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CONICAL SHAPED FILAMENT SUPPORT

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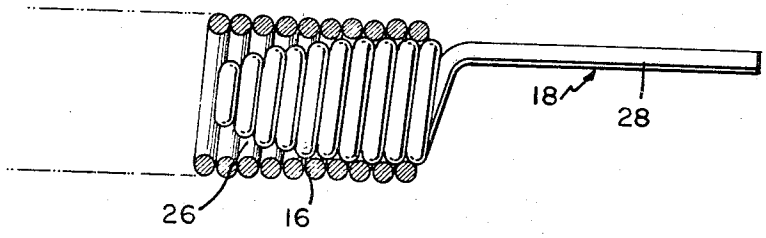


FIG. 1

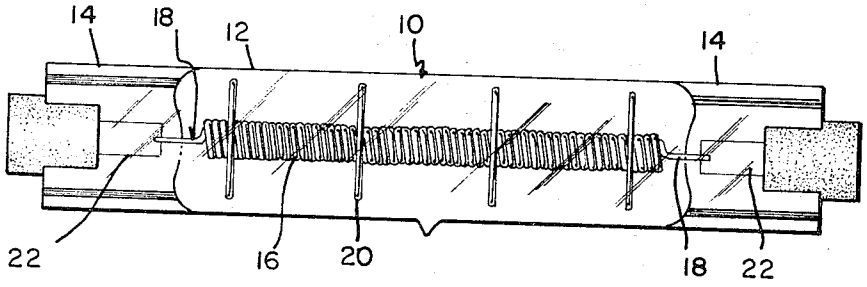


FIG. 2

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CONICAL SHAPED FILAMENT SUPPORT

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ABSTRACT OF THE DISCLOSURE

This invention relates to an improved method of axially supporting a legless filament in a tubular lamp. A tapered conductive wire insert is screwed into each end of a legless filament. The free end of the insert is provided with a straight leg that is welded to electrical sealing foils in the press seal of the lamp, thereby axially supporting and electrically connect the filament within a tubular envelope.

This invention relates generally to incandescent lamps and more particularly to lamp filaments for use in tubular incandescent lamps.

Tubular lamps having high luminous efficiency and long life, such as iodine-quartz lamps, have found many practical applications throughout the lighting industry. These lamps exhibit their long life and high luminous efficiency because of a regenerative-getter action occurring within the envelope during operation, in which tungsten iodide is produced when iodine contained within a fill gas combines chemically with particles of tungsten evaporating from the incandescent filament. Subsequent thermal decomposition of the tungsten iodide returns the tungsten particles to the filament to start the cycle anew. In conventional incandescent lamps, that is those not utilizing a fill gas containing iodine, the tungsten particles will evaporate and deposit on the relatively cold envelope wall thus causing a reduction of luminous efficiency of the lamp due to blackening. Furthermore, when large amounts of particles evaporate from any one point of the filament a rupturing may occur. In either case, the lamp will have to be replaced.

In the past, methods have been devised for the fabrication of the iodine-quartz lamp and procedures have been developed for the fabrication of the tungsten filament. An example of a method for introducing iodine into the lamp envelope is described in U.S. Patent 3,063,778 to Emery Audesse entitled, "Method for Introducing Iodine into a Lamp Envelope." In the method described by Audesse and in many methods of fabricating a quartz iodine lamp, it is necessary to seal a supported, axially positioned tungsten filament through both ends of an elongated tubular high-silica content glass envelope. Because of the nature of the regenerative-getter reaction and the ultimate use of the lamp, it is quite important to position the filament axially within the envelope.

To insure proper axially alignment, circular spacers, generally prepared of tungsten, have sometimes been positioned about the tungsten filament every one or two inches along its length, to prevent sagging when the filament is heated within the tubular glass envelope. In some instances where, for example, the filament is short or a special wire is used, such spacers have been eliminated.

