E. P. BECKWITH.

MOUNTING FILAMENTS.

APPLICATION FILED MAY 21, 1906.

1,023,357. Patented Apr. 16, 1912.

Fig. 4.

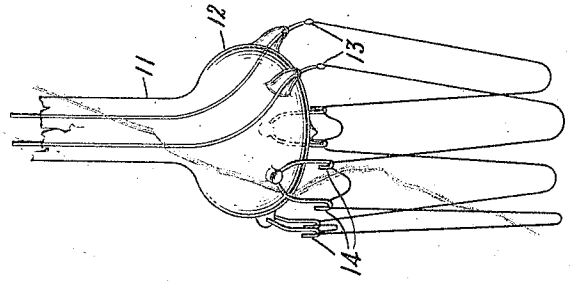


Fig. 3.

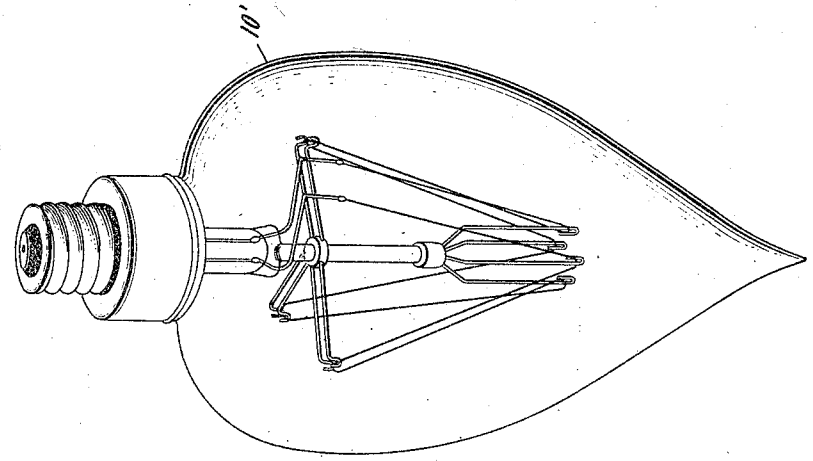


Fig. 2.

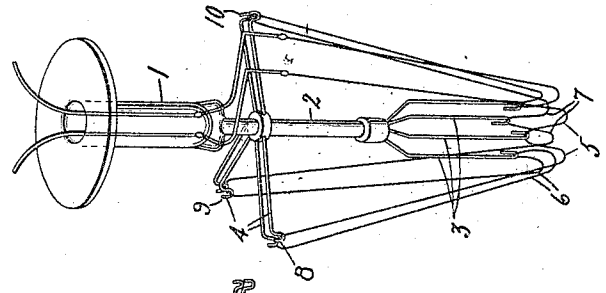
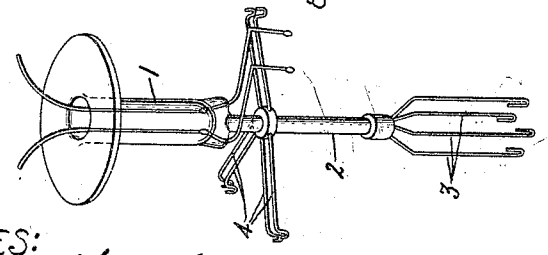


Fig. 1.



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MOUNTING FILAMENTS.

1,023,357. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed May 31, 1906. Serial No. 317,923.

To all whom it may concern:

Be it known that I, EDWARD P. BECKWITH, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Mounting Filaments, of which the following is a specification.

This invention relates to lamps having filaments of non-ductile material, and to a process of mounting the filaments for use in a lamp.

It has been proposed to use tungsten, molybdenum and various other refractory metals as material for an incandescing conductor for incandescent lamps. The metals above enumerated and others of a similar nature are usually obtainable in the form of powder and can be made into lamp filaments by first mixing with a small quantity of a suitable binder and then after shaping into filamentary form treating to remove the binder and to sinter or agglomerate the residue into a coherent wire. Although this wire may be brittle and non-ductile and incapable of being readily bent or manipulated, it is serviceable as a light-giving source in an incandescent lamp. The resistance of a metal filament is such that when used on commercial voltages the filament must be of considerable length, and hence must be coiled up or arranged in some special manner to make it fit within lamp globes of ordinary style and size.

According to the present invention the metal or compound of the metal is mixed or combined with a suitable binding material to make a mass or mixture which can be squirted or otherwise shaped into a filament. The raw filament thus produced is then strung on suitable supports with proper allowance for subsequent contraction during treatment and is there subjected to whatever treatment is necessary to drive out the binding material, or otherwise render the filament refractory and suitable for use in the finished lamp.

The filament remains on the supporting frame throughout all the treatment and the frame is used to support the filament in the finished lamp. It will be seen that even though the final product is non-ductile and could not be bent or coiled to the desired shape, it is possible to secure the desired shape by manipulations of the filament when it is in the raw or unfinished condition.

Although my process is applicable to a great variety of materials which are not ductile, I will describe the process as applied to one method of making tungsten filaments, and it will be understood that the novel features are equally applicable to other processes of making tungsten filaments, or to processes of making filaments of other refractory materials.

Figure 1 is a perspective view of a supporting frame suitable for holding the lamp filament; Fig. 2 shows the raw and unfinished filament in place on the frame; Fig. 3 shows the same frame and filament when finished and mounted in the lamp bulb; and Fig. 4 shows a modified form of supporting frame.

