Jan. 12, 1954 D. P. COOPER, JR 2,666,158

ELECTRIC PROJECTION LAMP

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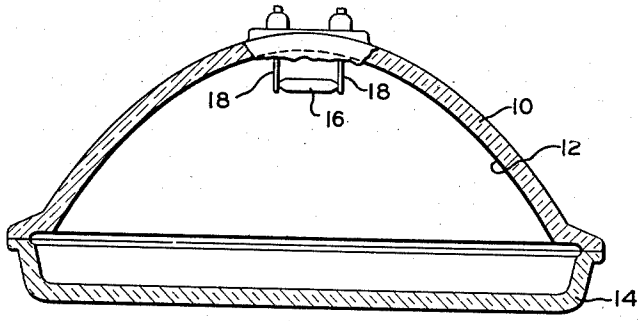


FIG. 1

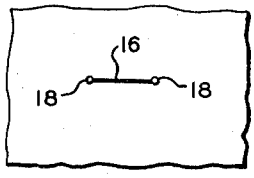


FIG. 2

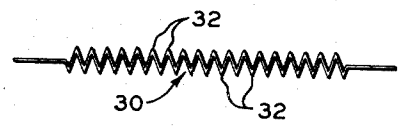


FIG. 3

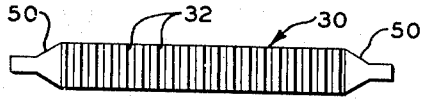


FIG. 4

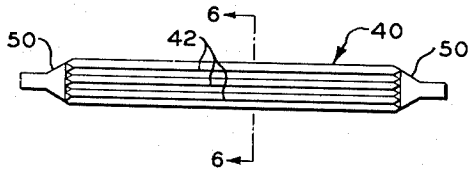


FIG. 5



FIG. 6

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ELECTRIC PROJECTION LAMP

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This invention relates to electric lamps and similar devices adapted to project a beam of light in a predetermined direction and comprising an enclosure or bulb having an electrical energy-translation element or filament sealed therein and a concave reflector so positioned as to substantially collimate light emitted by the filament.

Objects of the invention are to provide in such a device a flat ribbon filament predeterminedly positioned with respect to the focus of the reflector with the plane of the filament substantially parallel to the direction of propagation of light emitted by the device; to provide a ribbon filament, crimped or pleated throughout its light-emitting portion and with the peaks of the crimps or pleats substantially parallel to each other and either parallel with or perpendicular to the long dimension of the filament; and to provide a ribbon filament of the character described so shaped that the maximum filament temperature is maintained during operation of the lamp substantially to the points of contact of the ends of the filament with the lead-in wires.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises an article of manufacture possessing the features, properties, and relation of elements which will be exemplified in the article hereinafter described and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed descrption taken in connection with the accompanying drawing wherein:

Figure 1 is a view in section of a light-projecting device comprising one form of the invention;

Fig. 2 is a fragmentary view in elevation of the forward ends of the leads and the ribbon filament of the device shown in Fig. 1;

Figs. 3 and 4 are views in elevation and plan of a crimped or pleated ribbon filament useful in the invention in which the pleats extend perpendicularly to the long dimension of the filament; and

Figs. 5 and 6 are views in plan and section of a similar filament wherein the pleats extend parallel to the long dimension of the filament.

The drawing illustrates a vehicle headlamp of the sealed-beam type which comprises a cup-shaped base member 10 having its inner surface 12 silvered or otherwise coated to provide a metallic reflector, preferably of paraboloidal shape. The base member has hermetically sealed thereto a transparent cover plate 14 of glass which

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may serve also as a lens element for controlling the dispersion of light emitted from the lamp. Within the bulb there is mounted a filament 16 on lead wires 18 which, in turn, are mounted on the base element 10 in the usual manner. The filament is located accurately at the focus of the reflector 12 and may be formed of any desired material such, for example, as tungsten or a high-melting metallic carbide. After assembly, the bulb is evacuated and may be filled with an inert gas or, if a high-melting metallic carbide is employed as a filament, the bulb may be filled with an atmosphere comprising a volatile hydrocarbon and hydrogen with or without an inert gas such as argon.

The lamp filament 16 is ribbon-like and either flat, as shown in Figs. 1 and 2, or corrugated, pleated or crimped, as shown in Figs. 3 to 6 inclusive. In every case the filament is positioned and held by the leads with its narrowest dimension (thickness) perpendicular to, and its broad dimension (width) parallel with, the direction of propagation of light emitted from the lamp. If the filament employed is a flat thin ribbon, the long axis of the filament will be positioned perpendicularly to the axis of the reflector with the plane of the ribbon filament coinciding with the plane defined by the long axis of the filament and the axis of the reflector.

With the filament positioned at the focus of the reflector in the manner described, a substantially greater percentage of light emitted by the filament will be incident upon those areas of the reflector which are most effective in causing collimation of the beam projected by the lamp than would be the case were a bar or coil filament employed. The narrow edges of the filament only, i. e., the forwardly directed narrow edge shown for example in Fig. 2 of the drawing and the corresponding rearwardly directed narrow edge, emit light which is directed either through the transparent cover plate of the lamp without incidence upon the effective areas of the reflector or rearwardly toward those portions of the reflector which for one reason or another do not collimate the light rays well, for example either because of the difficulty of properly shaping the reflector or because the leads and lead mountings interfere. As a result, a greater percentage of useful radiation is obtained in the collimated beam from a flat ribbon filament mounted in the manner described than from a coil or bar filament. Where the total radiant output of a coil or bar filament is the same as that of a flat ribbon filament positioned in the manner described, the

flat ribbon filament is approximately from 25% to 30% more efficient than is the coil or bar filament.

