Nov. 5, 1968 R. H. VAN SICKLER ET AL 3,408,719

METHOD OF ASSEMBLING LAMP FILAMENT AND SUPPORT STRUCTURE

Original Filed Nov. 8, 1965

Fig. 1.

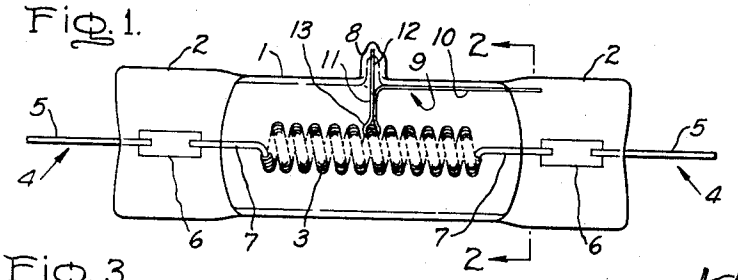


Fig. 2.

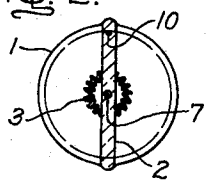


Fig. 3.

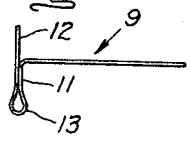


Fig. 5.

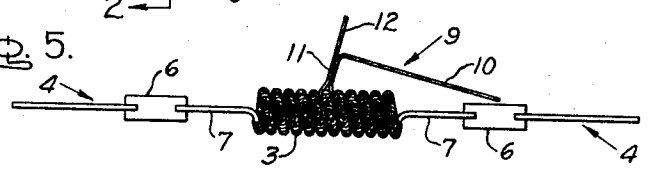


Fig. 4.

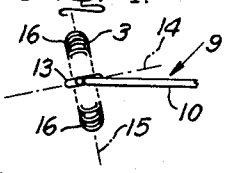


Fig. 7.

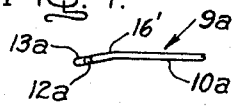


Fig. 6.

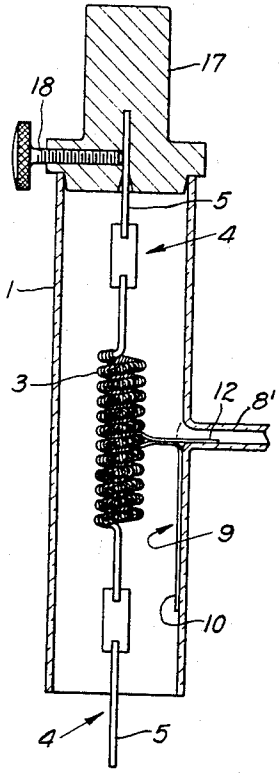


Fig. 8.

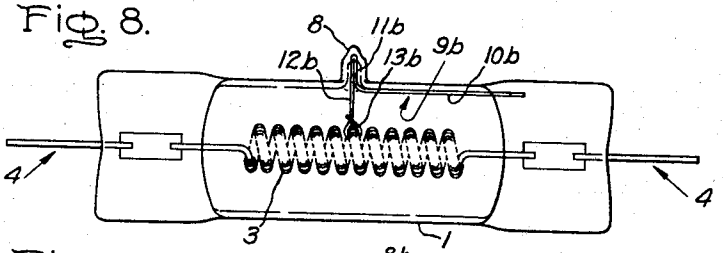


Fig. 9.

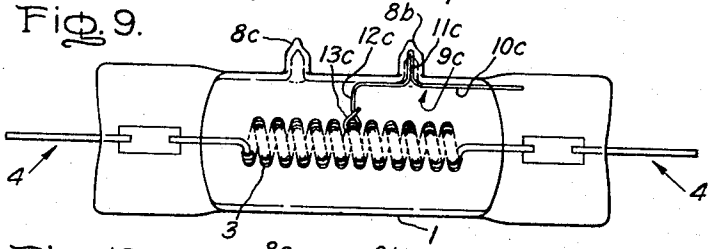
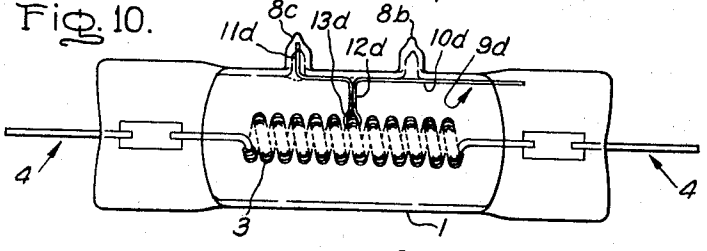


Fig. 10.



