

O. SCHLÜTER.
METHOD OF PRODUCING FILAMENT SUPPORTS FOR INCANDESCENT LAMPS.
APPLICATION FILED MAY 31, 1913.

1,238,575.

Patented Aug. 28, 1917.
3 SHEETS—SHEET 1.

Fig. 1.

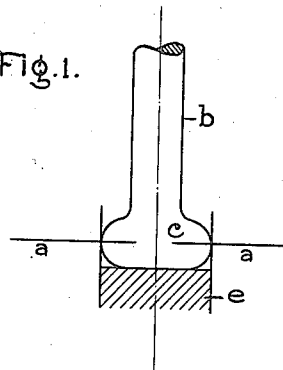


Fig. 2.

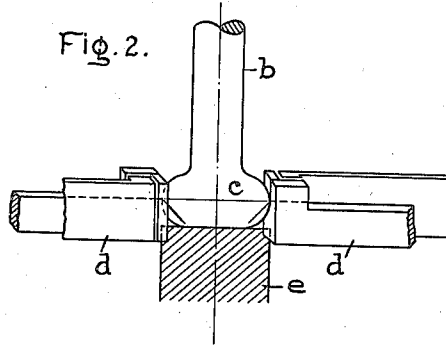
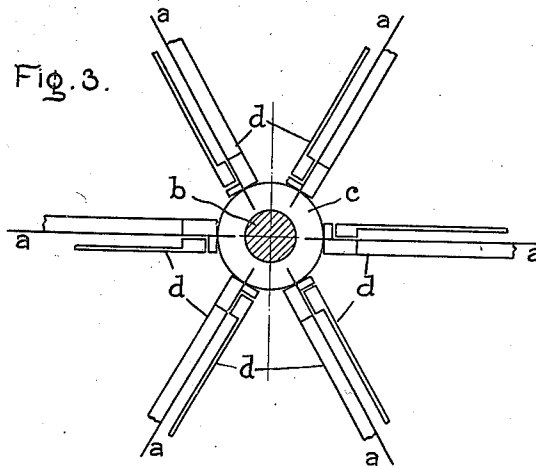


Fig. 3.