To produce a tungsten filament I may proceed by mixing tungsten and glucose to produce a plastic mass suitable for squirting through a die. To this mixture may be added one or more of the oxids of tungsten. As the mixture comes from the die the filament is sufficiently strong to support a considerable length of its own weight. While still soft it is hung in loops upon a frame of the general construction shown in Fig. 1. The supporting frame comprises a glass pedestal 1 carrying at its end a glass post 2 in the outer end of which nickel wires 3 are seated. Another set of nickel arms 4 project radially from the upper end of the bar 2 and serve as supports for the filament. These radial rods are grouped in pairs and each loop of the filament is supported on a pair of wires and is thereby protected from sharp bends at the points of support. The filament takes the form of a plurality of loops 5, 6 and 7, separated by the short horizontal stretches 8, 9 and 10 between hooks.

When the plastic filaments are looped over the double hooks and allowed to hang around the cylindrical glass rod, sufficient slack is left in the loops so that in case of a subsequent contraction of the filament it will not be ruptured. The loops are caught up and supported at the bottom by hooks turning inward and upward in such a manner that the loops may slip upward out of the hooks in case of very great contraction.

The filament may be fastened to the leads by a paste consisting of tungsten oxid and glucose. The frames may have three or four or even more loops according to the voltage of the lamp and the length of filament desired.

The next operation consists in drying the heretofore plastic filament to put it in condition for carbonization of the glucose. This step may be carried out by introducing the frame and filament in a resistance furnace and heating gradually to about 250° C. After a few minutes treatment the filament may be removed and placed in a second heater at a temperature of about 350° C., to carbonize the glucose. When this operation is complete the filament consists of a mixture of tungsten and carbon, and some oxid of tungsten-if the latter has been added to the original mixture. The frame and its filament may then be placed in a closed bulb and the air exhausted and a current passed through the filament to decompose the oxid and drive out some of the carbon in combination with the oxygen of the oxid. The remaining carbon may be removed by heating the filament in an oxidizing atmosphere to produce a film of oxid on the filament and then heating to a higher temperature in a reducing atmosphere to cause reduction of the oxid and combination of the oxygen with the carbon impurity of the filament.

The reactions and treatments above described produce a very marked contraction in the filament and take up the slack originally given to the loops, so that the finished filament assumes substantially the shape shown in Fig. 3. This figure shows the filament and its supporting frame mounted in a bulb 10′ of ordinary construction and ready for use on commercial circuits. The filament though strong and well able to resist fracture from shocks due to transportation is nevertheless non-ductile and cannot be bent to any great extent without danger of breaking.

It should be noted that according to the process above described, the entire filament is made at the same time and consequently is of uniform composition throughout. In this respect it is much superior to the composite filaments which have heretofore been made by cementing together short lengths of the non-ductile material.

In the modification shown in Fig. 4 the lamp stem 11 is provided with a bulb-like enlargement 12, in which are sealed the lead-wires 13 and the supporting metal hooks 14. This modification is primarily adapted for a lamp which is to remain vertical during use.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. The process of manufacturing electric incandescent lamps having filaments made from plastic material, which consists in suspending the filament, while plastic, in loops on a supporting frame, treating said filament while on said frame to render the filament refractory and non-ductile, and then mounting said frame with said filament thereon in the lamp bulb.

2. The process of manufacturing electric incandescent lamps having filaments made from plastic material, which consists in suspending the filament, while plastic, in loops on a supporting frame in such manner as to give the loops a predetermined amount of slack, treating the filament while on said frame to take up the slack and to render the filament refractory, and then mounting said frame with said filament thereon in the lamp bulb.

3. The process of manufacturing electric incandescent lamps having filaments of complex configuration made from plastic material, which consists in so applying the filament while plastic to a supporting frame as to give the filament substantially the desired configuration, treating said filament while on said frame to render it non-ductile, and then mounting said frame with the filament thereon in the lamp bulb.

4. The process of manufacturing electric incandescent lamps having filaments made from plastic material composed of metal and a binder, which consists in suspending said filament, while plastic, on a supporting frame, treating said filament while on said frame to remove the binder and to convert the filament into brittle metal, and then mounting said frame with the filament thereon in the lamp bulb.

5. A method of manufacturing electric incandescent lamps having filaments made from plastic material consisting in stretching the filaments while in a plastic condition on the support subsequently employed for supporting them in the lamps, in completing the manufacture of the filaments while on said supports, and in inserting the supports with the finished filaments in the lamp bulbs.

6. A method of manufacturing electric incandescent lamps having filaments made from plastic material consisting in squirting into the form of filaments plastic material consisting of powdered metal with a small quantity of a binding medium, in stretching the filaments while in a plastic condition on the support subsequently employed for supporting them in the lamps, in completing the manufacture of the filaments while on said supports, and in inserting the supports with the finished filaments in the lamp bulbs.

7. The method of manufacturing incandescent lamps having brittle filaments of metal which consists in supporting the fila-

ment while in an unfinished condition on a support subsequently employed for supporting it in a lamp and completing the manufacture of said filament while on said support.

8. The process which consists in mounting in looped form on its permanent supporting system a pliant filamentary body containing metal and binder and there treating said body to remove the binder and to convert the body into a brittle metal filament.

In witness whereof, I have hereunto set my hand this 19th day of May, 1906.

EDWARD P. BECKWITH.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.