

[54] **METHOD OF ASSEMBLING A
FILAMENT-MOUNT FOR A SINGLE-ENDED
INCANDESCENT LAMP**

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[22] Filed: **Apr. 18, 1973**

[21] Appl. No.: **352,369**

Related U.S. Application Data

[62] Division of Ser. No. 260,084, June 6, 1972.

[52] U.S. Cl. **29/25.15, 313/271**

[51] Int. Cl. **H01J 9/18**

[58] Field of Search **29/25.15, 25.18; 313/271;
140/71.5, 71.6**

References Cited

UNITED STATES PATENTS

3,069,582 12/1962 Reilly et al. 313/271

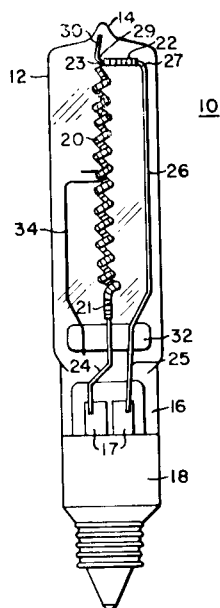
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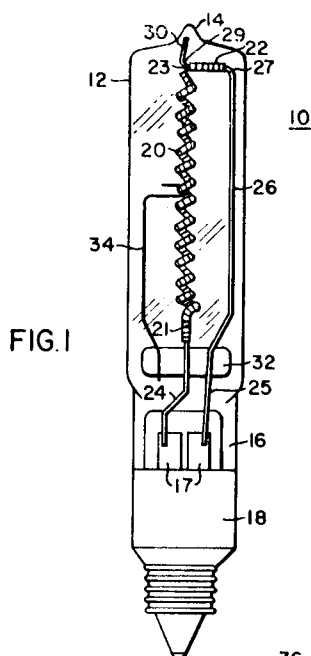
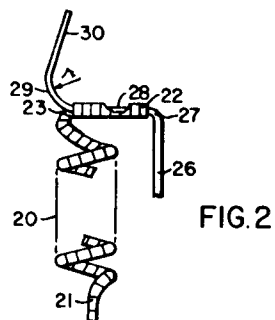
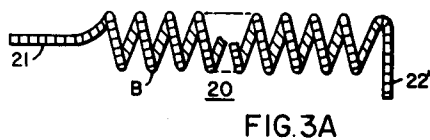
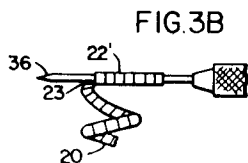
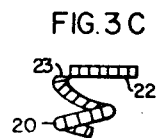
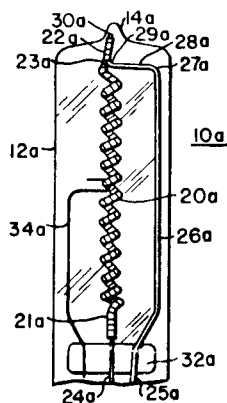
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[57] **ABSTRACT**

The coiled-coil filament of a quartz-halogen lamp is formed from a continuously-wound primary coil and is provided with a leg at each end. The filament is suspended in coaxial position within the tubular envelope by a pair of lead wires that extend into and are secured directly to the coil legs. A selected primary turn of the continuously-wound filament leg at the tipped-off end of the envelope is bent to provide an opening in the leg and the associated end of the lead wire is formed into an L-shaped hook that is inserted into the leg and through the opening therein so that the end of the hook projects beyond the filament.

5 Claims, 6 Drawing Figures





METHOD OF ASSEMBLING A FILAMENT-MOUNT FOR A SINGLE-ENDED INCANDESCENT LAMP

CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of application Ser. No. 260,084 filed June 6, 1972.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates to electric incandescent lamps and has particular reference to a novel method of manufacturing a filament-mount assembly for a quartz-halogen type lamp.

2. Description of the Prior Art:

Halogen type incandescent lamps are well known in the art and are used in various industries and applications where a compact source of light or heat is required. A persistent problem in the manufacture of these lamps is that of connecting the ends of the lead wires to the coiled-coil filament and maintaining the latter in centralized position within the tubular quartz envelope during the life of the lamp.

