

[54] **FILAMENT SUPPORT**

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[52] **U.S. Cl.**..... **313/274, 313/279**

[51] **Int. Cl.**..... **H01j 1/98, H01j 19/52, H01k 1/24**

[58] **Field of Search**..... **313/273, 274, 271,**  
**313/279**

[56] **References Cited**

**UNITED STATES PATENTS**

|           |         |                        |           |
|-----------|---------|------------------------|-----------|
| 3,392,299 | 7/1968  | Kern .....             | 313/279 X |
| 3,535,577 | 10/1970 | Notelteirs et al. .... | 313/274 X |
| 3,521,112 | 7/1970  | Walsh et al. ....      | 313/274   |
| 2,342,044 | 2/1944  | Foote .....            | 313/279   |

|           |         |             |           |
|-----------|---------|-------------|-----------|
| 3,416,024 | 12/1968 | Young ..... | 313/273   |
| 3,538,374 | 11/1970 | Kane .....  | 313/279 X |

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[57] **ABSTRACT**

A wire support for the coiled-coil filament of a tubular incandescent lamp having a pinch seal in which the wire support is formed with two transverse helical sections of several turns each with the sections having different diameters, the one of smaller diameter receiving the filament and the one of larger diameter engaging the inner wall of the envelope, the support being provided with a longitudinal tail section sealed in the press. In assembly, the helical section of larger diameter is twisted to reduce its diameter to enable passing the envelope over the wire support.

**1 Claim, 5 Drawing Figures**

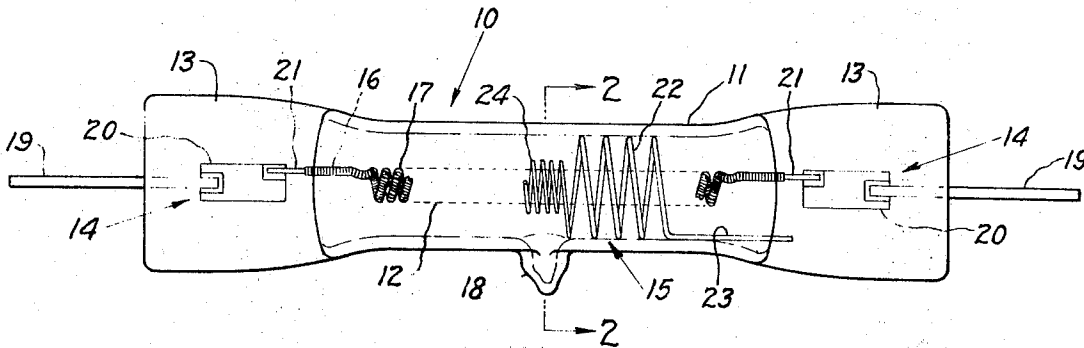


Fig. 1.

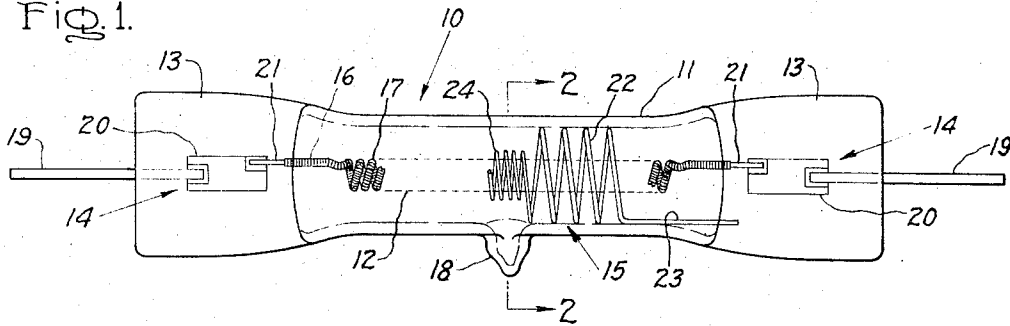


Fig. 2.

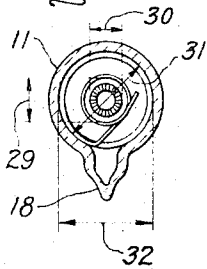


Fig. 3.

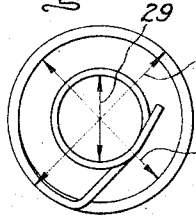


Fig. 4.

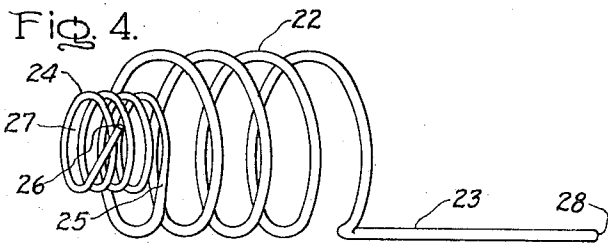
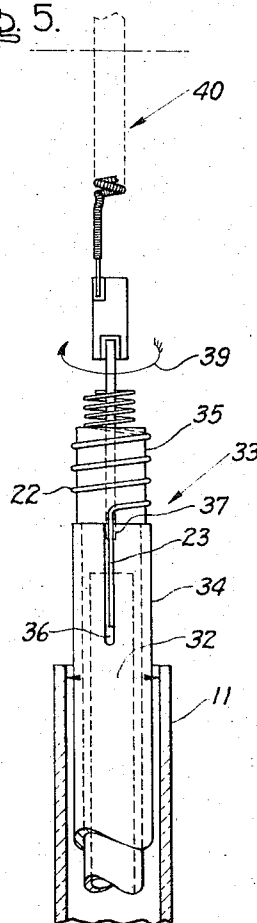


Fig. 5.



