United States Patent

Fradette

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[54] **APPARATUS FOR INCANDESCENT FILAMENT MOUNTING**

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[*] Notice: The portion of the term of this patent subsequent to Dec. 16, 1986, has been disclaimed.

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[21] Appl. No.: **878,690**

Related U.S. Application Data

[62] Division of Ser. No. 639,124, May 17, 1967, Pat. No. 3,484,600.

[52] **U.S. Cl.** **240/90,** 240/8.2, 240/8.3, 313/269

[51] **Int. Cl.** **F21v 15/04**

[58] **Field of Search** 240/7.1, 8.2, 8.3, 90; 248/358; 313/269; 339/93

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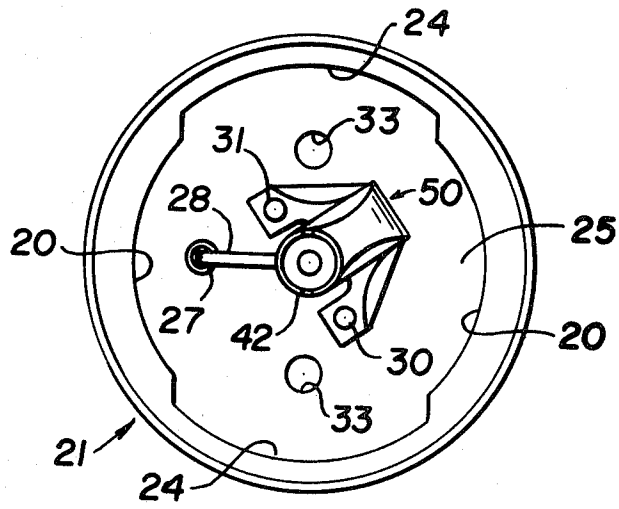
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[57] **ABSTRACT**

Automotive vehicle equipped with incandescent lamp filament mounting which isolates the filament from vibrations at the resonant frequency of the filament, thereby extending the life of the filament. The frequency isolation is accomplished with an exponential spring. The spring is secured to a lamp body and a socket is mounted at the node of frequencies which are the resonant frequency of the filament.

