Sept. 19, 1950 L. G. LEIGHTON 2,523,033

ELECTRIC RADIANT ENERGY DEVICE

Filed Dec. 16, 1949

Fig. 1.

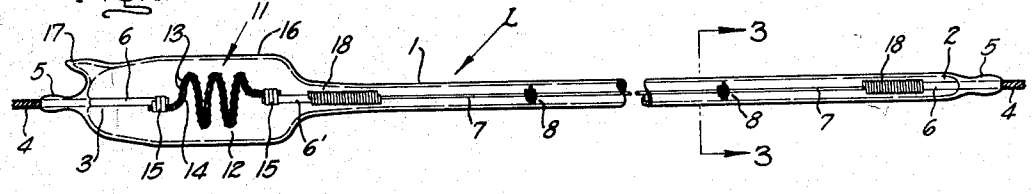


Fig. 2.

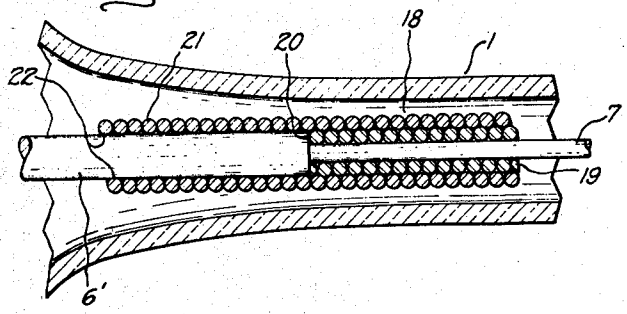


Fig. 3.

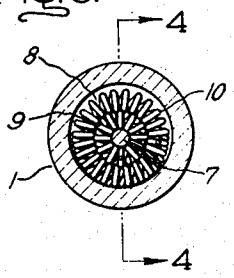
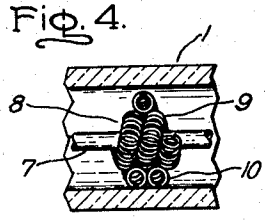


Fig. 4.



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ELECTRIC RADIANT ENERGY DEVICE

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3 Claims. (Cl. 176—16)

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My invention relates to an electric device for transforming electrical energy into radiant energy and particularly infrared energy, such as electric lamps and similar devices comprising a sealed radiation-transmitting envelope enclosing an electrical energy translation element such as a filament.

It is an object of my invention to provide an electrical device of the above character which is of relatively small transverse dimensions and so constructed as to effectively operate to emit an exceedingly high amount of infrared radiation.

Another object of my invention is to provide, in a tubular shaped electric lamp having an axially extending elongated filament and axially extending current inleads, an effective and mechanically strong electrical connection between the ends of the filament and the adjacent current inleads.

Still another object of my invention is to provide a tubular shaped electric lamp of high current capacity and having an axially extending filament and effective spring take-up means for the filament to compensate for the longitudinal expansion and contraction thereof during lamp operation.

A further object of my invention is to provide simple and readily assembled flexible intermediate supports for the elongated filament of such a tubular electric lamp.

Further objects and advantages of my invention will appear from the following description of a species thereof and from the accompanying drawing in which:

Fig. 1 is an elevation of an electric radiant energy device comprising my invention; Fig. 2 is an enlarged fragmentary sectional view of the lamp showing the filament joint thereof; Fig. 3 is a transverse section on the line 3—3 of Fig. 1; and Fig. 4 is a section on the line 4—4 of Fig. 3.