## FILAMENT SUPPORT

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The invention relates to incandescent electric lamps having a tubular envelope and lead-in conductors connected to the coiled-coil filament and sealed into the envelope. More particularly, the invention relates to a filament support structure which is in contact with the envelope wall and anchored in a pinch seal.

#### 2. Description of the Prior Art

With the advent of the tungsten halogen lamp, many incandescent lamps took the form of long tubular envelopes with small diameters as compared to the overall length of the envelope. The filament would extend the length of the envelope and after incandescence it would sag and possibly touch the bulb wall thereby causing lamp failure. Various supports such as spirals, discs, triangles and Y's have solved some of the problems created by the sagging filament. These solutions are more fully described in U.S. Pat. No. 3,521,112 assigned to the assignee of the present invention.

However, other problems remained such as the manufacture of the supports themselves. The spiral support illustrated in the Walsh et al U.S. Pat. No. 3,521,112 has a spiral of one full wire turn and a leg portion with a bend for giving the support stability. The manufacture of such a support is difficult because after the spiral is formed from wire, the wire must be extended in one direction, bent and extended back upon itself in an opposite direction to form the leg portion of the support. Bending and moving the wire in an opposite direction does not lend itself to speed in manufacture because the direction of manufacture must be reversed.

Furthermore, since the support leg extends the full length of the envelope, the probability of the coiled-coil arcing with the support leg is greatly increased. There is also the problem of the inner helix of the spiral having only one turn thereby exposing the terminal end of the spiral. When the coiled-coil and foil are threaded through the inner helix, the coiled-coil can contact the terminal end of the inner helix, and cause the filament to snag and stretch.

Another problem common to the spiral support of the prior art is the phenomena called "checking". The end of the support leg is in contact under pressure with the envelope wall and during the heating process for making the seal, the support at times adheres to the bulb wall. Upon cooling after sealing or in subsequent operation, the support, due to its higher coefficient of thermal expansion, shrinks and induces stress in the bulb wall which leads to cracks and eventual failure.

As previously indicated, the supports of the prior art made contact with the bulb wall through a spring-like action of a bent leg. In order to insert such a support, the transverse section and leg were compressed and inserted in the bulb and then sprung and moved into predetermined location. This type of operation also does not lend itself to automatic or mass production.

### SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a support with a configuration which lends itself to unidirectional manufacture and accurate and rapid assembly. A further object of the invention is to provide a support with more than one inner turn so that the terminal end of the inner helix is not exposed and the coil

assembly will not snag and stretch. Still another object of the invention is to reduce the probability of arcing by reducing the overall length of the support. A further object of the invention is to eliminate checking.

The objects of the invention are achieved by using a support member formed of wire having two transverse helical sections of differing diameter and a tail section which parallels the longitudinal axis of the bulb. Each of these sections or portions are consecutively connected so that the direction of processing is not reversed. The diameter of the smaller transverse helical section is such that the foil and filament can pass through it without snagging and stretching while still giving meaningful support to the filament. The larger helical diameter section forms an interference fit with the bulb wall and has more than one full wire turn to give the support stability without checking the envelope wall. A further object of the invention is achieved by shrinking the large helix portion before positioning the support in the envelope and then springing the helix to fit the envelope.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevation of a double-ended lamp having a support according to the invention;

FIG. 2 is a cross-section taken along line 2—2 of the lamp shown in FIG. 1;

FIG. 3 is a front view of the support of the invention;

FIG. 4 is a perspective view of the support in accordance with the invention; and

FIG. 5 illustrates a method of assembling the envelope support and filament mount according to the invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawings, a double-ended lamp 10 is made up of envelope 11, filament 12, pinch seals 13, lead-in conductors 14, and support wire 15. Filament 12 is of the coiled-coil type with primary turns 16 and secondary turns 17. Lamp 10 can be filled with an inert gas such as argon and a halogen such as iodine to produce the well-known tungsten-halogen cycle. The lamp is filled through an exhaust tube the tipped off residue of which is shown at 18. Lead-in conductors 14 are comprised of outer lead wire 19, foil 20 and inner lead 21. The lead-in conductors are hermetically sealed in envelope 11 at pinch seal 13.

