No. 683,085. Patented Sept. 24, 1901.

W. L. VOELKER.

MANUFACTURE OF FILAMENTS FOR INCANDESCING ELECTRIC LAMPS.

(Application filed July 30, 1900.)

(No Model.)

Fig. 1.

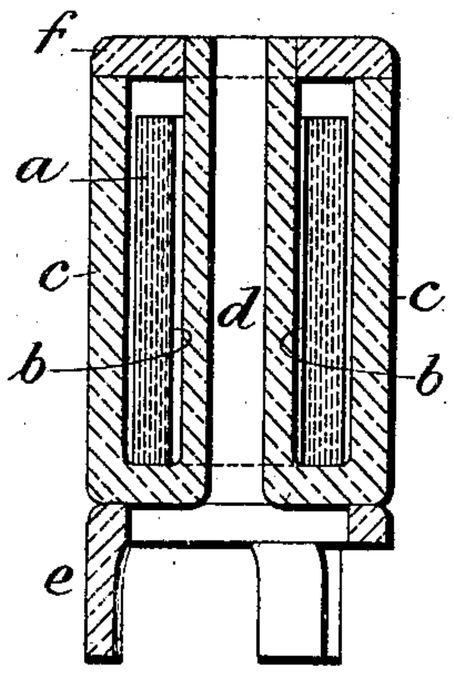


Fig. 2.

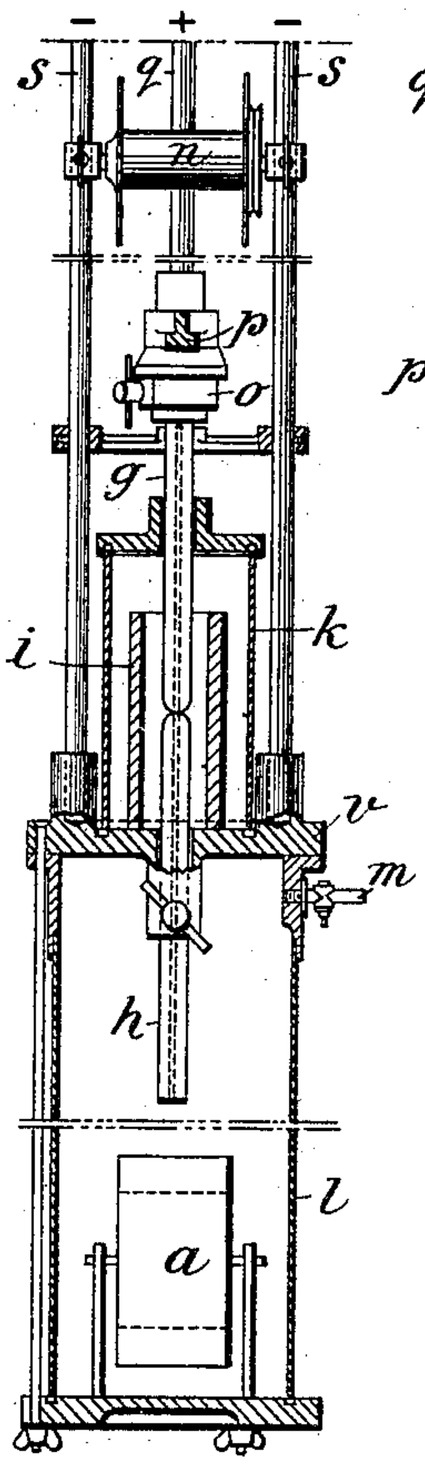


Fig. 4.

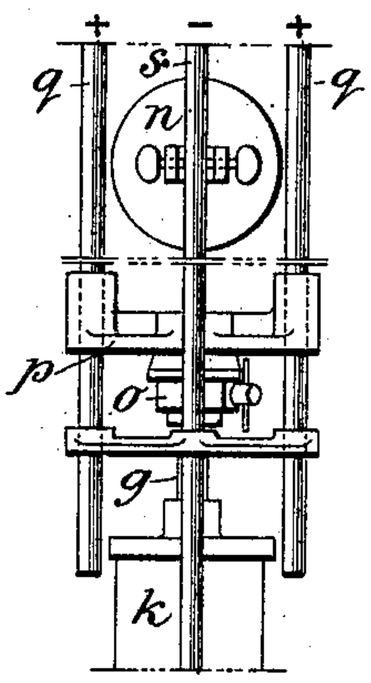


Fig. 5.