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Their Attorney

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METHOD OF ASSEMBLING LAMP FILAMENT AND SUPPORT STRUCTURE

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Original application Nov. 8, 1965, Ser. No. 506,644. Divided and this application Nov. 21, 1967, Ser. No. 684,816

4 Claims. (Cl. 29—25.15)

ABSTRACT OF THE DISCLOSURE

A coiled-coil filament is assembled and supported axially in a vertically disposed tubular vitreous envelope by engaging a lateral short leg of a support wire with the interior of a laterally extending exhaust tube, with another oppositely extending short leg connected to the filament at its midpoint and a long leg extending generally downward, pulling down on the lower end of the filament to stretch it and to swing the long leg flat against the envelope wall, and then pinch sealing the lower end of the long leg in the lower end of the envelope along with a lower lead-in conductor attached to the filament.

This application is a division of our application Ser. No. 506,644, filed Nov. 8, 1965.

This invention relates generally to electric lamps, and more particularly to incandescent electric lamps of the double-ended type comprising a tubular envelope having pinch seals at its ends through which extend current lead-in conductors connected to respective ends of a helically coiled filament extending longitudinally of the envelope. Still more particularly, the invention relates to a method of assembly of the filament and a novel support structure for supporting the filament at a point intermediate its ends to maintain its alignment in the tubular envelope, and more especially where the filament is of coiled-coil form, i.e., a primary helical coil again coiled into a secondary helix.

Whereas certain spiral wire supports and metallic disc supports have been used satisfactorily to support a helical single coil filament from the envelope wall, such supports are not suitable for coiled-coil filaments for such reasons as failure to grip the filament securely or short circuiting of an inordinate number of coil turns. Special support structures have also been proposed for use with coiled-coil filaments, again with some short-comings such as expensive construction or assembly, or looseness due to variations in envelope diameter or loss of springiness under the high temperature conditions prevailing in the lamp.

It is therefore an object of the present invention to provide a support structure for double-ended lamps of the type described, especially when provided with helically coiled-coil filaments, although also useful for helically single coiled filaments, and which is of simple construction and will effectively support the filament. It is a further object to provide a novel support construction which lends itself to relatively simple and positive assembly of the support with the filament, and assembly of the composite structure into the lamp envelope.

In accordance with one aspect of the invention, the above-mentioned objects are achieved by forming a wire support to include a main long leg portion which extends longitudinally alongside the envelope inner wall with one end embedded in one of the pinch seals, and which further includes a short leg portion formed to extend laterally away from the envelope axis into a depression in the inner envelope wall, and another short

leg portion formed to extend toward the filament and including a loop enclosing a localized portion of a turn of the filament coil. In accordance with a further aspect, the said depression is formed by a residue of exhaust tubing projecting from the envelope wall intermediate its ends. In accordance with a further aspect, the aforesaid laterally extending short leg portions of the support are formed at the free end of the wire opposite that embedded in the pinch seal to constitute a transversely extending end portion which includes the loop at one side thereof and the depression-engaging portion at the other side thereof.

The support is first assembled with the filament, with the loop preferably engaging the coiled filament substantially midway of its length and the main long leg portion of the support extending generally longitudinally of the filament. The assembly of filament and support is then inserted or lowered into a preferably vertically disposed envelope tube with the upper end of the filament held firmly and so oriented that the lateral depression-engaging portion or leg of the support extends into the interior of a depression which is conveniently constituted by an exhaust tube extending laterally outward from the envelope wall. Then, in accordance with standard practice, preparatory to forming the pinch seal at the lower end of the envelope tube, the filament coil is stretched by pulling down its lower end, whereupon the long leg main portion of the support wire is swung against the envelope wall by virtue of a pivotal engagement of one of the lateral short leg portions thereof with the exhaust tube. The support is thus properly positioned before the pinch seal is formed to embed therein the end of the main leg portion of the support along with the conventional lead-in conductor attached to the adjacent end of the filament. The alignment of the support wire alongside the envelope wall assures its separation from the filament and the lead wire attached thereto, with consequent avoidance of short circuiting of the filament.

Further features and advantages of the invention will appear from the following detailed description of species thereof and from the drawing wherein;

FIG. 1 is a side elevation, on an enlarged scale, of a lamp comprising a support member in accordance with the invention;

FIG. 2 is a section through a pinch seal of the lamp along the line 2—2 in FIG. 1;

FIG. 3 is a side view of a form of support wire comprising the invention;

FIG. 4 is a top plan view of the support wire of FIG. 3 on a further enlarged scale;

FIG. 5 is a side view of an assembly of filament and lead-in conductor with the support member;

FIG. 6 is a plan view, partly in section, showing a step in the assembly of the filament with the lamp envelope;

FIG. 7 is a view of a filament support member corresponding to that of FIG. 4 but slightly modified;

FIG. 8 is a side view of a lamp incorporating a modification of the filament support member shown in FIGS. 1 to 6; and

FIGS. 9 and 10 are side elevations of lamps having further modified species of the filament support.

