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(54) Assembly method for a light bulb mount for vehicle lamps

(57) The present invention relates to an assembly method for a light bulb mount for vehicle lamps. The mount incorporates a flexible metal track for mounting a based light bulb, wherein the track dampens vibrations between its mounting location and the lamp by virtue of its flexible nature. The lamp is permanently mounted (both electrically and mechanically) to the track by placing the lamp thereon and then reflowing the solder ball(s) which form the bottom contact(s) of the lamp, each solder ball being coupled to the internal lead wire of the lamp. The reflow operation eliminates the need for a socket for the lamp and provides a quick and low-cost means for mounting the lamp to the track without any extra materials. Once the lamp has been mounted to the track, the track is mounted to a lamp housing, wherein this mounting causes the lamp to be suspended within a well formed into the lamp housing. The base of the lamp and the distal portion of the track are then encapsulated with a resilient material poured into the well, such as silicone. The silicone encapsulation of the lamp provides further dampening for shock forces transmitted to the lamp assembly, and also protects the lamp electrical connections from moisture.

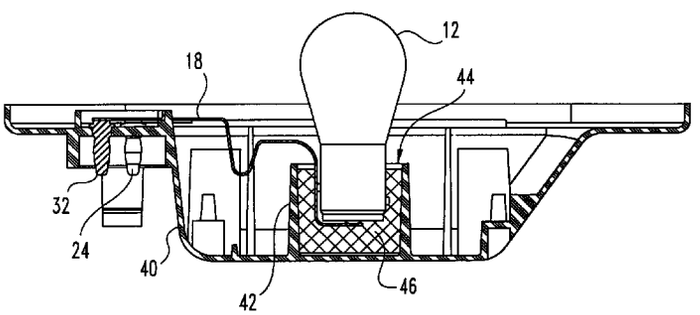

Fig. 4

EP 0 920 091 A2

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention generally relates to light bulb mounts and, more particularly, to an assembly method for a light bulb mount for vehicle lamps.

BACKGROUND OF THE INVENTION

[0002] Various vehicle lamps, such as stop, turn and tail lamps, used on motor vehicles are subject to harsh operating conditions while the vehicle is being driven. Shocks due to irregularities in the road and engine vibration, both of which are transmitted to the light bulbs through the vehicle frame, are primary causes of bulb failure due to breakage of the relatively delicate bulb filaments. This problem can be particularly severe in tracks and sport-utility vehicles that may be used in rough terrain. Furthermore, the lamp assembly must be protected against moisture and high humidity conditions.

[0003] Bulb failure, particularly at the rear of the vehicle, may not be immediately apparent to the vehicle operator. The loss of the ability to signal following vehicles as to turning and braking presents a danger and often results in violation of the law. Occasionally, even if bulb failure is discovered, the replacement is not immediate. Thus it is always desirable to extend bulb life.

[0004] In addition to providing protection to the light bulb from shock transmission, there is also a great need to provide a means of assembling the shock resistant light bulb mount that is simple, reliable, quick and inexpensive. Previously, in sealed lamp assemblies (those in which the light bulb is not separately replaceable), a variety of methods were used to mount the bulb. For example, some prior art devices used a socket similar to or identical to those found in bulb replaceable lamps, while others have tried to avoid the cost of a socket by using a wire bulb (one without a base), hard wiring the bulb to make electrical contact, and then cementing the bulb to provide bulb location and support within the device. Generally, the use of a socket increases the parts costs while lowering assembly time and cost, whereas eliminating the socket lowers the parts cost while increasing the assembly time and cost.

[0005] There is therefore a need for a light bulb mount and assembly method which provides adequate shock isolation to the light bulb, but which has a decreased assembly time and cost. The present invention is directed toward meeting this need.