5 Claims, 6 Drawing Figures



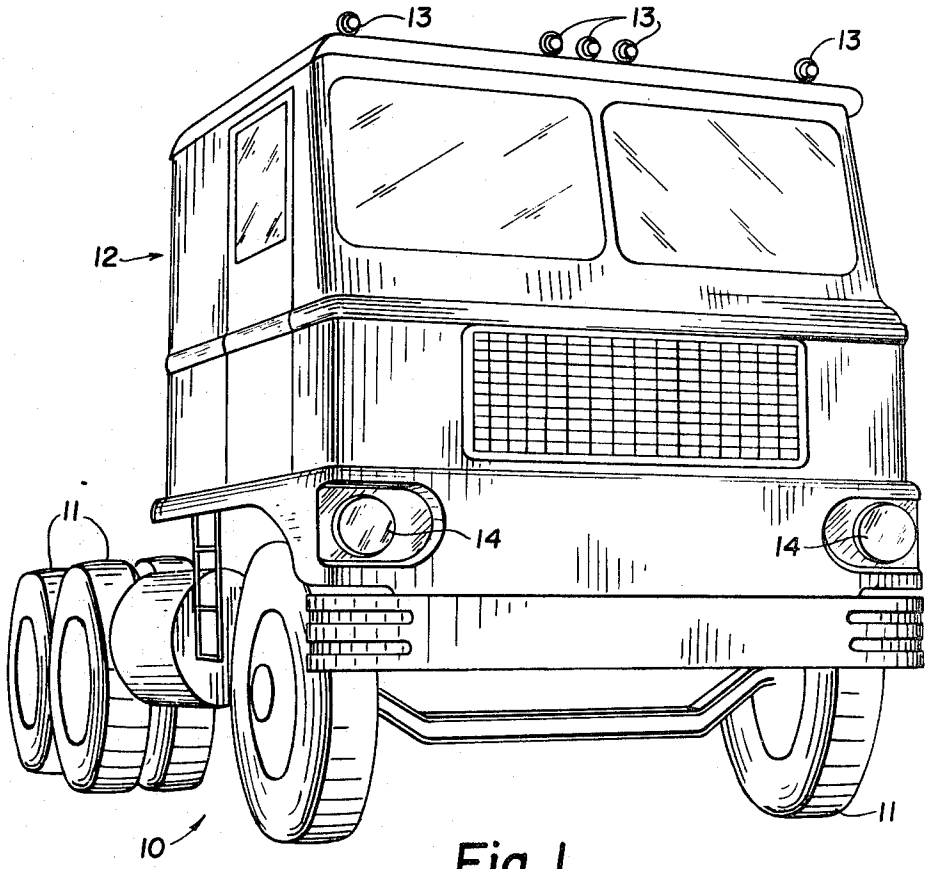


Fig. 1

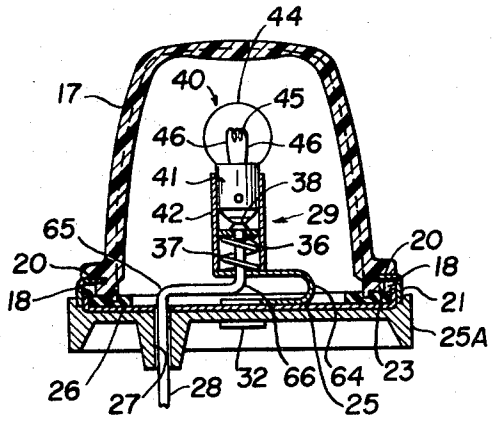


Fig. 2

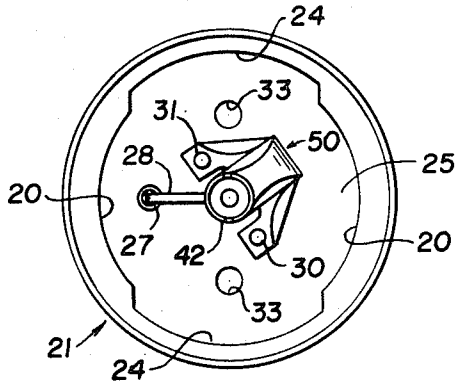


Fig. 3

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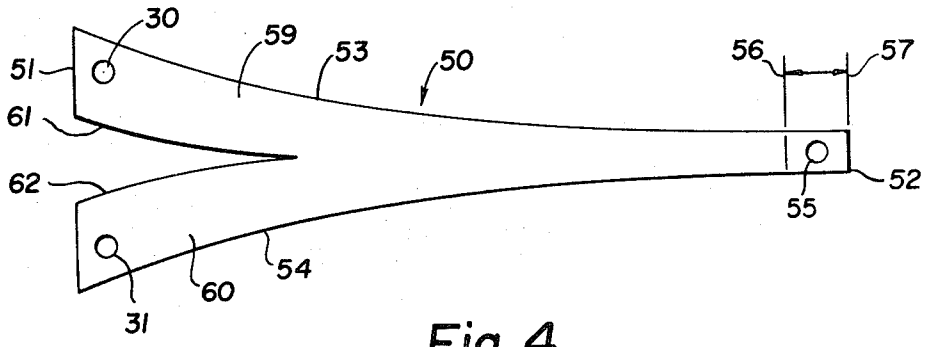


Fig. 4

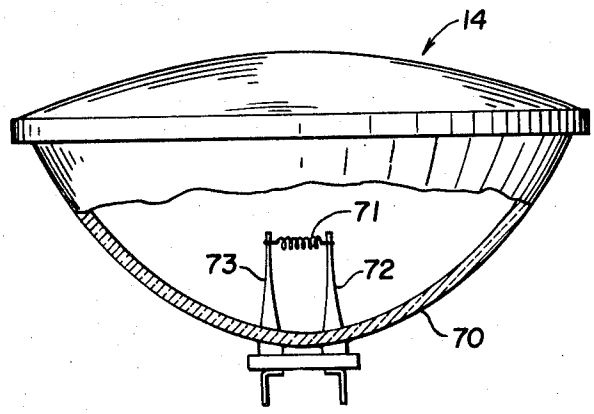


Fig. 6

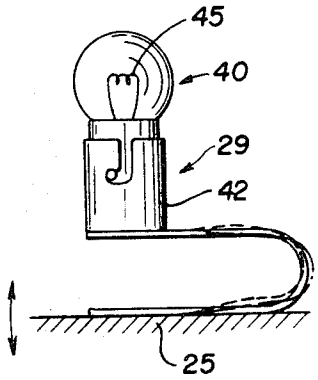


Fig. 5

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APPARATUS FOR INCANDESCENT FILAMENT MOUNTING

This is a division of U.S. Pat. application Ser. No. 639,124, filed May 17, 1967 and now U. S. Pat. No. 3,484,600.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed to a filament mounting for incandescent lamps and primarily directed to a mounting for the socket of small automotive lamps. The mounting is in the form of a spring which isolates the filament from vibrations at the resonant frequency of the filament.