Preferably, the ribbon filament should be maintained as thin as practicable. For example, ribbon filaments of the order of .0025 inch in thickness, .030 inch in width and .375 inch in length between leads have proved completely satisfactory.

A modified form of ribbon filament for use in the invention is shown in Figs. 3 and 4. Here, the filament **30** is pleated, crimped or corrugated with the pleats running crosswise of the filament, i. e., parallel to the axis of the reflector when the filament is positioned in the manner heretofore described in connection with the filament shown in Figs. 1 and 2. Crimping the filament in this way causes it to approach more nearly a "black body" in appearance, i. e., the surface brightness approaches more nearly that of a material with emissivity equal to unity. As compared to a flat filament, the loss of energy by convection from the crimped filament will increase, but less rapidly than the radiation loss, resulting in an increase in the luminous efficiency of the filament. Attention should be called to the fact that unless care is taken to make the crimp fine and uniform and with the distance between successive peaks as small as possible, portions of the filament, for example the peaks of the crimp, may lose heat at a different rate from other portions of the filament, for example the side walls of the crimp. Under these circumstances, the filament must be operated at a temperature lower than the maximum permissible temperature with a corresponding loss in luminous efficiency. This can be avoided by so crimping or corrugating the filament that the crimps are fine, i. e., adjacent peaks **32** are close together. More particularly, the distance between adjacent peaks **32** should be less than the width of the filament **30** and also less than the depth of the pleats.

The crimp depth should preferably be as great as possible consonant with the maintenance of substantially uniform temperature over all portions of the filament. For filaments of the character described, this means that the crimp depth may approximate or be slightly less than the filament width. A sharp bend at the peak of each crimp, as shown for example in Fig. 3, rather than a round bend is to be desired. Not only will all portions of the filament operate at more nearly the same temperature, but the sharp bend raises the effective emissivity of the element by reinforcing the actual emission with a reflected view of some other filament area. It will be apparent that pleating the filament will result in effectively reducing the distance between the leads.

In Figs. 5 and 6 there is shown a still further modification of the invention wherein the filament **40** is crimped or pleated with the peaks of the pleats **42** running lengthwise of the long dimension of the filament, i. e., perpendicular to the axis of the reflector.

In all of the embodiments of the invention shown, the ribbon filaments are reduced in cross-sectional area abruptly as they approach the leads. This is shown most clearly, for example, in Figs. 4 and 5 at 50. This reduction in cross-sectional area of the filament is for the purpose of keeping the filament ends in contact with the leads at the high temperature of the body of the filament, and tends to offset the temperature loss in the filament ends by convection to the cooler, heavier leads. Such a structure as is shown in the drawing is not essential to the practice of the invention but it improves the efficiency of the filament by permitting operation of substantially the entire filament length between leads at the same high temperature.

It is to be understood that it is not essential to the practice of the invention that the collimating reflector be formed integrally with the lamp envelope. The filament may, for example, be contained in a small supplemental lamp which is so positioned with respect to the reflector that the filament lies substantially at the focus of the reflector with the plane of the filament substantially parallel to a plane defined by the axis of the reflector and a line perpendicular thereto. Thus, the reflector may not only be positioned within the lamp envelop but it may be positioned outside the lamp envelope and either affixed to the outer surface of the lamp envelope or positioned outside the lamp envelope and wholly separate therefrom. In this latter case the reflector may be protected by a second cover plate or it may be open and unprotected. All such modifications of structure are to be deemed within the scope of the invention. Moreover, while the reflector has been described as paraboloidal in shape and as a collimating reflector, and while it is believed that such a reflector will be found most useful in the practice of the invention, it is to be understood that the invention is applicable to a device employing a concave reflector which is substantially a surface of revolution and which has a focus, even though it does not fully collimate a beam of light.

As has already been pointed out, the filament of the invention may be formed of any suitable material, such as tungsten, osmium or tantalum, or under certain circumstances, and where the lamp is to be operated at high temperatures, it may be formed of a high-melting metallic carbide such as tantalum carbide, columbium carbide or zirconium carbide.

It will be understood, moreover, that the invention is applicable to lamps producing infrared or other nonvisible radiation as well as to lamps producing visible radiation.

The use of the word "luminant" or "filament" throughout the specification and claims is to be understood as including a radiation emissive element whether employed in connection with the emission of visible or invisible radiation.

Since other changes may be made in the above article without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A radiation projecting device comprising a concave metal reflector which is substantially a surface of revolution and which has a focus, an hermetically sealed light-transmitting envelope, a crimped ribbon filament mounted in said envelope, the peaks of adjacent crimps being substantially parallel and closely adjacent with the crimp depth greater than the distance between adjacent peaks, and means positioning said filament substantially at the focus of said reflector with the long axis of said filament perpendicular to the axis of said reflector and the broad dimension of said filament parallel to the plane defined by said axes.

2. A device as claimed in claim 1 wherein the filament has a width-to-thickness ratio of the order of 10 to 1.

3. A device as in claim 1 wherein the filament is crimped with the peaks of adjacent crimps spaced from one another by an amount less than the width of the filament.

4. A device as in claim 3 wherein the peaks of the crimps are parallel to the reflector axis.

5. A device as in claim 1 wherein the filament is sharply crimped with the crimps parallel to the long axis of the filament.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,206,333	Keyes	Nov. 28, 1916
1,726,365	Pirani	Aug. 27, 1929
1,800,012	Foulke	Apr. 7, 1931
1,863,152	Barkey	June 14, 1932
2,419,432	Wright	Apr. 22, 1947
2,464,990	Plagge	Mar. 22, 1949
2,479,221	Eaton	Aug. 16, 1949
2,497,567	Stone	Feb. 14, 1950