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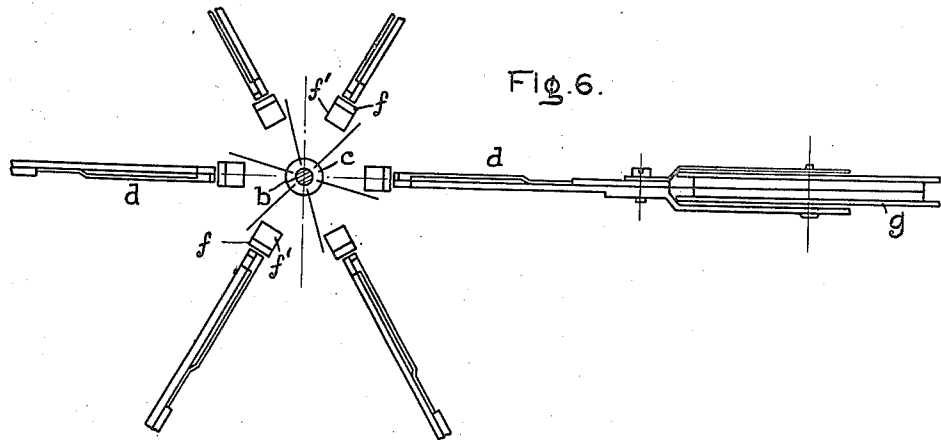
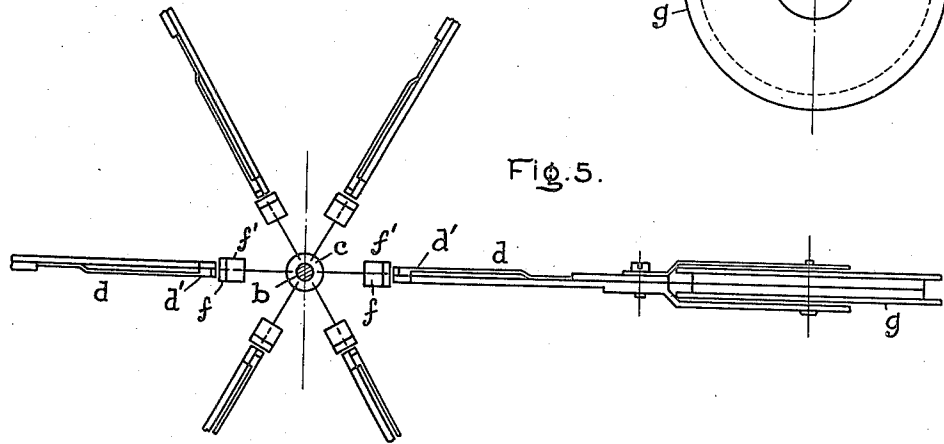
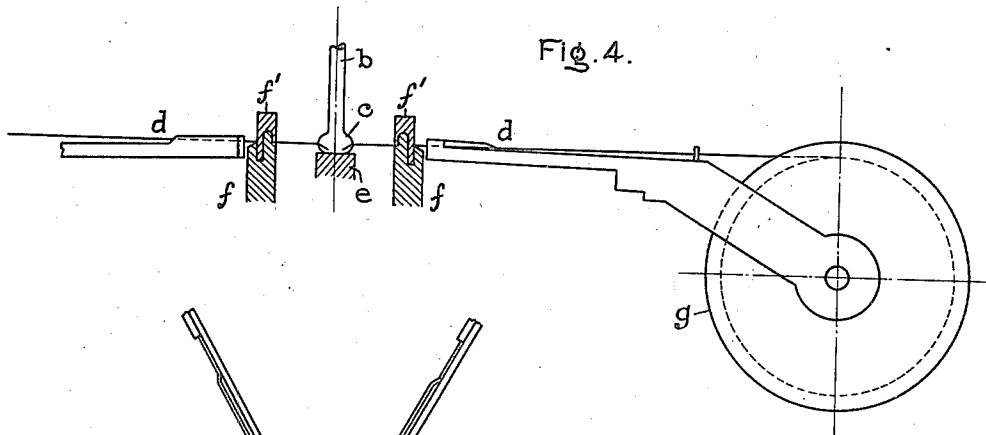
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3 SHEETS—SHEET 2.



Witnesses

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3 SHEETS—SHEET 3.

Fig. 7.

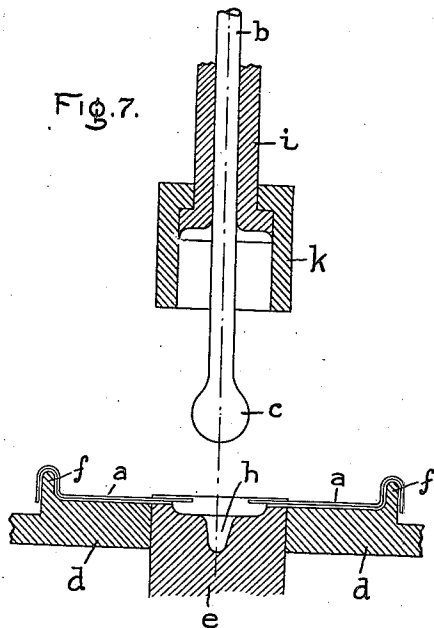


Fig. 8.