Referring to FIG. 1 of the drawing, the lamp illustrated therein may be of the regenerative cycle type containing a halogen such as iodine, bromine or chlorine or compounds thereof to maintain the bulb walls free of blackening for a long useful life. The lamp comprises a tubular envelope 1 of viterous material or relatively high melting point, preferably fused silica or quartz, having at each end thereof an integral flattened pinch seal 2.

A helically coiled-coil tungsten wire filament **3** extends longitudinally of the interior of the envelope and is connected at respective ends thereof to lead-in conductors **4** having portions thereof hermetically sealed in respective pinch seals **2**.

As illustrated herein, the lead-in conductors **4** each comprise an outer lead wire portion **5**, of molybdenum for example, welded to an extremely thin foil portion **6** which is also preferably of molybdenum and is hermetically sealed in the pinch seal **2**, and an inner lead wire portion **7** preferably of tungsten and suitably connected to the adjacent end of the filament **3**.

The interior of the envelope **1** contains an inert gas filling such as nitrogen, argon, krypton or xenon or mixtures thereof at a suitable pressure of from about 1 to several atmospheres, and also a halogen, preferably iodine, which maintains the envelope walls free from blackening due to vaporized tungsten from the filament by virtue of the well-known tungsten-iodine regenerative cycle. The envelope is filled with gas and iodine through an exhaust tube **8'** (FIG. 6), the sealed residue of which is shown at **8** in FIG. 1.

In accordance with the present invention, the filament **3** is supported by a wire support member **9**, preferably of tungsten, which is shaped to provide a main long leg portion **10** which extends longitiudinally alongside the inner wall of the envelope **1** and has one end embedded in a pinch seal **2** as shown in FIGS. 1 and 2. At its opposite end the support member terminates in a transversely extending portion composed of a short leg portions **11** and **12** extending in opposite directions (see also FIG. 3). The leg **11** is formed as a retroverted lateral extension of the long leg portion **10** extending toward the filament **3** and having a loop **13** (FIG. 3) at its end which encloses a localized portion of a turn of the coiled-coil filament. The leg **12** is formed as a continuation or free terminal end extension of the leg **11**, and it extends toward the envelope wall into the dimple-like depression formed by the exhaust tube residue **8**. The support member **9** thus has generally the shape of a square root symbol. The end of the said leg **12** may or may not be at least partially fused to and embeddied in the said exhaust tube residue **8**.

In assembling the lamp, the support member **9** is first attached to the filament **3** as indicated in FIG. 5, the lead wires **4** preferably having been previously attached to respective ends of the filament. This is done by slipping the transverse portion **11, 12** of the support between adjacent secondary turns of the filament **3** and bringing the loop **13** (FIG. 3) into position between adjacent primary turns of one of the secondary turns of the filament. This action is made easier by pulling the free short leg portion **12** in a direction to temporarily separate the contiguous individual legs of the composite retroverted short leg portion **11** so that said leg **11** is readily slipped over the primary coiling of the filament.

It is desirable that the support member **9** lie substantially in a common plane with the axis of the filament **3**, rather than at an angle thereto. To that end, as shown in FIG. 4, the loop 13 is preferably twisted to lie in a plane indicated at **14** and which is at an acute angle to the long leg portion **10** of the support member and which is essentially normal to the axis **15** of the adjacent primary coil turns **16** of the filament **3**. In the modification shown in FIG. 7, essentially the same effect is achieved by forming a bend at **16'** in the main long leg **10*a*** so as to place the entire transverse end portion of the support member in a plane making an acute angle with the long leg **10*a***.

In the next step, as illustrated in FIG. 6, the assembly of filament **3**, leads **4** and support **9** is inserted into a vertically disposed envelop tube **1** which has an exhaust tube **8'** extending laterally from the center thereof. As herein illustrated the said assembly is supported by a metal cap member **17** which has a central bore into which the upper outer lead wire **5** is inserted and held by a thumb screw **18**. The cap **17** is placed on the upper end of the tube **1** and is oriented to bring the short leg **12** of the support member into the interior of the exhaust tube **8'**, thereby centering the filament **3** longitudinally in the tube **1**.

At this time, since the center of gravity of the support **9** is below its point of attachment to the filament **3**, it is normally in a position such that the long leg **10** is swung or inclined toward the axis of the envelope **1** and toward the filiament and lower lead-in conductor, for example somewhat as indicated in FIG. 5. However, preparatory to making the pinch seal at the lower end of the tube **1**, the filament **3** is stretched in accordance with customary procedure by pulling downward on the lower lead-in conductor **4**. During this stretching step, the long leg **10** of the support member **9** is swung against the inner wall of the tube **1** as the short leg **12** is held by the exhaust tube **8'**. The support member is thus properly positioned before forming the pinch seal and it is fixed permanently in proper position when the pinch seal **2** is made as shown in FIGS. 1 and 2.