Referring to the drawing, the invention is there shown embodied in an electric lamp L for use as a radiant heater, for instance, as a de-icing lamp for airplane wind-shields. The lamp L comprises an elongated tubular envelope 1 of vitreous material, such as quartz, having current inlead conductors 2 and 3 sealed through the opposite ends of the envelope. In the particular case shown, the inlead conductors 2 and 3 each comprise a flexible stranded outer lead section 4 which may be made of nickel-plated copper wire strands, a tungsten press or seal lead section 5 fusion-sealed in and extending through the ends of the envelope 1, and an inner lead section 6 which may be of 80 mil diameter nickel wire. The gas-tight seals or joints between the ends of the envelope 1 and the seal lead sections 5 may be of the graded or step seal type such as described and claimed in U. S. Patent 2,177,685, Bol et al., issued October 31, 1939. An elongated high-wattage filament 7, in this case a straight length of relatively rigid tungsten wire of approximately 32 mil diameter and around 24 inches long, and having a wattage rating of approximately 1000 watts, extends axially of the tubular envelope 1 and is electrically connected at its ends to the inner ends of the current inlead conductors 2 and 3. The elongated envelope 1, which in the particular lamp illustrated is around 30 inches or so in total length, is filled with a suitable inert gas such as nitrogen at a pressure of 600 mm. of mercury, for instance.

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The filament 7 is supported in centered position within and from the wall of the tubular envelope 1, so as to extend more or less axially thereof, by means of a plurality of flexible intermediate filament supports 8 spaced apart lengthwise of the filament. As shown more particularly in Figs. 3 and 4, the said supports 8 each comprise an inner coiled coil 9 of tungsten wire, of about two turns or so, which fits snugly over and elastically grips the filament wire 7, and an outer coiled coil 10 of tungsten wire, of about one and one-half turns or so, which is screwed over the inner coil 9 and fits within the tubular envelope 1 with a slight clearance therebetween, as shown in Fig. 3, so that the assembly of the inner and outer coils 9 and 10 is free to move longitudinally within the envelope along with the filament during the expansion and contraction thereof when the lamp is energized and de-energized. Because of their coiled coil and therefore yieldable construction, the supports 8 afford yielding support to the filament 7 to minimize the effect of physical shocks.

At one end the filament 7 is rigidly connected directly to the inner lead section 6 of the associated inlead conductor 2. The other end of the filament, however, is connected to its associated inlead conductor 3 through a flexible tensioning connection means 11 which allows the said end of the filament to move freely axially thereof when the filament elongates and contracts during the energization and de-energization of the lamp. The said tensioning connection means 11 comprises a light-acting tension coil spring 12 connected at one end of the inner lead section 6 of the associated inlead conductor 3 and at the other end to another lead-in wire section 6' which, like the inner lead section 6, may also be of 80 mil diameter nickel wire. The coil spring 12 is mounted with its axis extending more or less axially of the tubular envelope 1, and because of the relatively heavy current which it must carry (37 amperes in the particular lamp shown) while still exerting only a relatively slight spring tension on the filament throughout a considerable degree of travel, it is formed of a bundle of fine tungsten wires 13 (i. e., a stranded wire) suitably bound together, as by an overwound wire 14, and coiled to a relatively large outside diameter of

around 5/8 inch in the particular case shown and a relatively open pitch of around 3/8 inch or so. Such an expansion coil construction possesses the necessary requirements mentioned above. The connection of the coil spring 12 to the inlead wire sections 6 and 6' may be made in any suitable way. In the particular connection shown, however, the ends of the coil spring 12 extend alongside and are welded to the inlead wire sections 6, 6', and the welded joints reinforced by several turns of nickel ribbon 15 wrapped thereabout.

The amount of tension exerted by the coil spring 12 on the filament 7 should be sufficient to maintain the filament taut and straight at all times, with its axis substantially aligned with that of the envelope. To insure this condition, and to prevent the filament 7 from bowing during the elongation thereof when heated by the passage of the lamp operating current therethrough, the tension of the coil spring 12 must be sufficient not only to take up the entire amount of the elongation of the filament when so heated, but also to overcome the frictional resistance, between the supplementary filament supports 8 and the envelope wall, to movement of the said supports 8 lengthwise of the envelope along with the filament during the elongation of the latter. Inasmuch as the expansion coil spring 12 is of considerably larger diameter than the lamp envelope (the latter having an inside diameter of 5 mm. and an outside diameter of 7 mm. in the particular case shown), the envelope 1 is provided with an enlarged diameter end or bulb portion 16 for accommodating the coil spring 12 therein. In the manufacture of the lamp, the envelope 1 is exhausted and filled with the desired inert filling gas through this enlarged bulb end portion 16 of the envelope, through an exhaust tube appendage or tubulation thereon, which tubulation is then sealed or tipped-off to leave the exhaust tip 17.

