Nov. 3, 1970 R. M. KANE 3,538,374

TUBULAR INCANDESCENT LAMP HAVING COILED FILAMENT WITH VARIED-PITCH SEGMENTS

Filed Aug. 18, 1967

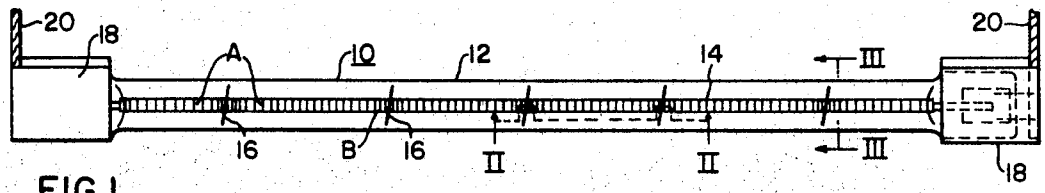
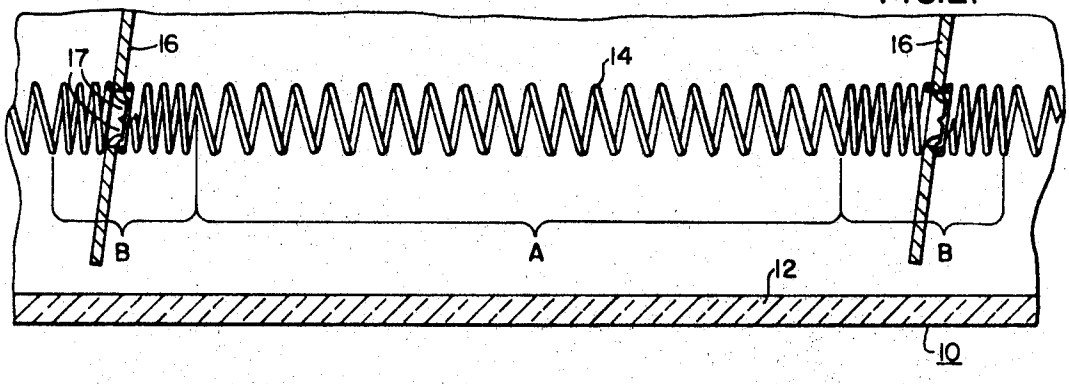


FIG.1.

FIG.2.



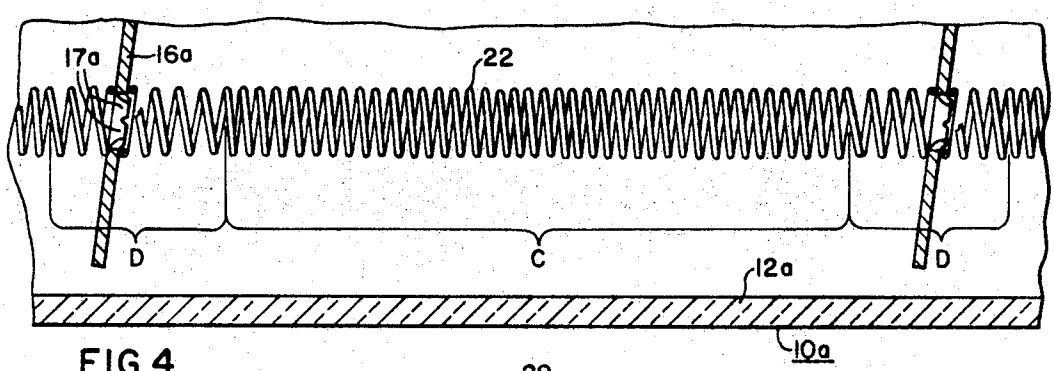


FIG.4.

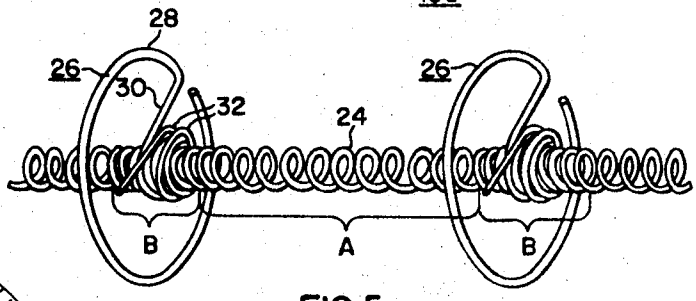


FIG.5.

