United States Patent

Martin et al.

[15] **3,696,265**

[45] **Oct. 3, 1972**

[54] **COMPACT SINGLE-ENDED INCANDESCENT LAMP HAVING IMPROVED FILAMENT MOUNT ASSEMBLY**

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[73] Assignee: **Westinghouse Electric Corporation**, Pittsburgh, Pa.

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[52] **U.S. Cl.** **313/222**, 313/276, 313/279

[51] **Int. Cl.**.....**H01k 1/18**, H01k 1/50

[58] **Field of Search**.....313/222, 274, 276, 279, 271

[56] **References Cited**

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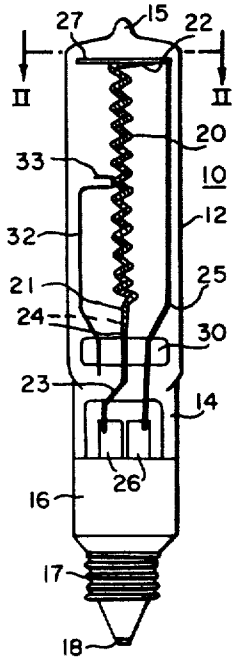
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[57] **ABSTRACT**

The coiled-coil filament of a single-ended halogen type lamp is suspended in generally coaxial position within a tubular envelope by a pair of rigid lead wires of unequal length that have smooth substantially straight ends which are slip-fitted into and hot clamped to singly-coiled legs provided at each end of the coiled-coil. An end segment of the longer lead wire is bent into a transversely-extending loop which is disposed in loose nesting relationship with the top of the bulb and thus also serves as an integral mount-positioning-and-bracing means. An optional bridge and anchored auxiliary support wire for the filament provide additional shock-proof protection. The simplicity of the resulting mount structure reduces the manufacturing cost of the lamp without affecting lamp quality or performance.

9 Claims, 5 Drawing Figures



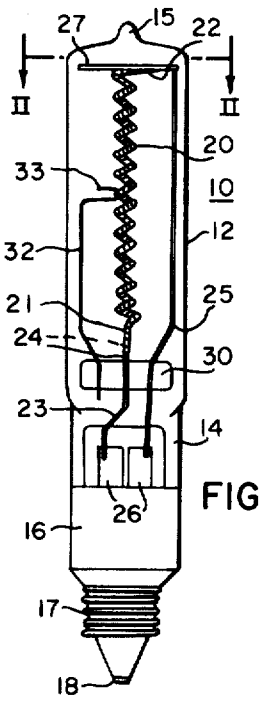


FIG. 1

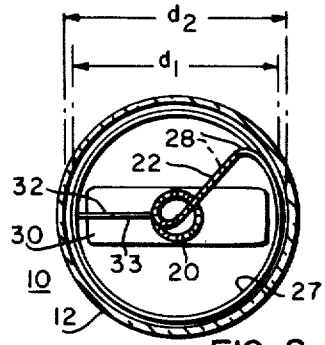


FIG. 2

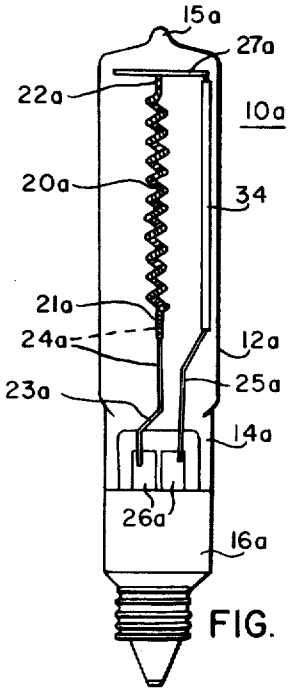


FIG. 4

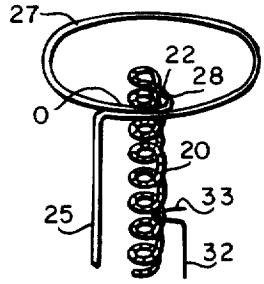


FIG. 3

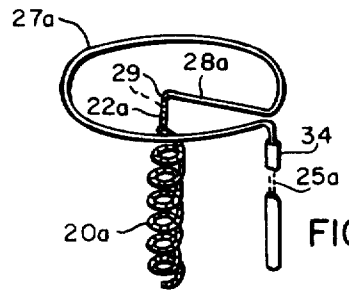


FIG. 5

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COMPACT SINGLE-ENDED INCANDESCENT LAMP HAVING IMPROVED FILAMENT MOUNT ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric lamps and has particular reference to a compact single-ended incandescent lamp of the halogen type that has an improved filament mount assembly.