In the automotive industry, the advent of 12-volt systems aggravated a problem that, prior to this discover, had never been satisfactorily solved. The problem is that of excessive filament failure. The increased failure, as compared with 6-volt systems, is due to the smaller filament sizes in 12-volt bulbs of corresponding candle power. The filament breakage in fact is such a problem that, in heavy-duty diesel trucks and the like, it has deterred the truck manufacturing industry from changing to 24-volt systems. A 24-volt system is desirable and, in the view of some, essential in order to obtain adequate cranking power in the starting systems for heavy-duty diesel engines.

In attempting to determine the cause of filament failures, I conducted a survey of small bulbs such as those used in truck marker and stop lamps. In analyzing a relatively large number of such bulbs after their filaments had failed, I determined that over 90 percent of the failures are what can be termed "cold" failures. That is, over 90 percent of the bulbs failed at a time when they were not illuminated and hot. The explanation for this is that the vast majority of lamp failures in the past have been caused by vibrations and the filaments are more brittle when cold than when hot.

A typical highway tractor will be equipped with five so-called marker lamps. It is fair to say that the average life of those lamps has been approximately 5,000 miles. Most such bulbs, so far as my survey could determine, failed due to breakage of the filament caused by vibration and very few burned out. Most such lamps which burned out were lamps from instrument panels within the cab where vibrations are minimized.

By contrast, in tests conducted with lamp assemblies made in accordance with this invention, all bulb failures have been due to burn out of the filament. The earliest bulb failure that has yet been experienced was at 155,000 miles and the second earliest was at 181,000 miles. In one truck, of five marker lamps, two were still operating at 423,000 miles and the other three had burned out at various times after the truck had traveled in excess of 400,000 miles.

Thus, the fact that one bulb failed at 155,000 miles by burning out simply suggests that that bulb was not as well constructed as those which have lasted in excess of four hundred thousand miles. What has previously been substantially, if not universally, the cause of failure —breakage due to vibration— has been substantially completely, if not completely, obviated.

2. The Prior Art

Previously, it has not been recognized that excessive filament failure has been caused by vibrations at the resonant frequency of the filament and that the filament can be isolated from such vibrations. While there have been proposals for lamp constructions in the past where a socket is spring mounted to isolate the lamp from shock, none have been expressly designed to dampen vibrations equal to or in beat with the natural frequency of a filament. The result has been excessive filament failure.

SUMMARY OF THE INVENTION

Tests were conducted with a selected bulb type in an attempt to determine the cause of bulb failure. A fatigue curve was generated for the selected bulb type which showed the critical frequency to be **1125** cycles per second. At such a frequency on vibration tests, filaments would break in a very short period of time.

It was then discovered that if the socket was mounted at a particular location on the spring, the filament would be completely free of vibration when the resonant frequency of the bulb, 1,125 cycles per second in this example, was applied to the base of the spring. Thus, the socket is mounted at the node for the resonant frequency of the filament of the bulb to be used, totally isolating the filament from its nautral frequency. The isolation of the resonant frequency in this test example was so successful it was possible to use smaller bulbs requiring less than fifty percent the amperage because the mechanical strength of the larger filament was no longer required to inhibit filament breakage.

It is believed that in any vehicle operating along a road, it can be assumed that there are random vibrations imposed on each lamp typically and therefore periodically. By appropriate positioning of the filament on a selected spring, this periodic vibration at the resonant frequency of the filament cannot introduce any work energy into the system. This effectively filters out the resonant frequency so that the filament is never excited or forced to vibrate at its resonant frequency.

It has also been discovered that certain spring shapes are advantageous in designing a filament support which will isolate resonant frequencies. It has been discovered for example that if a spring which is tapered in its transverse dimension is used, the positioning of the socket and therefore of the filament along the spring is far less critical than it is with a spring which is rectangular or trapezoidal in shape. It has further been discovered that the best results are obtained if the configuration of the sides of the spring is exponential. For reasons that are not fully understood, this results in a range of points along the narrower end of the spring where the filament is isolated from its resonant frequency.