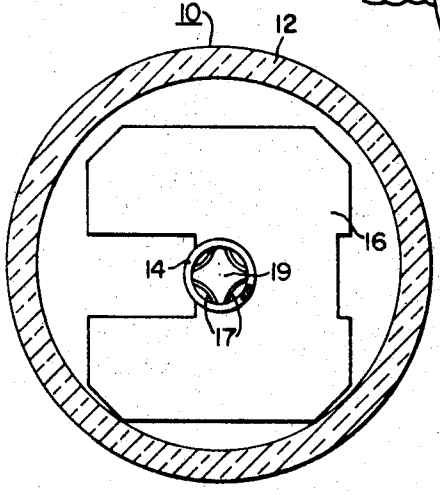


FIG.3.

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United States Patent Office 3,538,374 Patented Nov. 3, 1970

3,538,374

TUBULAR INCANDESCENT LAMP HAVING COILED FILAMENT WITH VARIED-PITCH SEGMENTS

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Filed Aug. 18, 1967, Ser. No. 661,588
Int. Cl. H01k 1/14, 1/24, 1/50
U.S. Cl. 313—273 10 Claims

ABSTRACT OF THE DISCLOSURE

The filament coil of a T3 or similar lamp is suspended within the envelope by spaced disc or wire supports that are anchored to short segments of the filament having a pitch which permits the supports to be clamped between or wrapped around the coil turns. The main segments of the filament are wound at a different pitch which provides the desired filament length and voltage and wattage ratings, and varies the radiant output per unit of lamp length, if desired.

BACKGROUND OF THE INVENTION

This invention relates to electric incandescent lamps and has particular reference to an improved filament and support structure for tubular double-ended lamps known as "T3 quartz" lamps.

The aforesaid T3 quartz lamps are well known in the art and consist of a coiled tungsten filament that is axially suspended within a quartz envelope by a series of spaced supports that are attached to the filament and engage the inner wall of the envelope. In certain lamp types these supports comprise discs of refractory metal such as tantalum that are slotted and inserted between adjacent turns of the filament coil. The tendency of such discs to rotate around the coil and gradually migrate from their mounted positions is prevented in accordance with one prior art solution to the problem by winding the filament at a pitch such that the spacing between turns is less than the thickness of the disc. The discs are thus compressibly clamped by and locked between the turns of the coil. An interlocked filament and disc support structure of this type is disclosed and claimed in U.S. Pat. No. 2,980,820 issued Apr. 18, 1961 to W. L. Brundige et al.

In the so-called "halogen-cycle" T3 lamps the support members must be fabricated from a material that will not be attacked by the halogen atmosphere. In the case of iodine or bromine-containing lamps, the filament supports comprise tungsten wire spirals or loops that are wound around the coil barrel and anchored in place by a few overlapping turns wound with a reverse pitch. A helical wire support of this type is described in U.S. Pat. No. 3,270,781 issued Sept. 6, 1966 to W. L. Brundige.

Both of the foregoing types of support members require that the spacing between turns of the filament be less than the thickness of the sheet metal or wire from which the supports are formed. This places a severe limitation on the design of such filaments and lamps since the pitch is, in effect, controlled by the thickness of the support material and the coils must be wound to a predetermined length in order to achieve the proper rating. The only parameter which could be varied, accordingly, was the diameter of the mandrel on which the coil was wound. However, in the case of low-wattage high-voltage lamps, such as 500 watt 208 volt T3 infrared lamps, the diameter of the mandrel and the resultant coil barrel diameter of the finished coil are so small that it becomes extremely difficult to anchor the supports. This is particularly true of disc supports which are pierced after they

are inserted into the coil to form burrs that prevent the discs from being displaced laterally from the coil during the lamp assembling operations, as disclosed in the aforementioned Brundige et al. Pat. 2,980,820.

SUMMARY OF THE INVENTION

It is accordingly the general object of the present invention to provide a tubular incandescent lamp that overcomes the foregoing manufacturing and design limitations and problems.

A more specific object is the provision of an improved filament and support structure for a double-ended tubular incandescent lamp which will permit the coil parameters to be varied as required to provide a filament of the desired wattage and voltage rating and still enable either disc or wire supports to be attached to the filament in the usual manner.

The foregoing objects and other advantages are achieved in accordance with the present invention by winding preselected spaced segments of the filament coil at the pitch necessary to accommodate the disc or wire supports and winding the remaining segments of the coil at a different pitch which will provide the desired coil length and electrical rating. The main coil segments may be wound at a pitch that is either larger or smaller than the pitch of interposed "support-anchorage" segments, and the latter are shorter than the main segments.