2. Description of the Prior Art

Halogen type incandescent lamps are well known in the art and are being used as light and heat sources in an increasing number of industries and applications. Basically, the lamps consist of a quartz envelope that contain a tungsten coiled-coil filament and a halogen gas such as iodine or bromine which provides a "gettering cycle" that returns vaporized tungsten to the filament during lamp operation. When the lamps are of single-ended construction, one end of the quartz envelope is generally closed by a press seal and the opposite end of the envelope is provided with a tubulation that is tipped off after the lamp has been evacuated and filled with an inert gas and the required amount of iodine or other halogen additive. The coiled-coil filament is held in coaxial position within the bulb by a mount structure which includes a pair of lead wires that are coupled to the ends of the filaments and have their opposite ends embedded in the press seal.

The prior art practice has been to electrically fasten the inner ends of the lead wires to the coiled-coil filament by means of so-called "button-hook" connections which were made by forming a single turn (or part of a turn) on the end of the lead wire and screwing it directly into the secondary turn at the end of the coiled-coil filament. The filament, accordingly, was not provided with singly-coiled legs at its ends. A juncture of this type wherein the upper end of a coiled-coil filament is fastened to the long lead wire by a separate spud or insert that is provided with a turn which is screwed into the end turn of the coiled-coil barrel is disclosed in Canadian Pat. No. 827,273 (FIG. 2) issued Nov. 11, 1969 to John G. Cardwell, Jr. In this particular design, the long lead wire forms part of a U-shaped support structure that extends longitudinally within and is seated against the inner walls of the envelope — thereby positioning the coiled-coil filament in the desired coaxial location within the envelope.

Various other types of mount structures for such lamps utilizing separate U-shaped connector wires, lead wires with coiled ends that are fitted over singly-coiled legs provided at the ends of the coiled-coil, intermediate connector members having two coiled sections which are fastened to and coaxially position the coiled-coil filament within the bulb, and long leads whose inner ends are located within the cavity formed by the tip-off or are embedded in a second press seal are disclosed in U.S. Pat. Nos. 3,466,489; 3,486,065; 3,493,808; 3,497,753 and 3,515,420.

A double-ended tubular incandescent lamp having a filament support member of spiral configuration that is seated within an annular recess formed in the bulb wall is disclosed in U.S. Pat. No. 3,496,402. A single-ended electric lamp having a V-shaped coiled-coil filament that is held in place within the bulb by a circular wire support that is compressively locked within a recess

formed at the doomed end of of the envelope and is coupled to the filament bight is disclosed in U.S. Pat. No. 3,496,403. A lamp having a long lead wire protectively encased in a vitreous tube is disclosed in U.S. Pat. No. 2,159,794 issued to Hagen et al.

While the aforementioned prior the finished mount structures provide the desired axial positioning of the coiled-coil filament and satisfactory electrical connections between the leads and filament, they were complicated and difficult to assemble and required precision-made spud wires, connectors, or filaments with non-coiled segments—all of which increased the manufacturing cost of the lamp and necessitated the use of highly-skilled workers in order to insure that thefinished lamps were of acceptable quality.

SUMMARY OF THE INVENTION

The foregoing deficiencies and problems associated with the prior art structures are avoided and the manufacturing cost of the lamp is drastically reduced in accordance with the present invention by utilizing a coiled-coil filament and lead-in conductors which are so designed that they can be quickly and securely fastened directly to one another and, when assembled, form a mount structure which automatically positions the filament within the envelope and protects it from mechanical impacts and vibration.