SUMMARY OF THE INVENTION

[0006] The present invention relates to an assembly method for a light bulb mount for vehicle lamps. The mount incorporates a flexible metal track for mounting a based light bulb, wherein the track dampens vibrations between its mounting location and the lamp by virtue of its flexible nature. The lamp is permanently mounted (both electrically and mechanically) to the track by placing the lamp thereon and then reflowing the solder ball(s) which form the bottom contact(s) of the lamp, each solder ball being coupled to the internal lead wire of the lamp. The reflow operation eliminates the need for a socket for the lamp and provides a quick and low-cost means for mounting the lamp to the track without any extra materials. Once the lamp has been mounted to the track, the track is mounted to a lamp housing, wherein this mounting causes the lamp to be suspended within a well formed into the lamp housing. The base of the lamp and the distal portion of the track are then encapsulated with a resilient material poured into the well, such as silicone. The silicone encapsulation of the lamp provides further dampening for shock forces transmitted to the lamp assembly, and also protects the lamp electrical connections from moisture.

[0007] In one form of the invention, an assembly method for a light bulb mount for vehicle lamps is disclosed, comprising the steps of: a) providing a light bulb mount having at least one contact pad; b) providing a light bulb having at least one solder ball contact; c) positioning the light bulb upon the light bulb mount such that the at least one solder ball contact is adjacent the at least one contact pad; d) elevating a temperature of the at least one solder ball contact until the at least one solder ball contact reflows, thereby forming a mechanical and electrical connection with the at least one contact pad; e) providing a lamp housing having an interior well formed therein; f) coupling the light bulb mount to the lamp housing such that at least a portion of the light bulb is positioned within the well; and g) substantially filling the well with a resilient material operative to dampen mechanical vibrations transmitted from the lamp housing to the light bulb.

[0008] In another form of the invention, an assembly method for a light bulb mount for vehicle lamps is disclosed, comprising the steps of a) providing a light bulb mount having at least one contact pad; b) providing a light bulb having at least one solder ball contact; c) positioning the light bulb upon the light bulb mount such that the at least one solder ball contact is adjacent the at least one contact pad; and d) elevating a temperature of the at least one solder ball contact until the at least one solder ball contact reflows, thereby forming a mechanical and electrical connection with the at least one contact pad.

[0009] In another form of the invention, an assembly method for a light bulb mount for vehicle lamps is disclosed, comprising the steps of a) providing a light bulb mount having a light bulb affixed thereto; b) providing a lamp housing having an interior well formed therein; c) coupling the light bulb mount to the lamp housing such that at least a portion of the light bulb is positioned within the well; and d) substantially filling the well with a resilient material operative to dampen mechanical

vibrations transmitted from the lamp housing to the light bulb.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a side elevational view of a light bulb mounted to a track using the method of the present invention.

FIG. 2 is a perspective view of a light bulb mounted to a track using the method of the present invention.

FIG. 3 is a side cross-sectional view showing the lamp contact solder reflowed to the mounting track, according to the method of the present invention.

FIG. 4 is a partial cross-sectional view of a lamp assembly having the track and light bulb of FIG. 1 mounted therein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

[0012] Referring to FIGS. 1 and 2, there is illustrated a combination circuit track/bulb assembly, indicated generally at 10. In a preferred embodiment, the assembly 10 includes a light bulb 12 having a double contact bayonet base, such as a Model No. 1157 manufactured by General Electric. The bulb 12 includes a metallic bayonet base 14. The bulb is mounted to the circuit track 18 in order to provide a shock-isolated mechanical mounting for the bulb 12 and to couple the bulb 12 to a source of electrical current. The long, flexible metallic fingers of the track 18 operate to dampen most vibrations before they reach the bulb 12, as detailed in U.S. Patent No. 4,922,395, the disclosure of which is incorporated herein by reference.

[0013] The two contacts 20 on the bottom of the bulb 12 are formed from balls of solder alloy which are connected to internal filament leadwires, thereby forming the external electrical contacts for the bulb 12. With reference to FIG. 3, the filament lead wires (not shown) pass through a glass insulator 22 formed on the bottom of the metallic base 14, and are secured by the ball of solder 20. A ground connection for the bulb 12 is made internally to the metallic base 14. Therefore, the ground contact 16 (see FIG. 2) of the circuit track 18 is coupled to the exterior of the metallic base 14, by a braze operation, for example. The opposite end of the ground contact 16 terminates in an electrical connection post 24.

[0014] Once the ground contact 16 has been coupled to the metallic base 14, the two contacts 20 of the bulb 12 are necessarily positioned upon a pair of conductive pads 26, 28. The pad 26 is coupled to a first electrical contact 30 of the circuit track 18, the electrical contact 30 terminating at the terminal 32. The pad 28 is coupled to a second electrical contact 34 of the circuit track 18, the electrical contact 34 terminating at a terminal 36.