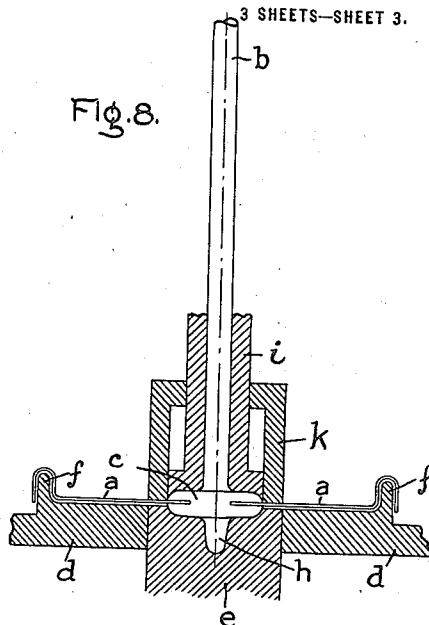
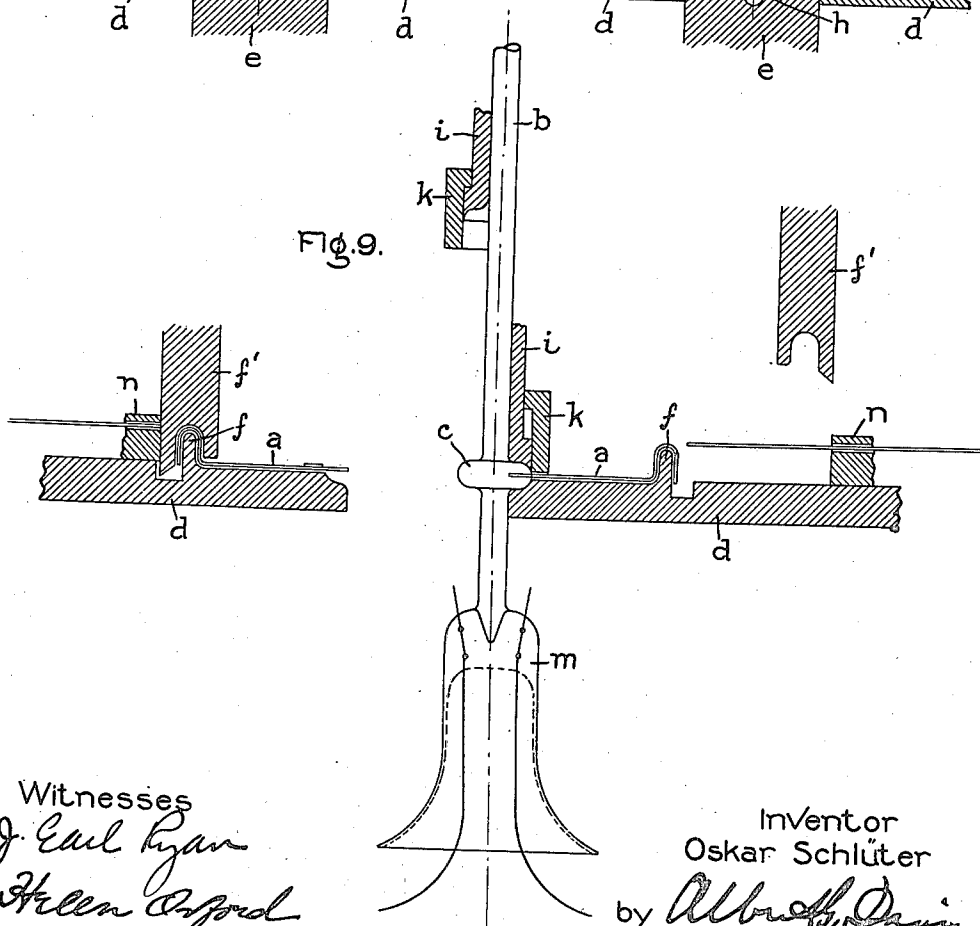


Fig. 9.



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UNITED STATES PATENT OFFICE.

OSKAR SCHLÜTER, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

METHOD OF PRODUCING FILAMENT-SUPPORTS FOR INCANDESCENT LAMPS.

1,238,575.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, OSKAR SCHLÜTER, a subject of the King of Prussia, residing at Berlin, Germany, have invented certain new and useful Improvements in Methods of Producing Filament-Supports for Incandescent Lamps, of which the following is a specification.

In the manufacture of filament supports for metal filament or drawn wire lamps the wires for forming the holders for the filament are inserted in the glass rod of the filament support and are usually bent into the form of hooks. Great care has been necessary on the part of the workman in inserting these hooks or holders in the small glass button on the end of the glass rod in order that the holders are neither irregularly distributed on the periphery of the button nor touch each other in its interior. In the first case the wires had to be bent obliquely in order to space the hooks equally about the glass rod and in this operation the wires might easily be broken; in the second case the touching of the wires would cause a short circuit which would render the lamp mount useless.