Support wire 15 of the invention is shown in greater detail in FIGS. 2, 3 and 4. As shown in FIG. 4, support wire 15 has a large diameter helical portion 22, a tail section 23, a small diameter helical portion 24 and a transition portion 25. In accordance with one aspect of the invention, large diameter portion 22 is made up of four full turns of wire. A minimum of more than one full turn, referred to herein as "several" turns, is required to prevent the support from tipping. Prior art supports have one or less than one full turn to contact the envelope wall. Large diameter helical portion 22 is connected to small diameter portion 24 by transition portion 25.

The small diameter helical portion 24 similarly has more than one full turn, or several turns, of wire. By having more than one turn, the filament can easily slide through the opening formed by the turns without catching on the terminal end 26 as was the case with certain

prior art supports of one or less turns. With one turn or less, the terminal end was always exposed and capable of snagging the filament. In the instance of a coiled-coil filament, the space 27 is smaller than the diameter of the filament primary. The total number of turns in portion 24 in excess of one is dependent upon the length of a secondary turn in a coiled-coil. The number of turns must result in a length which is greater than the length covered by a secondary turn of a coiled-coil. By making the pitch in this manner, not even a small portion of the filament wire can depend through the support and contact the envelope wall.

Tail section 23 of support wire 15 runs parallel to the longitudinal axis of envelope 11. The end portion 28 of the tail is anchored in pinch seal 13 to prevent longitudinal movement of support 15 after the support has been positioned in a predetermined relationship to the envelope. By anchoring the tail in the pinch seal and by having more than one turn on the large diameter section, both transverse and longitudinal movements of the support are prevented.

As shown in FIG. 2, the inside diameter 29 of small diameter section 24 is larger than the outside diameter 30 of filament 12. The inside diameter 29 should be large enough to allow the filament mount assembly to be threaded through the support helix without interference, and at the same time, small enough to give adequate support to filament 12 when it begins to sag.

As shown in FIG. 2, the outside diameter 31 of helical portion 22 is somewhat larger than the inside diameter 32 of envelope 11 thereby forming an interference fit between the envelope and the support. The interference fit insures that the support will not tip or slant but will be in an upright position at all times.

Referring now to FIG. 5, the assembly method of the invention is therein illustrated. A mount pin 33 is comprised of two sections 34 and 35 of different diameters. The diameter of section 34 is smaller than the inside diameter 32 of the envelope. Smaller diameter section 35 has a diameter which will allow the outside diameter 31 of large diameter support helix 22 to be reduced by twisting (hereinafter described) to a value less than inside diameter 32 of envelope 11. Groove 36 in mount pin 33 is used to hold the tail section 23 after the large diameter section 22 has been torqued to reduce outside diameter 31. Hole 37 in the top of section 35 is used to hold outer lead wire 19 in position until the filament mount assembly is aligned with the envelope and the support.

The first step in the method of assembling the envelope, support and filament mount is positioning envelope 11 over the large diameter portion 34 of mount pin 33. Support wire 15 is then placed on the shoulder formed between large diameter section 34 and small diameter section 35. At this time, the inside diameter 38 of the helix section 22 (FIG. 3) is larger than the di-

ameter 35 of mount pin 33. Outside diameter 31 of the helix 22 is presently larger than the inside diameter 32 of envelope 11.

After the support is positioned on the mount pin, a twist or torque is applied to the large helix portion in the direction of arrow 39. In the case illustrated in FIG. 5, the torque is applied by gripping transition portion 25 in a holder (not shown) and then taking the tail section 23 and moving it, in the direction of arrow 39, until the inside diameter 38 is equal to the diameter 35. The support can then be moved until the tail 23 fits inside holding groove 36. Filament mount 40 is then positioned in the mount pin by inserting outer lead 19 into hole 37 and by holding the opposite outer lead 19 in a conventional holding fixture, not shown.

With the components in position, envelope 11 is raised until support wire 15 is located in a predetermined position with respect to the envelope. The original size of large helix section 22 is greater than the inside diameter of the envelope. However, when the helix has been torqued, as described above, the diameter shrinks so that it is smaller than the inside diameter of the envelope. After the envelope is positioned over the support, the torque, which has been applied, is released by removing tail section 23 from groove 36 and by releasing the holder, not shown, which had been holding transition section 25. The large diameter helix section 22 then springs back to its original size thereby forming an interference fit with the bulb wall.

Following this step, the envelope 11 carrying support 15 is moved over the filament mount 40 until the mount is located in a predetermined position with respect to the envelope. The ends of the envelope are then pinch sealed according to methods well known in the art.

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

1. In an electric incandescent lamp having a tubular envelope, a helical coiled-coil filament within the envelope, and lead-in conductors connected to the filament, said lead-in conductors being hermetically sealed in the envelope with a pinch seal; the improvement which comprises a wire filament support having a first helical portion of several turns surrounding and supporting said filament and a second helical portion of several turns engaging the inner wall of said envelope, said wire support having a tail extending from the second helical portion parallel to the longitudinal axis of the envelope and being anchored in the pinch seal, said first helical portion having a termination which is unexposed when viewed through the diameter of the first helix in a direction forward of said tail portion, the space between wire turns of the first helix being smaller than the diameter of the primary turns of the coiled-coil filament.

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