BRIEF DESCRIPTION OF THE DRAWING

A better understanding of the invention will be obtained by referring to the accompanying drawing, wherein:

FIG. 1 is an elevational view of a double-ended T3 incandescent lamp embodying the present invention;

FIG. 2 is an enlarged fragmentary sectional view of the filament and associated disc supports along the line II—II of FIG. 1;

FIG. 3 is an enlarged cross-sectional view of the lamp along the line III—III of FIG. 1;

FIG. 4 is a view similar to that of FIG. 2 but showing an alternative lamp embodiment; and,

FIG. 5 is a perspective view, on a slightly reduced scale, of a portion of a varied-pitch filament that is provided with helical-wire supports in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 there is shown a 500 watt 208 volt T3 infrared lamp **10** consisting of a tubular quartz envelope **12** that contains an elongated coiled filament **14** that is wound from a suitable refractory metal wire such as tungsten. The filament **14** is supported in coaxial relationship with the envelope **12** by a series of spaced sheet-metal discs **16** of tantalum or the like that are inserted between selected adjacent turns of the filament and clamped therebetween. The ends of the envelope **12** are closed by press seals that are fitted with suitable base members **18** in the usual manner. The ends of the filament **14** are electrically connected to external leads **20** by conventional lead-in conductor assemblies that are sealed through the press seals.

As shown in FIG. 2, the filament **14** is preferably wound from a single piece of tungsten wire and the pitch is controlled to provide a group of spaced main coiled segments A that are joined together by a plurality of interposed auxiliary or "support-anchorage" coiled segments B of much shorter length. In this particular embodiment, the pitch of the main coiled segments A is such that the spacing between turns is much greater than that between the turns comprising the shorter coiled segments B. How-

ever, the diameter of the respective coiled segments is the same so that the coil barrel is of uniform diameter.

Each of the short coiled segments B are provided with a laterally-extending tantalum disc support **16** having a thickness greater than the spacing between the turns comprising such segments. The central portions of the discs are pierced in accordance with the teachings of the aforementioned Brundige et al. Pat. 2,980,820 to provide burrs **17** that are bent toward the coil axis and, in conjunction with the compressive clamping effect of the displaced adjacent turns, securely lock the discs in place on the filament **14**.

As illustrated in FIG. 3, the discs **16** are slotted and are of generally rectangular shape with clipped corners which nestingly seat against the arcuate inner walls of the tubular envelope **12**.

In the case of the 500 watt 208 volt lamp here illustrated, the filament **14** had an overall length of approximately 175 millimeters, was wound from tungsten wire having a diameter of 0.15 millimeter, and consisted of six main coiled segments A and five short "anchorage" segments B. The spacing between turns of the main segments A was 0.25 millimeter (350% pitch) and each of these segments were approximately 28 millimeters in length, except for the two end segments which were shorter (approximately 18 millimeters), as will be noted in FIG. 1. The spacing between turns of the "anchorage" segments was 0.05 millimeter (140% pitch) and their accumulative length was approximately 20 millimeters. The main coiled segments thus comprised approximately 85% of the total length of the filament. The coil barrel diameter was approximately 1 millimeter and the thickness of the disc was 0.056 millimeter.

ALTERNATIVE EMBODIMENT I

In FIG. 4, there is shown a portion of an alternative form of tubular incandescent lamp **10***a* that is of the same basic construction as the lamp **10** described above except that the filament **22** consists of a group of main coiled segments C having a plurality of turns wound at a pitch that is smaller than those of the interposed and shorter "anchorage" coiled segments D. As before, the spacing between turns of the shorter segments D is less than the thickness of the disc **16***a* so that the latter is compressively clamped between the coil turns. As will be obvious to those skilled in the art, the pitch of the main coiled segments C can be varied to provide an extremely compact lamp of high wattage rating. This type of filament is also especially useful where lower voltage ratings are required and proportionately shorter lengths of heavy wire are involved.

ALTERNATIVE EMBODIMENT II

In FIG. 5 there is shown a portion of still another embodiment of the present invention wherein the filament **24** consists of a group of main coiled segments A having a pitch greater than the interposed "anchorage" segments B (as in the case of the lamp shown in FIGS. 1–3) but which is provided with a plurality of helical supports **26** formed from tungsten wire or the like. Each of the supports **26** are bent to form an enlarged circular loop **28** having a radially extending leg **30** that is wrapped tightly around the turns of the short segments B and locked in place by one or two overlying turns **32** wound at a reverse pitch in accordance with the teachings of the aforesaid Brundige Pat. 3,270,781. This type of filament and wire support combination are adapted for use in halogen-cycle lamps that contain a chemically active atmosphere such as iodine or bromine.