The difficulties mentioned are comparatively slight when holders made of rigid wire, as for example, copper or nickel wire, are fused into the glass support. The difficulties are very great, when, on account of strength and of an attractive appearance of the lamp, the filament holders or hooks are made of fine elastic wires. For these wires refractory metals may be used, as, for example, iridium, platinum, molybdenum and tungsten. These wires of refractory metal sometimes have only one-tenth the diameter of the filament holders or hooks made of copper or nickel wire. In this case the difficulties increase in direct proportion to the number of filament holders or hooks (often more than ten) which are to be inserted in one button.

The practice of fusing rigid holders or hooks in place by means of a machine is known and for a long time it has been customary to make the stems of carbon filament lamps by placing the leading-in wires and the anchor wires in a sheath, slipping a glass tube over the wires and heating the surrounding portion of the tube to fusion, so that the stem which is thus formed contains both the leading-in wires and the

anchor wires. Furthermore, a method is known by which the wires which are subsequently to form the filament holders or hooks are positioned in a casing or guide having longitudinal passages running parallel to each other and to the longitudinal axis of the glass rod, the wires being placed in such a manner that their ends, which in some cases are fed forward automatically, project into a recess in the casing or guide and are parallel to and separated from one another. The glass button for holding the wires is formed by pressing the hot soft end of the glass rod into the recess into which the ends of the wires project so that the ends of the wires are embedded in the softened glass. This method is not applicable to small flexible wires, since the ends of such wires extending out of the passages in the casing and into the button forming recess are either pushed back by the pressure exerted against them as the softened glass is pressed into the recess, or else are bent in different directions so that adjacent wires come into contact, unless the ends extending or projecting upwardly into the recess and afterward fused into the glass button are so short that the strength of the joint with the glass is impaired, or else the glass button is made so large that there is danger of subsequent breakage.

According to the present invention the wires from which the filament holders or hooks are to be formed are not placed parallel to the longitudinal axis of the glass rod, but are positioned perpendicularly, or nearly so, thereto, either in one plane or in a flat conical surface. They are led concentrically into an open space or recess into which the hot softened part of the glass rod is pressed, in which operation the hot part of the rod swells out to form a glass button.

My invention will best be understood in connection with the accompanying drawings in which simply for purposes of illustration I have shown some of the many different forms in which my invention may be embodied and in which Figure 1 is a diagrammatic view of the end of the glass rod with two of the wires for the filament holders or hooks in position; Fig. 2 is a similar view showing the clamps by means of which the wires are fed into position; Fig. 3 is a transverse section taken just above the clamps shown in Fig. 2 and showing the wire feed-

ing clamps concentrically positioned about the axis of the glass rod; Fig. 4 is a view showing diagrammatically the wire feeding clamps and also the mechanism by which the wires are cut off and bent into hooks; Fig. 5 is a transverse section of Fig. 4 taken on the plane just above the mechanism shown in Fig. 4 and showing the position of the parts as the wires are fed into position and the glass rod is forced against the stop to cause its end to swell out into a button; Fig. 6 is a similar view after the wires have been cut, the hooks have been formed, and the glass rod given an angular rotation sufficient to swing the wires out of the wire cutting and hook forming mechanism so that the completed filament support can be withdrawn from the machine; Figs. 7 and 8 are longitudinal sections of a form of machine in which the button is shaped by being pressed by a movable mold or die; and Fig. 9 is a sectional view of a form of my invention in which the button is formed intermediate the ends of the glass rod and the wires are cut and formed into hooks by suitable mechanism before being embedded in the button.

The automatic sealing of the filament holders or hooks into a glass button formed on the end of the glass supporting rod is best shown in Figs. 1 to 3. of the drawing, which represent this operation on an enlarged scale. In these figures, *a* indicates the wires from which the filament holders or hooks are to be formed, *b* is the glass rod, *c* is the glass button formed on the end of the rod, *e* is the stop which causes the softened end of the rod to swell out to form the button in which the filament holders or hooks are embedded, and *d* indicates clamps, grips or similar devices for holding and concentrically feeding forward the wires of which the filament holders or hooks are formed.