The prior practice has been to fasten the ends of the lead wires to the filament with so-called "button-hook" connections which were made by forming a single turn (or a partial turn) on the end of the lead wire and screwing it directly into the secondary turn at the end of the filament barrel. A lamp in which the upper end of a coiled-coil filament is fastened to the long lead wire by a separate spud wire using such a "button-hook" juncture is disclosed in U.S. Pat. No. 3,403,280 issued Sept. 24, 1968 to J. G. Cardwell, Jr.

In another prior art lamp the coiled-coil filament was wound in such a way that it was terminated by a singly-coiled leg at each end, which legs were joined to the coiled-coil barrel portion of the filament by uncoiled sections of wire or "breaks" in the primary winding. The filament thus had a sectionally wound primary coil instead of one which was continuously wound. The ends of the lead wires were bent into hooks which were inserted into the coil legs and the end of the longer lead wire was positioned within the hollow seal tip formed on the end of the bulb. A lamp having such a filament and mount structure is disclosed in U.S. Pat. No. 3,466,489 issued Sept. 9, 1969 to E. G. Audesse et al.

While the aforementioned prior art mounts held the filament in the desired coaxial position within the envelope and provided satisfactory electrical connections between the leads and filament, they were complicated and difficult to assemble and required expensive precision made spud wires or filaments which had uncoiled sections and could thus not be wound continuously. Such filaments, accordingly, had to be wound on machines which provided the desired "breaks" or uncoiled sections in the primary coiling and the secondary winding operation then had to be done by a skilled operator in order to insure that the uncoiled sections were positioned at the proper location between the respective coil legs and the ends of the coil barrel. This prevented the filaments from being manufactured on automatic secondary-winding machines and greatly increased the manufacturing cost of both the filaments and lamps.

SUMMARY OF THE INVENTION

The foregoing deficiencies and problems encountered with the prior art filaments and mount structures are overcome in accordance with the present invention by utilizing a coiled-coil filament that initially has a continuously wound primary winding and, by means of a simple operation, is subsequently modified by bending a primary turn in such a way that it provides an opening in one of the filament legs which permits the hooked end of the long lead wire to be inserted into the leg and through the opening in the leg so that the end of the lead extends beyond the filament. In the preferred embodiment the end of the longer lead is bent into an L-shaped hook having an arcuate bend and an upstanding stud segment. The stud segment projects through the leg opening into the hollow tip of the envelope and thus maintains the filament in the desired centralized position within the envelope.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be obtained from the exemplary embodiments shown in the accompanying drawing, wherein:

FIG. 1 is an elevational view of a 250 watt T4 incandescent lamp that has been assembled in accordance with the present invention;

FIG. 2 is an enlarged view of the top portion of the mount structure employed in the lamp of FIG. 1;

FIGS. 3A to 3C are views illustrating different stages in the manufacture of the coiled-coil filament according to the invention; and

FIG. 4 is an elevational view of another mount assembly having an alternative form of filament-lead wire connection.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 there is shown a 250 watt single-ended incandescent lamp 10 of the halogen-cycle type which has been assembled in accordance with the preferred form of the invention. As will be noted, the lamp 10 has the usual tubular envelope 12 of quartz (or other suitable high melting point material) that is terminated by a hollow tip 14 and is hermetically closed at its opposite end by a press seal 16 which is cemented to a suitable base 18. The envelope 12 in this particular embodiment is of the T4 type one-half inch or 12.7 mm O.D.) and contains a coiled-coil filament 20 of linear configuration that is wound from a suitable refractory metal wire such as tungsten. The filament 20 is suspended in coaxial position within the envelope 12 by a short lead wire 24 and a long lead wire 25 that are anchored in the press seal 16 and connected to the usual ribbon conductors 17 embedded in the seal.

The coiled-coil filament 20 has a coaxially extending singly-coiled leg 21 that is slipped over and hot clamped to the end of the short lead wire 24 and has a transversely extending singly-coiled leg 22 at its opposite end that has a bent primary turn which defines an opening 23 in the filament leg that is located at the end of the coil barrel.