In the situation where, as in a tail lamp, there are two filaments, normally one is a minor and the other a major filament. That is, in the tail lamp example, the tail light filament will be relatively small and the stop light, being of considerably more candle power, is relatively large and heavy. In that circumstance, the lamp assembly is constructed to isolate the minor filament from vibrations since it is the minor filament which most frequently fails first due to vibrations.

It will be appreciated that while in the summary the description has been directed to a construction where the socket is mounted on a spring, it is within the scope of the invention to, in larger bulbs such as sealed-beam headlights for example, mount the filament itself on a pair of springs which serve as the conductors for supplying electric energy to the filament and also serve to isolate the filament from vibrations of its own resonant frequency.

The construction of this assembly then has the advantages of very marked improvement in the life of the filaments. This permits 24-volt, or even higher volt systems where desired, and even isolates the lamp from shock. It also permits the use of smaller lamps with lower current drains in many applications where, prior to this invention, bulbs of larger size than required for the lighting function were used simply to provide filaments having sufficient mechanical strength to last something resembling a reasonable length of time.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a highway tractor equipped with lamp assemblies of this invention;

FIG. **2** is a cross-sectional view of an improved marker lamp assembly;

FIG. **3** is a top plan view of the base and socket and supporting structure of the lamp assembly of FIG. **2**;

FIG. **4** is a plan view of the filament resonant frequency isolating spring of the assembly of FIGS. **2** and **3** prior to bending into its finished configuration;

FIG. **5** is a somewhat diagrammatic view illustrating the flexure of a frequency isolating spring of a lamp assembly made in accordance with this invention; and,

FIG. **6** is a somewhat diagrammatic sectional view of a sealed-beam lamp with frequency isolating springs within a glass envelope and directly supporting a filament.

Referring to the drawings and FIG. 1 in particular, a highway tractor is shown generally at 10. The tractor 10 has the usual road wheels 11 and is of the wellknown cab-over-engine type. The tractor has a cab 12 mounted above an engine (not shown) and the road wheels. The illustrated tractor has five marker lamps 13 and sealed-beam headlamps 14.

Referring now to FIGS. 2 and 3, the marker lamp assembly includes a somewhat dome-shaped lens 16. The lens is of conventional molded plastic construction with flutes, not shown, along sidewall portions 17. The lens 16 has a pair of mounting tongues 18 which, when the lamp is assembled are below mounting flanges 20 of a mounting ring 21. The flanges 20 project into a groove 23 in the lens and above the tongues 18.

The tongue and mounting ring construction is more clearly understood by reference to FIG. 3 and is conventional. The mounting ring 21 is secured to a base 25. The mounting ring 21 has a pair of diametrically opposed cut-out portions 24. When the lens 16 is connected to the base 25, the tongues 18 are passed through the cut-out portions 24. The lens is then pressed inwardly against a deformable sealing gasket 26 and rotated until the tongues 18 are disposed beneath the mounting flanges 21.

The base 25 is metal. A base gasket 25A is provided. The gasket 25A is molded of a suitable material such as soft rubber. The base 25 and gasket 25A include a wire passage 27 for a supply conductor 28. A socket assembly shown generally at 29 is riveted or otherwise suitably secured to the base as by rivets 30, 31 connected to a ground strap 32. The ground strap 32 is suitably grounded to the frame when the base 25 is secured to the frame as by fasteners inserted through the mounting apertures 33, FIG. 3.

The socket assembly 29 includes the usual contact 26 connected to the supply conductor 28. The contact is biased by a contact spring 37 into engagement with base 38 of a bulb shown generally at 40. The bulb 40 has a shank 41 which is conventionally secured to a socket 42. The socket 42 serves both to mechanically mount the bulb and to provide a connection to grounding on the frame. The bulb 40 has the usual generally spherical glass envelope 44 which houses a filament 45. The filament 45 is connected by conductors 46 to the base 38 and to the shank 41 in the usual manner.

The socket 42 is connected to the base 25 by a frequency isolation spring 50. The spring 50 is preferably of a construction in which the transverse dimension diminishes from a base end 51 to a smaller socket mounting end 52, FIG. 4. As indicated in the introduction to this application, the construction is preferably exponential so that sides 53, 54 are in the shape of logarithmic curves. It has been found that with this exponential construction, location of a conductor aperture 55 near the socket end 52 of the frequency isolation spring 50 is far less critical than with rectangular or trapezoidal configurations and in fact considerably less critical than with a linearly tapered construction.