Fig. 1 shows the holder wires *a* in the position which they originally have when first fed into place and the position which they maintain if the end of the glass rod *b* was sufficiently soft when the button on the end of the rod was formed.

But if the wires are bent during the pressing of the glass rod against the stop *e* they can be bent only in the direction of movement of the glass rod, which is the direction of pressure, that is, more or less perpendicularly to the plane of the holder wires so that the bending of the wires does not cause adjacent wires to approach each other and contact of the wires inside the glass is impossible. Under the most unfavorable conditions, therefore, the wires may be so bent that they assume, for example, the slanting position shown in Fig. 2, but even in this position they are surrounded by enough molten glass to make a firm construction.

The clamps *d* are connected with suitable actuating mechanism in any suitable man-

ner, such that they all simultaneously take hold of the wires passing through them, and then concentrically approach one another until their inner ends are separated by a distance dependent on the diameter of the glass button which is to be formed on the end of the rod. At this time, as best shown in Fig. 3, the ends of the wires project from the clamps and are immediately above the stop *e*. Then the glass rod *b*, which has in the meantime been heated until the lower end is soft and viscous, is pressed downward against the stop *e*, preferably automatically by any suitable connections to the driving mechanism, whereupon the softened glass swells out and forms a button in which the projecting ends of the wires are embedded, after which the clamps *d* release the wires and move apart concentrically to their original position.

The simplest way is to hold the wires in the clamps entirely by means of a spring *d'*, under and past which the wires slide as the clamps are moved apart in consequence of the pull exerted upon the wire, which then has its end embedded in the glass rod. When the clamps advance toward one another the spring grips the wire and carries it forward with its end projecting a suitable distance beyond the clamp.

It is advantageous to place upon the machine a further device to cut off the wires to a suitable length after they are sealed into the button and also to bend them into suitable shape, such as a hook, either before or after cutting them off. The essential parts of the suitable device which simultaneously cuts off the wire and bends the cut end into a hook form are shown diagrammatically in full size in Figs. 4 to 6, and comprises two suitably bent and bladed jaws *f* and *f'* for each wire. During the movement of the clamps *d* one of these jaws is below and the other is above each holder wire. After the ends of the holder wires are embedded in the glass button and the clamps *d* have moved apart to their original position, the jaws *f* and *f'* are moved toward each other and consequently toward the holder wire by any suitable connection to the mechanism of the machine, cutting the holder wire to the necessary length and bringing it into the desired form, as, for example, a hook. It is evident that it would be possible to bend the holder wires into any suitable form such as spirals or other shapes, provided this has not already been done before or during the forward concentric movement of the wires. After the holder wires are cut and bent into the desired form the jaws *f* and *f'* then move apart again. After the filament support, which has just been completed, is removed from the machine the clamps *d*, which in the meantime have seized the holder wires again and gripped them

firmly with their ends projecting the proper distance, will again approach one another for the purpose of making the next filament support. The wire for the filament holders or hooks is preferably placed on rollers or reels *g* which are mounted on the clamps *d* in any suitable manner so as to rotate easily. A suitable form of roller is represented in Figs. 4 to 6 mounted on the right-hand clamp *d*. As the clamps *d* move apart with the end of the holder wire held fast in the button on the end of the glass rod *b* the holder wire slides under the spring *d'* on the clamp and is reeled off from each roller *g* since the tip of the wire is held firmly in the glass button.

If the ends of the holders, after being cut off, are bent in the machine itself into the form of hooks or similar shapes, then in taking out the complete filament support from the machine care must be taken that the filament holders or supports do not strike against any parts of the machine and thereby lose their correct form. As shown in Fig. 6, this result may be secured in a very simple manner and complicated construction may be avoided by rotating the glass rod *b* through a small angle about its longitudinal axis, whereupon the rod can be drawn out of the machine in the direction of its longitudinal axis without the filament holders or hooks being bent or striking any part of the machine. It is obvious that instead of doing this, the table which supports the jaws *f* and *f'* might be turned through a suitable angle, but this is not as simple as rotating the glass rod.