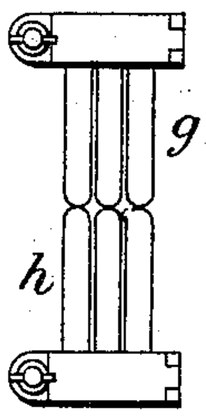


Fig. 3.

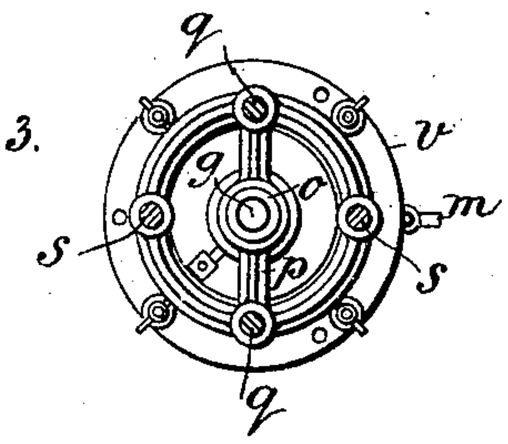
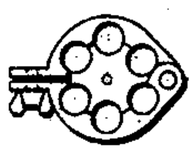


Fig. 6.



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MANUFACTURE OF FILAMENTS FOR INCANDESCING ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 683,085, dated September 24, 1901.

Application filed July 30, 1900. Serial No. 25,337. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM LAWRENCE VOELKER, a citizen of the United States of America, residing at 42 Bernard street, Russell Square, London, England, have invented new and useful Improvements in the Manufacture of Filaments for Incandescing Electric Lamps, (in respect whereof I have applied for a patent in Great Britain, to bear date June 22, 1900, No. 11,344,) of which the following is a specification.

This invention relates to the manufacture of carbid filaments from threads or fibers of some carbonizable material capable of absorbing or otherwise taking up the salt of the metal—such as uranium, titanium, zirconium, or beryllium—which is to be combined with the carbon in the formation of the carbid.

In the accompanying drawings, Figure 1 is a vertical section of a crucible adapted for the reception of the spooled thread or filament during the carbonization of the filamentous foundation and the conversion of the metallic salts into oxids. Fig. 2 is a vertical section of apparatus for use in passing the carbonized thread or filament through an electric arc. Fig. 3 is a corresponding plan, and Fig. 4 a side view, of the upper portion of the said apparatus. Figs. 5 and 6 illustrate in elevation and plan a multiple-electrode arc-producing device.

In carrying out my improved process any kind of homogeneous fiber capable of being converted into carbon by the aid of heat may be employed—as, for example, a long-fiber cotton thread or a filament formed by forcing cellulose while in a viscous condition through a die. The thread or filament having been rendered chemically clean in any of the ways known to chemists is soaked in a solution of the salt or salts of the metal or metals intended to form the metallic base of the carbid. The salt or salts should be of a readily-decomposable kind, such as the acetate or cyanid. After soaking the thread or filament is well dried and then spooled. Where the salt has been prepared with a mineral acid and acts deleteriously on the carbon at a high temperature, the thread or filament should be ammoniated in order to convert the salt into an oxid.

The spooling of the thread or filament may be conveniently effected on a cylinder of paper, a strip of thin rice-paper being interposed between each layer as it is wound on. The required quantity having been wound, the spool is placed in an oven and well dried at a temperature which will not char the thread or filament. The spool is then placed in a crucible and well packed with powdered sugar-carbon and with powdered carbid of the kind to be produced.

a is the spool of thread or filament, and *b* the cylinder of paper whereon the same is wound. The spool is arranged in the crucible *c* upon a hollow core *d*, formed integral with the crucible. The object of the hollow core is to insure a proper distribution of the heat about the spool and to prevent unequal shrinkage of the filament, the crucible being placed upon a kind of grid *e* with a view to facilitating access of the heated gases to the central duct formed by the hollow core *d*. The crucible having been carefully sealed by means of the cover *f* is then placed in a suitable furnace—such, for instance, as that known to metallurgists as an "American gas-furnace" or a Siemens regenerative furnace—and the temperature gradually raised to an intense white heat, with the effect that the filamentous foundation becomes carbonized and the metallic salts converted into oxids. The furnace having been allowed to cool slowly and the spool removed therefrom, the end of the carbonized thread or filament is next passed through two longitudinally-perforated carbon electrodes *g h*, mounted axially in line with one another and capable of being moved apart, or several carbon pencils may be arranged about a central passage through which the filament is led, (see Figs. 4 and 5,) the carbons being connected in such a manner as to produce a multiple arc. The space to be occupied by the arc is in either case immediately surrounded by a cylinder *i*, composed of the metal intended to form the metallic base of the carbid or composed of the carbid itself, this cylinder being in turn inclosed within a tight-fitting globe or vessel *k*, formed of glass or of the same substance as the cylinder. A small electric arc is struck between the extremities