The tube **1** is then inverted and the operations of pulling down on the then lowermost lead-in conductor **4** and forming the other pinch seal, are performed. The envelope **1** is then evacuated and filled with gas and halogen through the exhaust tube **8**, and the exhaust tube is sealed or tipped off to leave the residue shown at **8** in FIG. 1. During the tipping off of the exhaust tube, the short leg **12** may be captured or sealed therein, but this is not necessary since support is derived from the fact of the long leg **10** being secure in the pinch **2**.

In FIG. 8, the same reference numerals are used for corresponding parts as in FIG. 1 with the exception of addition of the letter "*b*" to the support member and its component parts. In this case the transverse end portion is first formed as the retroverted short leg portion **11*b*** which extends into the exhaust tube residue **8** and which continues on as another short leg portion **12*b*** which terminates at its free end in a loop **13*b*** which encloses a localized portion of a turn of the coiled-coil filament **3**. In this case the loop **13*b*** may be formed originally as an open hook which is slipped into place between adjacent primary turns of a secondary turn of the coiled-coil filament **3** and then bent to a closed loop.

In FIG. 9, the exhaust tube residue **8*b*** is offset from the longitudinal center of the envelope **1**. Actually, in this case the envelope may be provided with a second exhaust tube residue **8*c*** which may be employed in connection with a processing procedure where the envelope is flushed out by introducing gas into one tube and expelling it through the other. In this case, the lateral short leg portions **11*c*** and **12*c*** are spaced apart longitudinally of the main long leg portion **10*c*** of the wire support **9*c***. The short leg **11*c*** is a retroverted portion of the wire extending toward the wall of the envelope **1** and into the exhaust tube residue **8*b***. The short leg **12*c*** is bent to extend toward the filament **3** and terminates at its free end in a hook **13*c*** which is engaged between adjacent primary turns of the filament coil at the longitudinal center of the coil.

In FIG. 10, the retroverted short leg **12*d*** extends toward the filament **3** and may be of the same shape as the short leg **11** in FIGS. 3 and 4 with the loop **13*d*** in the end thereof engaged between adjacent primary turns of the secondary coil at the longitudinal center of the filament. The short leg **11*d*** is a lateral extension of the free end of the main long leg **10*d*** and extends toward the envelope **1** into the exhaust tube residue **8*c***.

The lamps of FIGS. 8 to 10 may be assembled in a manner analogous to that described in connection with FIGS. 1 to 6, and the ends of the short legs **11*b***, **11*c*** and **11*d*** may or may not be caught or embedded in the respective exhaust tube residues **8**, **8*b*** or **8*c***.

While specific details of construction have been shown

and described herein, it will be evident to those skilled in the art that further changes or modifications may be made within the spirit and scope of the invention as defined in the appended claims.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. The method of assembling and supporting a helically coiled filament in a tubular envelope of vitreous material which comprises forming a depression in the wall of said envelope intermediate its ends, preliminarily assembling with said filament a lead-in conductor extending longitudinally from each end thereof and also a support wire member formed to comprise a main long leg portion, a first short leg portion extending laterally of the long leg portion with a loop at the end thereof, and a second short leg portion extending laterally of the long leg portion in the opposite direction from said first short leg portion, and with said loop in said first short leg portion enclosing a localized portion of a turn of the coiled filament about midway of the filament length and with the long leg portion extending generally longitudinally of the filament, inserting the filament and support wire assembly longitudinally into the generally vertically disposed envelope with the upper end of the filament held firmly and so oriented that the second short leg portion of the support extends away from the filament into the interior of said depression in the envelope wall and with the long leg portion hanging downward and terminating short of the lower end of the envelope, pulling down on the lower end of the coiled filament to stretch it and to swing the long leg portion of the support wire member against the envelope wall while its second short leg is held in said depression, fusing and pinch sealing the lower end of the envelope to embed therein a portion of the adjacent lower lead-in conductor along with the lower end of said long leg of the support wire member, and subsequently embedding the other lead-in conductor in a pinch seal at the other end of the envelope.

2. The method as set forth in claim 1 wherein the said depression is formed by an exhaust tube extending laterally away from the envelope wall.

3. The method as set forth in claim 2 wherein the said exhaust tube is subsequently tipped off in a manner to embed therein the end of the said second short leg portion of the support member.

4. The method as set forth in claim 1 wherein the support wire member is formed in the general shape of a square root symbol where the long leg portion terminates at one end in a transversely extending portion which includes a retroverted first short leg portion having the loop at its bend, and the free terminal end portion of which extends to the other side of the long leg as the second short leg portion.

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