The embodiment of my invention above described can also be utilized with some modifications if the glass button is to be placed, not on the end of the glass rod, but at an intermediate point, as in the case, shown in Fig. 7, of that button which is near the stem of the lamp, such as the stem *m* of Fig. 9. In that case the glass rod of the filament support is connected with the stem after the formation of this glass button and after the filament holders or hooks are sealed into the button. Of this construction Figs. 7 and 8 show an example, or it is possible for the glass rod to be connected first with the glass stem of the lamp, that is, before the formation of the glass button on the rod and the sealing in of the filament holders or hooks, and of this construction Fig. 9 shows an example. In both cases it is advantageous to press the softened part of the glass rod against the lower stop by a stamp or die, whereby, in the example shown in Figs. 7 and 8, an offset *h* is made at the same time with the glass button *c*, this offset serving later for making the connection with the stem. With advantage the stamp or die for forming the button may consist of two concentrically arranged parts *i* and *k*

which move downward near the glass rod after its lower end has been softened and moved downward. This downward movement of the parts *i* and *k* of the stamp or die may be effected by the machine mechanism, by their own weight, or by spring pressure. These two parts should move in such a manner that first the outer annular part *k* rests upon the stop *e*, and only after this occurs is the inner part *i* which surrounds the glass rod *b* pressed against the softened mass of glass to force it into the recess provided in the stop *e* for the purpose of forming the offset *h*, while the lateral extension of the glass is limited by the outer ring or annular part *k* and by the edge portion of the stop *e*. Fig. 7 shows the glass rod and the stamp in the position which they assume during the fusion of the lower end of the glass rod, and Fig. 8 shows them in the position which they assume during the formation of the glass button *c* and of the offset *h*. The pressing of the fused mass of glass into the form of a button which surrounds and embeds the concentrically guided ends of the filament holders or hooks and which as shown, in the case of necessity, also makes possible the formation at the same time of an offset for the purpose of connecting the filament support with the stem, proves advantageous also in case of a coarser, more rigid wire, not only on account of the possibility just mentioned, but also on account of the great regularity and strength of the sealing in of the filament holders or hooks and of the rapidity of manufacture.

In Figs. 7 to 9 the use of such rigid wires is shown. In this case a further precautionary measure is important, that is, not to wait until after sealing the wires into the button to cut off the wires to the necessary length and bend them, but as indicated above to do this cutting off and bending beforehand, since otherwise there is danger that the rigid holders may be torn out of the glass button during the bending or may be broken off at the button.

A suitable manner of cutting off and bending the more rigid wires and then assembling them concentrically about the glass rod is shown by way of example in Fig. 9. In the left-hand portion of this figure the clamps *d* and jaws *f* and *f'* which serve for cutting and bending the wire *a*, and the stamp or die portion *i k* are shown in the position assumed by them while the glass rod is being heated at the proper place and while the holder wires are being cut off and bent. In the right-hand portion of this figure these same parts are shown in the position which they assume during the formation by pressure of the glass button *c*. Here the central portion of the glass rod which has already been connected to the glass stem *m* is heated. In order to be able