Briefly, the foregoing advantages are achieved by providing singly-coiled legs at each end of the coiled-coil filament and by using lead wires that have free ends which are conformed to be slip-fitted into and hot-clamped directly to the coil legs. An end segment of the longer lead wire is bent into a transverse loop which loosely fits and nests within the top of the bulb and thus axially positions the filament and mechanically braces the mount structure. Additional shock-proof protection is provided in a preferred embodiment by joining the lead-in conductors with a bridge of insulating material, anchoring an auxiliary support wire in the bridge member and coupling the wire to a center turn of the filament.

The improved mount structure eliminates the separately-formed connector members, coiled spud wires, "button-hook" connections, etc. employed in the prior art structures and is thus very inexpensive and simple to manufacture. Moreover, since the seal tip at the top of the bulb is completely isolated from the mount structure, the possibility of forming poor "tip-offs" and leaky lamps due to the presence of a part of the mount structure in the exhaust tube is eliminated. The tipping-off operation and the salvage of sub-quality lamps by sealing a new exhaust tubulation to the bulb and refilling the lamp are also facilitated.

BRIEF DESCRIPTION OF THE DRAWING

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

FIG. 1 is an enlarged side elevational view of a 250 watt T4 single-ended incandescent lamp embodying the present invention;

FIG. 2 is an enlarged cross-sectional view of the lamp along the lines II—II of FIG. 1;

FIG. 3 is a fragmentary perspective view of the filament mount structure shown in FIGS. 1 and 2;

FIG. 4 is an elevational view of an alternative lamp embodiment; and

FIG. 5 is an enlarged perspective view of the upper portion of the filament mount structure employed in the lamp embodiment of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 there is shown a 250 watt single-ended incandescent lamp **10** embodying a preferred form of the invention. The lamp **10** comprises a tubular envelope **12** of quartz or other suitable vitreous light-transmitting material that will withstand the extreme operating temperatures involved. As shown, the envelope **12** is of cylindrical configuration (preferably a T4 bulb type) and is closed at one end by a press seal **14** which is secured with a suitable cement to a ceramic base member **16** that has a metal threaded shell **17** at an end contact **18**. A coiled-coil filament **20** of linear configuration and suitable refractory metal wire, such as tungsten, is suspended in generally coaxial position within the envelope **12** by a pair of rigid lead-in conductors **23** and **25** of suitable wire that are attached directly to singly-coiled legs **21, 22** provided at the respective ends of the filament **20**.

The lead wires **23, 25** are of unequal length and are welded to molybdenum ribbons **26** that are hermetically embedded in the press seal **14**. The opposite ends of the ribbons **26** are fastened to outer leads (not shown) that are connected to the shell **17** and end contact **18** of the base **16** in the usual manner. The medial portion of the long lead wire **25** is off set toward and extends longitudinally along a side wall of the envelope **12**.

The domed end of the envelope **12** is closed by a seal tip **15** formed when the exhaust tubulation is tipped-off in the well-known manner after the exhaust and gas filling operations have been completed. In the case of a halogen type lamp, the envelope **12** is filled with an nitrogen mixture and a suitable halogen gas such as iodine or bromine, and the portions of the lead-in wires **23, 25** that are located within the envelope **12** are fabricated from tungsten or other suitable metal that will not be chemically attacked by the halogen atmosphere.

As will be noted in FIGS. 1–3, an end segment of the long lead wire **25** is bent into a loop **27** that extends transversely of the lamp axis and is loosely and nestingly seated within the top of the bulb **12**. The loop **27** is preferably of circular configuration and, as shown in FIG. **2**, has an outer diameter d_1 which is smaller than the inner diameter d_2 of the tubular envelope **12**. The loop **27** is also of closed configuration, and as shown most clearly in FIG. **3**, is so formed that the arcuate segment immediately adjacent the laterally-extending straight end **28** of the long lead **25** overlies and overlaps the arcuate segment of the wire that is immediately adjacent to the longitudinally-extending offset part of the lead and thus comprises the beginning of the loop **27**. The resulting overlap O of the aforesaid arcuate segments of the long lead wire **25** permits the filament **20** to be mounted under tension without causing a downward displacement of the attached part of the loop **27** and distortion of the mount.