of the carbons *g h*, so as to produce a high-heating effect without much pressure, the globe or vessel *k* being meanwhile charged with hydrogen or carbureted hydrogen or with vapor of a hydrocarbon or of the metal intended to form the metallic base of the carbid. The spool *a* is preferably mounted in a gas-tight container *l*, to which the hydrogen or other gas is admitted by way of a cock *m*, the said gas passing from the container *l* through the perforation in the carbon *h* into the interior of the cylinder *i* and globe or vessel *k*. The extremity of the carbonized thread or filament having been passed through the carbon electrodes and carried to a drum or reel *n*, the thread or filament is drawn through the electric arc at a speed depending upon the strength of the current. The carbid resulting has a metallic appearance, and although of a highly-crystalline nature may when cut into the required lengths be readily bent into horseshoe form and mounted in incandescing-lamp globes in the ordinary manner. The temperature which should be employed at the final stage of converting the filament into carbid will vary slightly when working with different kinds of metals. The temperature appropriate may, however, be determined by that at which incipient fusion of the metallic oxids takes place.

The function of the cylinder *i* is twofold—first, to retain the heat generated by the electric arc, and, secondly, by vaporization of the substance of the cylinder to furnish the metal to be combined with the carbon of the filament in the formation of the carbid. The hydrogen or other gas admitted into this cylinder becomes charged with the vapor of the metal composing the cylinder, the latter being thus conveyed to the carbon of the filament and combining therewith forms, under the influence of the intense heat of the electric arc, a carbid. The gases mentioned may, so far as regards their mechanical functions, be considered as equivalents. The gas serves in every case to displace oxygen and at the same time to convey the base metal in the form of vapor to the carbon of the filament. This function prevails whether the metalliferous vapor be supplied as such or whether it be obtained by vaporizing the surrounding cylinder. From a chemical point of view, however, the several classes of gases mentioned cannot be regarded as equivalents. It is well known that hydrogen is a powerful reducing agent. It is also well known that hydrocarbon gas or vapor when subjected to a high temperature becomes decomposed into its constituent elements, the hydrogen reducing the oxid in the filament and the carbon uniting with the metal of the cylinder and of the filament. Such a chemical action is advantageous; but it is not essential to the carrying out of my invention, while the mechanical functions of the gaseous medium are essential.

The carbons *g h* may be mounted in a similar manner to those in an ordinary electric-arc lamp and their regulation effected by suitable mechanism or by hand. In the accompanying illustrations the carbon *g* is held in a socket *o*, carried by a transverse bar *p*, the latter being supported by rods *q q*, while the carbon *h* is carried by the plate *r*, in which the supporting-rods *s s* terminate.

The method of manufacture hereinbefore described is well adapted for use in the production of incandescing-lamp filaments, where uranium, titanium, zirconium, or beryllium, either singly or in combination, or in combination with other metals, is employed as the metallic base of the carbid.

What I claim as my invention, and desire to secure by Letters Patent, is—

The herein-described method of producing carbid filaments for electric incandescing lamps, consisting in soaking a long-fiber cotton thread or cellulose filament in a solution of a readily-decomposable salt or salts of the metal or metals intended to form the metallic base of the carbid, drying and spooling the same, packing the spool with powdered carbon and carbid of the kind required in a sealed crucible and subjecting the same to a temperature adapted to convert the salt or salts into oxid or oxids, passing the filament thus carbonized through an electric arc while surrounded by a cylinder or like envelop composed of the aforesaid metallic base and inclosed within a vessel charged with hydrogen or like gas incapable of supporting combustion, substantially as set forth.

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

WILLIAM LAWRENCE VOELKER.

Witnesses:
PERCY E. MATTOCKS,
IRENEO FRAN. VELHO.