As will be noted in FIG. 1 and more particularly in FIG. 2, the longer lead wire 25 has its medial portion 26 offset toward the wall of the envelope 12 so that it extends along but is spaced from the filament 20. At a point abreast of the leg opening 23, the long lead wire

25 is provided with a sharp angular bend 27 and the end portion of the lead is formed into a generally L-shaped hook consisting of a transverse arm segment 28 that is joined by an arcuate bend 29 to an upstanding stud segment 30 which constitutes the terminus of the lead wire and projects into the hollow tip 14 of the envelope 12. As shown in FIG. 2, the arcuate bend 29 has a radius of curvature "r" that is much larger than that of the sharp angular bend 27 and the stud segment 30 is tilted slightly toward the offset medial portion 26 of the lead wire. The radius of curvature "r" is at least three times the diameter of the lead wire 25. This permits the L-shaped hook portion of the longer lead wire 25 to be slipped into the filament leg 22 and through the leg opening 23 until these two components are firmly connected to one another, in the position shown in FIGS. 1 and 2, with the end of the stud segment 30 in substantial alignment with the filament axis.

As will be noted in FIGS. 1 and 2, the filament leg 22 and transverse arm segment 28 of the lead wire 25 are of such length that the free end of the leg is seated against the sharp angular bend 27. The latter thus serves as a stop which automatically positions the filament 20 on the lead wire 25 and aligns the filament with the envelope axis when the mount assembly is inserted into the envelope and stud segment 30 slips into the bulb tip 14.

As illustrated in FIG. 1, the rigidity of the mount structure is enhanced by a transverse bridge member 32 of vitreous material that is fused to the lead wires 24, 25 at a point adjacent the press seal 16. An auxiliary support wire 34 is embedded in the bridge member and coupled by means of a hook to one of the secondary turns of the filament 20. The conjoined filament 20, lead wires 24 and 25, bridge 32, and auxiliary support wire 34 thus constitute a unitary mount structure that can be readily handled and inserted into the envelope 12 and sealed therein when the press seal 16 is subsequently formed.

In the case of a halogen incandescent lamp of the type illustrated, the envelope 12 and bridge 32 are composed of quartz and the lead wires 24 and 25, the filament 20 and the auxiliary support wire 34 are all fabricated from tungsten. The envelope is filled with an inert gas such as an argon-nitrogen mixture that is dosed with a suitable halogen such as iodine or bromine. Of course, the improved mount can also be employed in standard incandescent lamp types that are not dosed with a halogen.

METHOD OF ASSEMBLY

As shown in FIG. 3A, the coiled-coil filament 20 as originally formed has a barrel portion B that consists of a plurality of spaced secondary turns and is terminated at one end by an axially extending singly-coiled leg 21 and at its opposite end by another singly-coiled leg 22' that lies perpendicular to the axis of the filament. As will be noted, the filament 20 "as formed" consists of a continuously-wound primary coil which, in turn, is wound into a coiled-coil helix that is initially devoid of any openings, breaks or uncoiled sections of wire. The coiled-coil filament 20 can thus be automatically wound on conventional primary and secondary coiling machines in a very economical manner.

As shown in FIG. 3B, the desired opening 23 in the transverse filament leg 22' is formed by inserting a pointed mandrel-like tool 36 into the leg and manipu-

lating the tool so that its tip permanently deforms and bends a single primary turn from its "as-wound" configuration. The tool 36 is then withdrawn. The finished filament 20 (FIG. 3C) thus has a singly-coiled leg 22 of predetermined length with an opening 23 therein that is located at the end of the adjoining secondary turn of the filament.

To facilitate the turn-bending operation, the tool 36 should have a diameter that is slightly less than the inner diameter of the primary coil. In the case of the 250 watt T4 lamp illustrated, satisfactory results have been obtained by using a tungsten tool whose diameter was about 0.025 mm. smaller than the diameter of the primary mandrel. The lead wire 25 had a diameter of about 0.38 mm. and the radius of curvature "r" of the arcuate bend 29 was approximately 1.5 mm. or about four times the wire diameter.