The filament 7 and the inlead wire sections 6 or 6' are physically and electrically connected by a joint 18 as shown more particularly in Fig. 2. Each end of the filament 7 is butt-welded to the adjacent end of its associated inlead wire section 6 or 6', as the case may be. A close-wound tungsten wire slip-over coil 19, having an outside diameter approximately the same or slightly larger than the diameter (80 mils) of the inlead wire section 6 or 6', fits tightly over the filament wire 7 and butts up against the shoulder 20 formed by the end of the inlead wire section 6 or 6'. A close-wound tungsten wire outer coil 21 having an inside diameter approximately the same as the diameter (80 mils) of the inlead wire section 6 or 6' is screwed over the inner coil 19 and fits over a considerable length of the adjacent inlead wire section 6 or 6'. The said outer coil 21 is welded at its outermost end or otherwise fixedly secured to the inlead wire section 6 or 6', as indicated at 22, to positively fix it in position thereon. The combination of the two coils 19 and 21 bridging the butt-welded joint between the ends of the filament 7 and the inlead wire section 6 or 6' thus serves to take some of the mechanical strain off the welded joint, and so reinforces the same. The resulting filament joint 18 is therefore mechanically strong and possesses the required amount of mass to keep it from operating at too high a temperature such as might result in ultimate failure of the joint.

Although a preferred embodiment of my invention has been disclosed, it will be understood that the invention is not to be limited to the specific construction and arrangement of parts shown, but that they may be widely modified within the spirit and scope of my invention as defined by the appended claims.

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

1. An electric device for transforming electrical energy into radiant energy comprising an elongated tubular vitreous envelope having an enlarged portion at one end thereof and containing a relatively rigid straight-wire filament extending longitudinally therethrough, inlead conductors sealed through the opposite ends of the envelope and having inner lead-in wires extending longitudinally of the envelope and electrically connected to opposite ends of said filament, a plurality of resilient filament supports comprising coiled wires coiled around and elastically gripping the filament at spaced points therealong for supporting it from the envelope wall and having a slight clearance with the envelope wall for unrestrained movement through the envelope, and tensioning means disposed in the said enlarged end portion of the envelope and comprising a light-acting tension coil spring having a larger coil diameter than the envelope proper and electrically and mechanically connected under tension between one end of said filament and the adjacent inlead conductor to exert tension on said filament.

2. An electric device as set forth in claim 1 wherein the said tension coil spring consists of a flexible stranded wire coiled to a larger diameter than the envelope proper.

3. An electric device for transforming electrical energy into radiant energy comprising an elongated tubular vitreous envelope having an enlarged portion at one end thereof and containing a relatively rigid straight-wire filament extending longitudinally therethrough, inlead conductors sealed through the opposite ends of the envelope and having inner lead-in wires extending longitudinally of the envelope and electrically connected to opposite ends of said filament, a plurality of resilient filament supports mounted on said filament at spaced points therealong for supporting it from the envelope wall, said supports being freely movable longitudinally within the envelope, and tensioning means disposed in the said enlarged end portion of the envelope and comprising a light-acting tension coil spring having a larger coil diameter than the envelope proper and electrically connected in tension between one end of said filament and the adjacent inlead conductor to exert tension on said filament, said filament having each of its ends connected by a butt-weld joint to an end of and in substantial alignment with an adjacent lead-in wire section of larger diameter than said filament, an inner coil fitting tightly over the end of the filament wire and abutted against the facing end of the adjacent lead-in wire section, said inner coil having an outer diameter approximately the same as the said lead-in wire section, and an outer coil screwed over the said inner coil and fitting over a considerable length of the adjacent lead-in wire section and fixedly secured thereto.

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No references cited.