It will be appreciated from the foregoing that the objects of the invention have been achieved in that an inexpensive and simple filament-support structure has been provided which permits tubular incandescent lamps of various lengths and wattage and voltage ratings to be manufactured on a mass production basis. The flexibility of design afforded by the use of a coil having segments of varying pitch permits tubular lamps to be made in an assortment of sizes and ratings that were heretofore impractical.

While several embodiments have been illustrated and described, it will be appreciated that various changes in the construction and arrangement of parts can be made without departing from the spirit and scope of the invention. For example, the pitch of the turns in the main coiled segments may be varied from segment to segment to control the amount of radiant energy emanating from a particular part of the lamp. Thus, where higher radiant-energy outputs at the ends of the lamp are required, such as in photoreproduction apparatus, the pitch of the main coiled segments at the ends of the lamp will be smaller than that of the intermediate main coiled segments. This type of differential output lamp provides a very practical solution to the problem of uniformly irradiating the paper being processed in photocopy machines, which problem is referred to in U.S. Pat. No. 3,295,007, issued Dec. 27, 1966, to W. D. Young.

I claim as my invention:

1. An electric incandescent lamp comprising;
a tubular light-transmitting envelope,
lead-in conductor means sealed through the respective ends of said envelope,
an elongated filament of coiled refractory metal wire electrically connected to said lead-in conductor means and extending longitudinally within said envelope, said filament having (a) a first coiled segment that consists of a plurality of spaced turns of predetermined pitch and (b) a second coiled segment comprising a plurality of spaced turns that have a pitch different from that of the turns comprising said first segment, and
a support member that is anchored to the turns of said second coiled segment of the filament and extends laterally therefrom to the inner surface of said envelope and thus suspends said filament within the enclosing portion of said envelope,
the pitch of the turns comprising said second coiled segment being so correlated with respect to the thickness of the anchored portion of said support member that the latter is securely interlocked with the turns of said second coiled segment of the filament.

2. The incandescent lamp set forth in claim **1** wherein said first and second coiled segments of the filament are of unequal length but have substantially the same outside diameter.

3. The incandescent lamp set forth in claim **1** wherein;
said filament consists of (a) a plurality of main coiled segments that are wound at a predetermined pitch and (b) a plurality of auxiliary coiled segments that are shorter and are wound at a different pitch than said main coiled segments and are interposed between the latter so that the respective coiled segments are alternately disposed along the length of the filament,
each of said interposed auxiliary coiled segments have a support member secured thereto, and
the turns comprising said main and auxiliary coiled segments have substantially the same configuration so that the coil barrel of said filament is thus of substantially uniform dimension throughout its length.

4. The incandescent lamp set forth in claim **3** wherein at least one of the main coiled segments is wound at a pitch which is different than said predetermined pitch and thereby provides a lamp which has a differential radiant output along its length.

5. The incandescent lamp set forth in claim **3** wherein said main coiled segments are wound at a pitch that is greater than that of said interposed auxiliary coiled segments.

6. The incandescent lamp set forth in claim 3 wherein said main coiled segments are wound at a pitch that is smaller than that of said interposed auxiliary coiled segments.

7. The incandescent lamp set forth in claim 4 wherein;

said filament is wound from a single piece of refractory metal wire and is terminated at each end by a main coiled segment, and

the pitch of said terminally-disposed main coiled segments is smaller than the pitch of the intermediate main coiled segments and thus provides a higher radiant-energy output at the ends of the lamp.

8. The incandescent lamp set forth in claim 3 wherein;

said main coiled segments constitute a major portion of the total length of the filament,

said support members are fabricated from refractory metal of substantially uniform and predetermined thickness, and

said interposed auxiliary coiled segments are wound at a pitch such that the spacing between the turns comprising the respective auxiliary segments is less than the thickness of the refractory metal from which the support members are fabricated.

9. The incandescent lamp set forth in claim 8 wherein;

said filament is fabricated from tungsten wire, and said support members comprise slotted discs of sheet metal

that are forcibly inserted between adjacent turns of the respective auxiliary coiled segments and are compressively clamped between said turns.

10. The incandescent lamp set forth in claim 8 wherein said support members comprise loops of refractory metal wire one end of which is wound around the turns of the respective auxiliary coiled segments and locked in overlying relationship therewith by at least one turn that is wound with a reverse pitch.

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U.S. Cl. X.R.

313—222, 279, 344