The range of suitable locations for the conductor aperture 55 and therefore the axis of the socket 42 is indicated in FIG. 4 by the lines 56, 57. With rectangular or trapezoidel configuration, the locus of points which will be along a node of the resonant frequency of a filament will be essentially a line transverse to the spring while, as indicated schematically by the lines 56–57 it has been found that the socket may be positioned with its axis anywhere within the generally rectangular configuration between those two lines.

It has been further found that in order to provide a satisfactory and stable mounting, space for the wire, and the like, without detracting from the characteristics of the mounting on an exponential type spring, the frequency isolation spring 50 may have leg portions 59, 60. These leg portions have transverse dimensions which are exponential. In other words inner surfaces 61, 62 of the leg portions 59, 60 respectively, are exponential with respect to sides 53, 54 respectively.

It will be recognized from an examination of FIGS. 2 and 3 in comparison with FIG. 4 that the spring shown in a flat condition in FIG. 4 is bent at 64 to provide the mounting configuration shown in FIGS. 2 and 3. It will be further recognized that the portion of the spring adjacent the socket end 52 is somewhat enlarged to provide adequate body to the spring for secure mounting of the socket 42. Nonetheless, the spring is exponential in shape and the axis of the socket is secured to the isolation spring 50 at a location where frequencies of a resonant level of the filament are isolated. The isolation is demonstrated by reference to FIG. 5. There, the vibrations of the isolation spring 50 are indicated schematically by dotted lines. As shown, the lamp assembly 29 remains essentially stationary with respect to the base 25 even though the spring is vibrating appreciably at the frequency which is the resonant frequency of the filament 45.

It has also been found that the conductor 28 may conduct vibrations at the resonant frequency of the filament 45. Accordingly, the conductor aperture 27 in the base 25 is radially offset from the conductor aperture 55 in the isolation spring 50 to provide bends at 65, 66, in the conductor, which bends permit the wire to flex and therefore fail to transmit vibrations to the filament.

Referring now to FIG. 6, the sealed-beam headlamp 14 is shown in a somewhat schematic form there. The headlamp 14 has an envelope 70 which houses a filament 71. Conductors 72, 73 which support the filament 71 are secured at their bases to the remainder of the headlamp. The conductors 72, 73 are formed to be exponential vibration isolation springs so that resonant frequencies of the filament 71 are not transmitted to it. It is preferred that the isolation conductors 72, 73 differ somewhat from one another in configuration so that they do not resonate with one another.

The proper location of the socket 42 on the spring 50 is determined by trial and error. So far as I am aware, there is no mathematical formula for determining the appropriate and critical distance from the rivets 30, 31 to the axis of the socket. One process that has been developed is to:

1. First determine the resonant frequency of the filament;
2. Apply vibrations to the base of the frequency isolation spring at the resonant frequency; and,
3. Trim the length of the spring by trial and error until the filament doesn't vibrate at that resonant frequency. A stroboscope may be used for this purpose.

After the appropriate length has been determined, a die can be constructed to accurately and inexpensively produce springs of the appropriate length.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. In an incandescent light mounting fixture for a vehicle:
   a. a base;
   b. a light bulb assembly housing including a filament;
   c. a socket assembly supporting said bulb assembly; and,
   d. a leaf spring supporting said socket assembly on said base; said spring comprising:
      1. a base end defined by first and second leg portions integrally connected to said base;
      2. a socket mounting end;
      3. a generally U-shaped bend intermediate said ends whereby said socket mounting end is spaced from said base;
      4. sides of said spring tapering from near said base end around at least part of said bend toward said socket mounting end whereby said spring is wider across said base end than across said socket mounting end; and,
      5. said legs merging at a location spaced from said base.

2. In a mounting fixture as claimed in claim 1 wherein said socket mounting end extends substantially parallel to said base.

3. A mounting fixture as claimed in claim 2 wherein said legs merge together along said bend.

4. A mounting fixture as claimed in claim 1 wherein said base defines an opening through which an electrical conductor extends to said socket assembly, said conductor loosely extending between said base and said socket assembly whereby flexure of said spring is substantially unimpeded by said conductor.

5. A mounting as claimed in claim 1 wherein each of said leg portions defines at least part of one of said tapered sides of said spring.

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