A common construction for the tungsten filaments used in these lamps is a coil with unitary relatively straight legs at each end of the coiled body. For example, the filament was made from a continuous length of tungsten wire which was formed on a "skip-space" coiling machine where a starting straight leg of wire was first secured to a rotating head. Thereafter, the head was rotated about

a mandrel to form a coil. After a desired length was attained, the rotation of the head was stopped but the wire continued to advance axially to form a "straight leg" portion used for support and electrical connection of the coil. The wire was programmed to repeat the process thereby forming continuous coils joined by straight leg portions. A continuous length of "skip-space" coiled wire was then taken up on a reel for further processing. The coiling was then manually cut at the center of the straight portion into the individual filaments, since this type of "skip-space" coiling was not amenable to machine cutting. The legs of the filament were straightened as much as possible and then sintered. The mandrel was then removed by a conventional acid treatment.

In particular, the filament worked upon is quite breakable because of the crystal structure of drawn and sintered tungsten wire. Normally drawn tungsten wire contains long strand-like fibers, but after annealing relatively small crystals are formed which are easily broken upon bending. Thus, not only must correct support be given to the wire, but also heating within precise limits is vital since the tensile strength of the stabilized or recrystallized wire is materially reduced.

Two decided disadvantages of the above-mentioned process were that the legs of the filament had to be displaced away from the axis of the coil insert tungsten support rods before heat treating the coil and secondly, the legs had to be repositioned after stabilization and removal of the rod for proper mounting in the lamp. The stabilization made the tungsten wire considerably more brittle, which sometimes causes fracturing of the legs during the course of fabrication.

As an example of my invention, skip spacing is eliminated and the coil is formed continuously on a mandrel. After heat treating, the coiling is cut into suitable lengths wherein they can be easily inserted on specially designed inserts for stabilization.

When stabilized, the coil is ready to be sealed into a glass envelope. To support the coils, a pair of inserts made from suitable refractory metal wire, such as molybdenum or tungsten are formed in the shape of a tapered cone with a leg extending rearwardly therefrom. The outside diameter of the cone at its widest point is substantially equal to the inside diameter of the coil. The tapered or cone-shaped portion of the insert insures easy insertion at any angle. This is especially helpful when a coil is cut, a burr or enlarged edge is frequently left. Therefore, entrance of the insert is restricted by this protrusion.

With my cone-shaped insert, the smaller forward point can bypass the obstruction of the burr and by turning the insert in a screwing fashion the tapered cone will align itself after the maximum diameter of the cone is reached.

Therefore, an object of my invention is to support tungsten filaments in a suitable envelope by using adaptable support legs for preformed coils.

A feature of my invention is to form cone-shaped inserts of refractory metal wire to support straight legless coils.

Other objects, features and advantages of this invention will become apparent to those skilled in the art upon reading the following specification and the accompanying drawings in which:

FIGURE 1 is an enlarged detail of one of the conical-shaped support legs, showing in particular the mating arrangement of the coil and the conical-shaped insert.

FIGURE 2 is an elevational view of a completed lamp structure.

Referring to FIGURE 2 which is an illustration of a completed tubular lamp structure 10, the quartz envelope 12 is of relatively small diameter that is closed at each end by a press seal 14. Sealed within the envelope

is a legless coiled filament **16** spaced from the wall envelope by circular spacers **20**. This particular type of filament is formed continuously on a mandrel of about 43 mils. having 110–120 turns per inch and in lengths of hundreds of meters. None of the conventional straight leg portions are formed.

When manufactured, the coil is heat treated at 1200–1700° C. and cut into suitable lengths. The cut coil is then sintered and the mandrel removed after which the coil is inserted on a suitable rod for stabilization. The stabilized coil is completed and ready for insertion and sealing in a glass envelope.

Conventional methods of support which required the straight leg portion of the filament to be directly connected to molybdenum foil sections have many disadvantages. One in particular is that during the alignment before sealing, the straight support leg portion of the filament had to be aligned. Rebending of the crystallized legs caused a high percentage of failure.

I have overcome this disadvantage by supporting my legless coils on cone-shaped support inserts **18**. The inserts of my inventon are more clearly shown in FIGURE 1.