ALTERNATIVE EMBODIMENT

As shown in the alternative embodiment depicted in FIG. 4, the coil-winding and "turn-bending" operations can be performed in such a manner that a longitudinally extending singly-coiled leg 22a having an opening 23a therein is provided at the top of the lamp 10a. In this case, the arcuate bend 29a of the long lead wire 25a extends into the opening 23a formed in the filament leg 22a by the tool and the upstanding stud segment 30a of the hooked end of the lead is located within and projects beyond the filament leg 22a into the bulb tip 14a. The arm segment 28a is thus isolated from the filament 20a and merely serves to maintain the offset medial portion 26a of the lead wire 25a in the desired location adjacent the envelope wall.

Since only the stud segment 30a extends through the leg 22a in this embodiment, the arcuate bend 29a can have the same radius of curvature as the sharp bend 27a and the stud segment can extend axially and need not be tilted. The other leg-lead wire juncture and features of the mount assembly are identical to those shown in FIG. 1 and previously described.

I claim as my invention:

1. In the manufacture of a filament-mount assembly for an electric incandescent lamp wherein a coiled-coil filament of refractory metal wire and linear configuration is attached directly to the ends of a pair of rigid lead wires that hold the filament in place within the lamp envelope, the method of mechanically coupling and electrically connecting the filament to one of said lead wires, which method comprises the steps of;

50 fabricating said coiled-coil filament from a continuous primary winding and providing a depending singly-coiled leg of uniformly-spaced and continuously-wound primary turns at the end of the filament which is to be fastened to said lead wire,

55 inserting a tool into the free end of said filament leg and manipulating said tool so that the tip thereof bends and permanently displaces a selected primary turn from its as-wound configuration and thereby forms an opening in said leg,

60 withdrawing said tool from the filament leg,

shaping the end of said lead wire into a generally L-shaped hook which has a transverse arm segment and an upstanding stud segment that are joined by an arcuate bend having a predetermined radius of curvature, said arm segment being joined to the body portion of said lead wire and said stud segment constituting the terminus of said lead wire,

inserting the stud segment of said lead wire hook into the free end of said filament leg and manipulating the lead wire until the stud segment and arcuate bend portion of the hook pass through the opening formed in the filament leg and the arm segment of the hook is disposed within said filament leg, and then

securing said lead wire to a bridge member that is joined to the other lead wire and thus maintains the filament and lead wires in assembled operative relationship.

2. The method of claim 1 wherein; the depending leg of said coiled-coil filament extends transversely relative to the filament axis.

the arm segment of said lead wire hook is joined to the body portion of the lead wire by a sharp angular bend, and

the L-shaped hooked end of said lead wire is inserted into the filament leg until the free end of said leg is seated against the sharp angular bend in said lead wire and said bend thus serves as a stop that positions the filament on the hooked end of said lead wire.

3. The method of claim 2 wherein; the hooked end of said lead wire is of uniform circular cross-section, and

the radius of curvature of the arcuate bend portion of said lead wire is at least three times as large as the diameter of said lead wire.

4. The method of claim 2 wherein; said tool comprises a pointed mandrel-like member that has a diameter which is slightly smaller than the inner diameter of the filament leg, and the pointed end of said member is inserted into the filament leg.

5. In the manufacture of a filament-mount assembly

for an electric incandescent lamp wherein a coiled-coil filament of refractory metal wire and linear configuration is attached directly to the ends of a pair of rigid lead wires that hold the filament in place within the lamp envelope, the method of mechanically coupling and electrically connecting the filament to one of said wires, which method comprises the steps of;

fabricating said coiled-coil filament from a continuous primary winding and providing a longitudinally depending singly coiled leg of uniformly-spaced and continuously wound primary turns at the end of the filament which is to be fastened to said lead wire,

inserting a tool into the free end of said filament leg and manipulating said tool so that the tip thereof bends and permanently displaces a selected primary turn from its as-wound configuration and thereby forms an opening in said leg,

withdrawing said tool from the filament leg,

shaping the end of said lead wire into a generally L-shaped hook which has a transverse arm segment and an upstanding stud segment that are joined by an arcuate bend, said arm segment being joined to the body portion of said lead wire and said stud segment constituting the terminus of said lead wire,

inserting the stud segment of said lead wire hook into the opening formed in said filament leg and manipulating the lead wire until the stud segment of the hook is located within the leg and the latter engages the arcuate bend portion of said hook, and then

securing said lead wire to a bridge member that is coupled to the other lead wire and thus maintains the filament and lead wires in assembled operative relationship.

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