As shown in FIGS. 1–3, the free ends **24, 28** of the lead wires **23, 25** are connected directly to the respective coil legs **21, 22**. This is achieved by making the diameter of the lead wires slightly smaller than the inside diameter of the coil legs so that the ends of the leads can be slipped into the legs the required distance. The coil legs **21, 22** are then hot clamped to the enclosed lead wire ends **24, 28** so that the primary turns of the coil legs firmly grip the wires and provide a positive electrical connection. The lead wire ends **24, 28** are made smooth and burrs and splits are eliminated to insure a trouble-free fit when they are inserted into the coil legs **21, 22**.

Since the free end **24** of the short lead wire **23** is substantially coincident with the longitudinal axis of the envelope **12**, the leg **21** at the bottom of the filament **20** (as viewed in FIG. 1) extends longitudinally from the coil barrel and is generally located in coaxial position. However, since the free end **28** of the longer lead **25** extends laterally toward the envelope axis, the leg **22** at the opposite end of the filament **20** extends transversely relative to the filament axis to accommodate the lead wire end **28**.

Additional shock-proofing of the filament **20** in cases where the lamp **10** will be subjected to rough service operating conditions can be provided, if desired, by embedding the portions of the lead wires **24, 25** that are located between the press seal **14** and the proximate end of the filament **20** in a quartz bridge **30** and anchoring an auxiliary support wire **32** in the bridge, as shown in FIGS. 1 and 2. The opposite end of the support wire **32** is bent into a hook **33** that is coupled to a center turn of the coiled-coil **20**. The conjoined bridge member **30**, leads **23** and **25**, filament **20** and support wire **32** form a unitary mount structure that is simple but very rugged.

Excellent results have been obtained by winding the coiled-coil filament **20** in such a manner that the coil legs had an inner diameter (nominal) of 0.46 millimeters and by using lead wires 0.43 millimeters in diameter so that a clearance of approximately 0.03 millimeter is provided between the coil legs and inserted ends of the lead wires prior to the hot-clamping operation. The clearance should not exceed about 0.05 millimeter otherwise excessive deformation of the clamped primary turns of the coil legs may occur. The coaxial leg **21** was 4 to 4.5 mm. long and the lateral leg **22** had a length of 5 to 5.5 mm. and extended about 3 mm. beyond the coil barrel. In the case of a T4 type bulb having an inner diameter (dimension d_1) approximately 11 millimeters (nominal), satisfactory axial positioning of the filament within the bulb was achieved by employing a circular loop **27** having an outer diameter of from 9.75 millimeters to 10 millimeters.

ALTERNATIVE EMBODIMENT (FIGS. 4 AND 5)

In FIG. **4** there is shown an alternative single-ended lamp **10*a*** that is similar to that shown in FIGS. **1** and **2** but is further simplified by eliminating the quartz bridge and auxiliary support wire for the filament. Thus, the coaxial filament **20*a*** is held in place solely by lead wires **23*a*** and **25*a*** which have their straight ends **24*a*** and **28*a***, respectively, slip-fitted into and hot-clamped to the coil legs **21*a*** and **22*a***. As will be noted more particularly in FIG. **5**, the circular loop **27*a***

formed at the end of the longer offset lead **25***a* is not closed in this embodiment and its laterally-extending free end **28***a* is bent into L-shaped configuration so that its tip **29** extends in an axial direction. The coil leg **22***a* at the associated end of the coil-coiled filament **20***a* is thus coaxially oriented to accommodate the lead wire tip **29** and both of the coil legs are coaxially disposed in this embodiment.

In order to prevent the filament **20***a* from accidentally touching the longer lead **25***a* and causing a short circuit, the offset medial part of the lead **25***a* is protectively encased in a quartz tube **34** that is slipped in place before the lead wire is bent into the desired shape.