to bring the glass rod with the stem from above into the position indicated and in order that after the sealing in of the filament holders the rod may be moved upward again, the special part serving as a stop is not used, but the mold for the lower part of the glass button is formed by the moving together of the clamps *d* themselves, which clamps during the insertion or withdrawal of the filament support are moved so far apart that the glass stem *m*, which is usually flattened, can pass between them. In this particular case, only the upper jaw *f'* of the two jaws *f* and *f'* is movable in the vertical direction, and the lower jaw *f* is movable not in the vertical direction but radially and moves simultaneously with the clamp *d* upon which it is mounted or with which it is integral. By means of the blades on the jaws *f'* the holder wires *a* are cut off at the parts which act as guides for them and then they are bent between the jaws. The guide parts *n* are fixed in place. After the bending the jaws *f'* move upward. The clamps *d* then come together until the inner ends of the filament holders or hooks almost touch the glass rod. During this operation the wires *a* are sufficiently held in position by their grip upon the jaws *f* upon which the hooks remain. During the moving together of the clamps *d* the piece of wire which serves for forming the next filament holder is simultaneously carried through the guide portion *n*, this wire being laid hold of by the clamp *d* at a point lying outside of the parts shown in the drawing, and being wound off from the roller like that shown in Figs. 4 to 6. After the clamps are moved together, the ring *k* is seated upon them, preferably on the raised or edge portion. Then, by subjecting the glass rod to pressure in the direction of its longitudinal axis to upset it at the softened portion and at the same time compressing the upset or enlarged part by the stamp portion *i*, the button *c* is formed from the softened part of the glass rod, which button surrounds and embeds the ends of the filament holders or hooks. After the glass button is formed the glass rod *b* with the stem is lifted a little until the outer ends of the filament holders, which were bent into a hook shape over the jaws *f*, are released from the jaws, then the clamps *d* are concentrically moved apart, releasing the filament holders, and finally the filament support is entirely lifted out of the machine. In this particular case, the rotation of the filament support before being entirely lifted out of the machine is not generally necessary, since the jaws *f'* are beyond the ends of the filament holders when the clamps *d* are withdrawn from the stem. It may be noted that the filament holders or hooks made of fine wire are generally

applied at the end of the filament support which is farthest from the stem, and the coarser and more rigid holders or hooks and the leading-in wires are applied at that part of the rod adjacent the stem.

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

1. The method of fixing radially projecting wires in the end of a glass rod which consists in holding the wires stationary in the desired relation about a common center with their inner ends in the same horizontal plane and separated, moving a glass rod with a softened end vertically to bring its softened end into the gap between the inner ends of said wires, and then enlarging said end horizontally while still soft and while said wires are stationary and thereby firmly embedding the inner ends of said wires in the softened glass.

2. The method of fixing radially projecting wires in a glass hub on a glass rod which consists in positioning the wires in the same plane to project radially from a common center with their inner ends spaced apart and then holding the wires stationary in the same relation as in the finished article, moving a glass rod with a softened portion perpendicularly to the plane of said wire to bring said softened portion to said common center and into alinement with the inner ends of said wires, and enlarging said softened portion in the plane of the wires to cause the glass to flow over the ends of said wires and embed them.

3. The method of fixing wires in glass in definite relation to one another which consists in holding said wires stationary and radially arranged about a common center in the desired relation with their inner ends separated, moving a glass rod having a softened portion to bring said softened portion to said center between the inner ends of said wires, and enlarging said softened portion to cause it to expand and the softened glass to flow along said stationary wires to embed them in the glass.

4. The method of fixing a plurality of radially projecting wires in a glass rod which consists in positioning said wires horizontally about a common center in the desired relation to one another and with their inner ends separated and holding said positioned wires stationary, moving a glass rod with a softened portion vertically to carry said softened portion to said common center and into the space between the ends of said wires, and compressing said softened portion of the rod vertically to enlarge it horizontally while the wires are stationary and thereby cause the softened glass to embed the inner ends of the wires.

5. The method of fixing radially arranged wires in a central rod which consists in assembling said wires with their inner ends

spaced apart and in their permanent relation to one another and holding them fixed in said relation, providing a mass of softened glass on said rod and moving said rod longitudinally to carry the softened mass between the inner ends of said wires, and then enlarging said mass transversely of said rod to cause the mass of glass to flow over and embed the inner ends of said wires.

6. The method of producing a filament support for incandescent lamps which consists in positioning wires in substantially the same plane and radially about a common center with their inner ends adjacent one another in the same relation as in the finished filament support and holding said positioned wires stationary, heating a portion

of a glass rod until soft, placing said rod substantially perpendicular to the plane of said wires with its softened portion at said common center between the inner ends of said wires, causing said softened portion to expand and flow along said wires to embed the inner ends in the glass, cutting said embedded wires, and bending the cut ends to produce hooks concentric with said glass rod.

In witness whereof, I have hereunto set my hand this 29th day of May, 1913.

OSKAR SCHLÜTER.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.