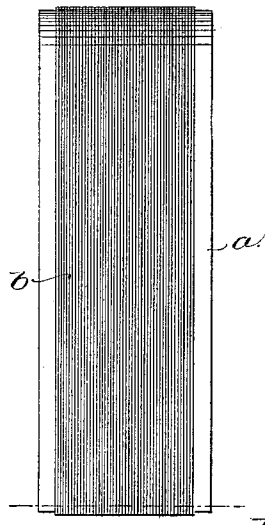


Fig. 2.

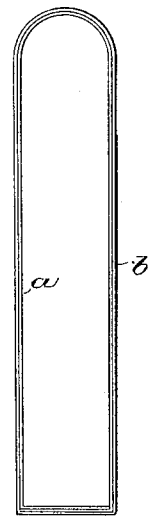


Fig. 3.

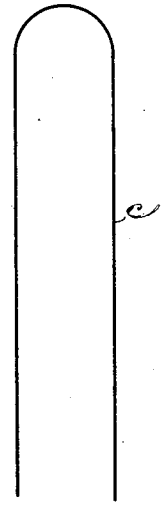


Fig. 4.

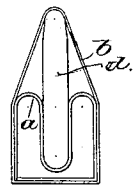
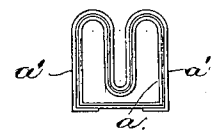


Fig. 5.



Witnesses,
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by Crosby & Gregory attys.

UNITED STATES PATENT OFFICE.

FREDERIC SCHAEFER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO LEOPOLD SCHLEGELMILCH, TRUSTEE, OF SAME PLACE.

MANUFACTURE OF FILAMENTS FOR INCANDESCENT LAMPS.

SPECIFICATION forming part of Letters Patent No. 320,297, dated June 16, 1885.

Application filed November 26, 1884. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC SCHAEFER, of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Manufacture of Filaments for Electric Lamps, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The object of this invention is to facilitate and cheapen the manufacture of filaments for electric lamps, as well as to improve the product. As heretofore usually practiced, the filaments, which are very slender and delicate, and require careful handling, have been shaped and carbonized singly, each one having a separate mold or occupying a separate recess in a compound mold to retain it in the proper shape while being carbonized; or they have been carbonized on a solid unyielding former made of carbon or graphite.

In accordance with my present invention, a large number—several hundreds, if desired—of filaments may be shaped and carbonized at a single operation and in a very short time.

In accordance with my invention, filaments to be carbonized are wrapped or wound about a flexible or yielding former, preferably while the said former is held upon or supported internally by a mold shaped to correspond in cross-section with the shape desired for the carbonized filament, the said former, the filaments having been wound thereon, being removed from the mold and then placed in a retort or crucible, where the former and the filaments thereon are subjected to heat and carbonized, the said former within the filament carbonizing and shrinking in unison with the filaments, thus obviating all strain upon the same, leaving the carbonized filaments unbroken upon the carbonized former, ready to be cut off as desired.

In accordance with my invention, the former is composed of paper, cloth, or other material which will carbonize substantially in unison with or shrink to substantially the same degree as the thread filaments when the latter are being carbonized. I select for the production of my former a carbonizable flexible material, in order that it may be bent into any desired shape, and if the material selected is not sufficiently stiff to retain its shape it may be stiffened by stiffening material—such as wax—so as to retain the shape given to it. The thread to be carbonized will preferably be wound on the former in successive turns, the thread being laid evenly and parallel, one turn by the side of the other. After carbonizing the former and the thread thereon the said thread may be cut or divided at proper places to enable the carbonized filaments to be removed as needed for use. If desired, the filaments may be retained on the light-weight carbonized former for storage or transportation.

Figure 1 is a side elevation of a former provided with a continuous thread or a series of turns of thread for the manufacture of filaments in accordance with this invention; Fig. 2, an end elevation thereof; Fig. 3, a side elevation of one of the finished filaments, and Figs. 4 and 5 modifications showing the method of producing filaments of other shapes.

The yielding carbonizable former *a* may be made of the shape desired for the finished filaments, it being formed or shaped over a suitable mold or die, which may be of wood or of any desired material. The yielding former *a* is itself composed of paper or cloth or similar flexible carbonizable material which may be easily shaped, and which is sufficiently stiff, or may be provided with stiffening, to cause it to retain its shape when the former is removed from the mold. Upon the said yielding carbonizable former *a* is wound a thread, *b*, of silk, cotton, or other material, of greater or less length, suitable for carbonizing and forming a carbon filament, the said thread, either before or after winding, being subjected to the usual processes practiced in preparing the same for carbonizing—such, for instance, as saturating with sirup and applying pulverized carbon or other materials usually employed, although dry thread may be used without other material. The successive turns of the thread *b* are laid close to one another, so that they are substantially parallel and all of the same shape, and the entire series or turns of thread, together with the yielding former *a* after it shall have been removed from the mold, is subjected to the usual carbonizing process by being embedded or inclosed in pulverized carbon or surrounded with pieces of carbon in an air-

tight box or crucible and subjected to strong heat, and, owing to its nature, the yielding former, which is carbonized at the same time as the thread, shrinks or contracts in unison with it. When thus carbonized, the successive turns of the thread *b* may be broken or cut and separated from one another and from the former, each of the said turns forming a complete filament, as shown at *c*, Fig. 3, the entire series being of uniform size, shape, and quality; or the threads upon the former as they are may be shipped at once. The former, as the thread is carbonized, permits the thread to contract and prevents it from breaking.

This method may be employed for making filaments of any shape. When, however, the filament contains re-entering portions, as employed in some kinds of lamps, the former *a*, made, as hereinbefore described, of proper shape to fit the interior of the filament, will be provided, as shown in Fig. 4, with a block or support, *d*, over which the thread *b* will be wound, leaving each turn of the thread of sufficient length to fit the exterior of the former *a*, after which the block *b* will be removed, and an outside carbonizable former, *a'*, (see Fig. 5,) corresponding in shape to the outline of the inner former; *a*, will be applied to thus retain the thread close upon the surface of the former *a*, the said thread being carbonized while held between the inside and outside carbonizable formers, *a a'*, as before described.

A carbonizable former, *a*, may be shaped at both ends like the rounded end of the one shown in Fig. 1, the thread after it shall have been carbonized being severed midway between the ends of the former, so that each turn of the thread around the former makes two complete filaments.

The filaments when thus made may be placed in a lamp-globe and be connected with platinum or other conductors passing out through the same in any suitable or usual manner.

I do not claim a metallic former, nor a former containing metal in any way, for the heat necessary to properly carbonize the thread is greater than that required to melt all metals, and therefore the metal would melt before the carbonizing of the thread was completed; nor do I claim carbonizing a filament on a rigid or on a carbonized former of any shape.

I claim—

1. That improvement in the art or method of manufacturing filaments for electric lamps which consists in laying a thread over a yielding carbonizable former, the said former receiving its shape from a mold, which is removed from the former after the thread has been wound thereon, then simultaneously carbonizing the thread and former, whereby the molecular structure of the thread or filament is in no way subjected to a strain, the former yielding in the carbonizing process, thus obviating the breaking of the filaments, substantially as described.

2. That improvement in the art or method of manufacturing filaments for electric lamps which consists in laying a thread in a series of turns over the surface of a yielding carbonizable former, and simultaneously carbonizing the thread and former located within it, thus preserving the thread upon the former in a convenient form for shipment, substantially as described.

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

FREDERIC SCHAEFER.

Witnesses:
JOS. P. LIVERMORE,
W. H. SIGSTON.