The inserts **18** are formed of suitable refractory metal wire on a conical shaped mandrel. The taper formed angle **26** that establishes the cone angle diminishes from the diameter of the mandrel which is about 43 mils, to a tightly wound coil end representing almost a point. The wire is formed on the mandrel until at least two loops of the coil are wound to an outside diameter of 43 mils which corresponds to the inside diameter of the finished coil **16**. Also it is wound to the same number of turns per inch. The cone-shaped insert is then terminated in a rearwardly extending straight leg portion **28**. The corresponding mating diameters of at least two turns of the coiled insert and the inside diameter of the coil both have the same number of turns per inch. They provide a thread and screw arrangement whereby the coiled insert **18** can be screwed into the legless coil **16** providing the coil with support legs that can be electrically connected to the foil sections **22**.

The tapered shape of the insert insures easy insertion at any starting angle, and as mentioned above when burrs are present on the ends of the coil, the insert can bypass this obstruction. The tapered inserts not only provide easy assembly but since they are not stabilized they are still flexible enough to withstand internal strains. An insert of the above-description is disposed in each end of the finished coil and with the above-described arrangement the coiled insert not only supports the filament but provides a positive electrical connection from a power source to the filament **16**.

Various modifications of the device can be made by a person skilled in the art without departing from the spirit and scope of the invention.

What I claim is:

1. An electric incandescent lamp comprising: a tubular lamp envelope, having press seals disposed at each end thereof; a substantially coaxially disposed refractory wire filament having coiled end sections disposed in said envelope; an unstabilized conical shaped coiled conductive insert disposed in either end of said filament, said conical inserts being the sole means to convey current to said filament, each of said inserts, being wound substantially to the same number of turns per inch as said end section of said filament, and having a leg extending

rearwardly therefrom, whereby said conical shaped insert can be threaded into said coiled end portions of said filament thereby mechanically coupling said insert and said filament in positive electrical engagement, said leg being sealed in said press seal of said lamp envelope, and means to conduct current to each of said legs through said press seal.

2. An electric incandescent lamp comprising: a tubular lamp envelope, having press seals disposed at each end thereof; a substantially coaxially disposed refractory wire filament having coiled end sections disposed in said envelope; an unstabilized conical shaped coiled conductive insert having an outside diameter substantially the same as the inside diameter of said coiled end sections of said filament, said conical inserts being the sole means to convey current to said filament, and each of said inserts being wound substantially to the same number of turns per inch as the end sections of said filament and each having a leg extending rearwardly therefrom, whereby said conical shaped conductive insert is threaded into said coiled end portions of said filament thereby mechanically coupling and supporting said filament in positive electrical engagement, said leg extending from the rear of said insert is sealed into said envelope, and means to conduct current to each of said legs through said press seal.

3. An electric incandescent lamp comprising: a tubular lamp envelope, having press seals disposed at each end thereof, a substantially coaxially disposed refractory wire filament having coiled sections disposed in said envelope; an unstabilized conical shaped coiled conductive insert, the diameter of the cone progressing from a point to a diameter equal to the inside diameter of said filament, said conical inserts being the sole means to convey current to said filament, and wound to the same number of turns per inch as said filament and thereafter terminating in a straight leg that extends rearwardly therefrom; whereby said conical shaped conductive insert is threaded into said coiled end portions of said filament thereby mechanically coupling and supporting said filament in positive electrical engagement, said leg being sealed through said press seals into said lamp envelope, and means to conduct current to each of said legs through said press seal.

4. An electric incandescent lamp comprising:

a tubular lamp envelope having press seals disposed at each end thereof;

a substantially coaxially disposed refractory wire filament having coiled end sections disposed in said envelope;

an unstabilized conical shaped coiled insert disposed in either end of said filament, said conical inserts being the sole means to convey current to said filament, each of said inserts having a leg extending rearwardly therefrom and sealed in said press seal of said lamp envelope, and means to conduct current to each of said legs through said press seal.

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