While the protective tube **34**, bridge member **30** and envelopes **12** and **12***a* have been described as being composed of quartz, they may be fabricated from other types of vitreous materials that have a sufficiently high silica content and softening point, such as Vycor glass for example. The simplified mount structure can also be used in lamps having ratings above 250 watts and, in such cases, will obviate the need for expensive separately-formed spiral supports for the filament.

We claim as our invention:

1. A single-ended electric incandescent lamp comprising, in combination;

an elongated tubular envelope of vitreous light-transmitting material that has a press seal at one end,

a pair of spaced rigid lead-in conductors of unequal length hermetically embedded in said press seal and extending into said envelope,

the inner end of the shorter conductor terminating at the press-sealed end of the envelope and the longer conductor being offset toward and extending longitudinally along a side wall of the envelope and terminating in a transversely-disposed loop portion the free end whereof depends laterally toward the axis of said envelope, and

a coiled-coil filament of refractory metal wire and substantially linear configuration having a singly-coiled leg at each end that extends directly from the filament barrel and encloses and is electrically fastened to the free end of one of the respective lead-in conductors so that said filament is thereby suspended by said conductors in a longitudinally-extending position within said envelope,

the maximum width dimension of the traverse loop portion of said longer lead-in conductor relative to the minimum inner dimension of said tubular envelope which encloses said loop portion being such that said loop portion is in loose nesting relationship with the surrounding walls of said envelope and said longer conductor thereby serves both as a current-carrying support member for said filament and as a guide-and-bracing means for the filament mount structure.

2. The incandescent electric lamp of claim **1** wherein;

the laterally-extending free end of said loop portion is generally L-shaped and oriented so that its tip segment is directed toward and is in substantial alignment with the envelope axis, and

the legs at both ends of said linear coiled-coil filament extend longitudinally from the filament barrel and are substantially coaxial therewith.

3. The incandescent electric lamp of claim **1** wherein;

said envelope is composed of quartz and contains a halogen atmosphere,

said linear coiled-coil filament is composed of tungsten and disposed in substantially coaxial relationship with said envelope, and

the part of said envelope that contains said filament is of cylindrical configuration and substantially uniform in diameter throughout its length.

4. The halogen-incandescent lamp of claim **3** wherein the leg of the coiled-coil filament that is located at the press-sealed end of the envelope extends longitudinally from the filament and the leg at the opposite end of said filament extends transversely relative to the filament axis.

5. The halogen-incandescent lamp of claim **3** wherein;

the portions of said lead-in conductors that are located within said envelope comprise tungsten wires the free ends whereof are substantially straight and smaller than the inside diameter of the filament legs; and

the free ends of said tungsten wires are locked in place within the respective filament legs by a plurality of primary turns in each of said legs which are clamped around and tightly trip the enclosed ends of said wires.

6. The halogen-incandescent lamp of claim **3** wherein;

the end of said envelope opposite said press seal is terminated by a sealed depending tip, and

the transverse loop portion of the longer lead-in conductor is of substantially circular configuration and spaced from the sealed tip of the envelope so that the latter is isolated from the filament mount structure.

7. The halogen-incandescent lamp of claim **3** wherein;

portions of the lead-in conductors that are located between the press seal and the proximate leg of the coiled-coil filament are anchored in a quartz bridge member and said bridge member, conductors and filament thus comprise a unitary mount assembly, and

the transverse loop portion of the longer lead-in conductor is of closed configuration and conformed so that the segment thereof immediately adjacent its laterally-extending free end overlaps and overlies the segment that is immediately adjacent to the longitudinal-extending part of said conductor and thus constitutes the beginning of said loop portion.

8. The halogen-incandescent lamp of claim **7** wherein an auxiliary support wire is anchored in said bridge member, extends therefrom to a medial secondary turn of said coiled-coil filament, and has its free end coupled to said medial secondary turn.

9. The incandescent electric lamp of claim **1** wherein;

said filament is held in suspended position within the envelope solely by said pair of spaced lead-in conductors, and

the offset medial portion of the longer lead-in conductor is protectively encased in a tubular member of vitreous insulating material.

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