[0015] With the bulb 12 thus mounted with the contacts 20 in contact with the pads 26, 28, the bulb 12 may be permanently attached thereto by elevating the temperature of the contacts 20 and/or the pads 26, 28 to a temperature above the melting point of the solder used to form the contacts 20. This will cause the solder of the contacts 20 to reflow, thereby wetting to the pads 26, 28, and forming a positive mechanical and electrical connection thereto. In prior art lamp assemblies, the contacts 20 would have been welded to the pads 26,28. However, the present invention economically makes use of the solder which is already present in the contacts 20, by simply reflowing this solder until connection with made with the pads 26, 28. The solder reflow attachment process of the present invention is therefore much more economical than the prior art attachment processes. It is preferred that the pads 26, 28 be formed in an annular configuration in order to provide a more positive solder joint, although the present invention comprehends the use of the reflow technique with any configuration pad.

[0016] Referring now to FIG. 4, once the bulb 12 has been assembled to the circuit track 18 by means of the solder reflow process described above, the circuit track/bulb assembly 10 may be installed into a lamp housing 40. The lamp housing 40 is preferably made from a high-impact injection-molded plastic, however, the particular material used is not critical for the present invention. Mounting the assembly 10 to the housing 40 is operative to suspend the lower portion of the bulb 12, including the connections between the bulb 12 and the circuit track 18, within a hollow well formed by an annular wall 42 formed as part of the lamp housing 40. It will be noted with reference to FIG. 4 that the bulb 12 is suspended within the well formed by the annular wall 42 and does not touch the bottom or sides of this well.

[0017] Referring once again to FIG. 2, the cross-members 43 of the circuit track 18 are separated from the circuit track 18 in order to electrically isolate the individual contacts 16, 30 and 34. The cross-members 43 are operative to stabilize the flexible circuit track 18 until the track/bulb assembly 10 is installed into the lamp housing 40.

[0018] After the circuit track 18 has been mounted to the lamp housing 40, the well 44 is filled with a resilient, shock-absorbing material 46, which acts to encapsulate the base 14 and electrical/mechanical connections thereto. The resilient material 46 is operative to further

dampen any shocks or vibrations which would otherwise be transferred from the lamp housing 40 to the bulb 12.

[0019] In a preferred embodiment, the encapsulating material 46 comprises silicone formed as a two-part system, the first part is a primary liquid silicone component, and the second part is a liquid silicone catalyst. When mixed together, the compound cures to a solid at room temperature. Faster cure schedules can be achieved by elevating the ambient temperature. The hardness of the silicone compound can be made harder or softer by altering the mix ratio of the two parts, as known in the art. In the preferred embodiment, the two liquid components of the silicone compound are accurately metered to a mixing head at a specific predetermined ratio and then dispensed into the well 44 of the lamp housing 40 during assembly.

[0020] A suitable silicone material for use as the encapsulation material 46 is, for example, a dimethyl polysiloxane available from SHIN-ETSU Silicones of America in Union City, CA (part numbers SEKE1052DAKG18 and SEKE1052DBKG18) mixed in a ratio of 1:1 and cured at 25°C for 30 minutes.

[0021] It will be appreciated by those skilled in the art that the annular wall 42 conveniently forms a mold for the silicone encapsulation material 46, while the shock-absorbing circuit track 18 conveniently positions the bulb 12 within the well 44 (but does not secure the bulb 12 therein) during the encapsulation process 46. Because the bulb 12 is not secured within the well 44, the only connection between the bulb 12 and the housing 40 after the encapsulation process is through the encapsulation material 46 or through the circuit track 18 (which is further dampened by the encapsulation material 46). There is therefore no non-dampened route for transferring vibrations between the housing 40 and the bulb 12.

[0022] It will therefore be appreciated by those skilled in the art that the light bulb mount and assembly method of the present invention provides improved shock isolation to the light bulb at a decreased assembly time and cost.

[0023] While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit and scope of the invention are desired to be protected.

Claims

1. An assembly method for a light bulb mount for vehicle lamps, comprising the steps of:

   a) providing a light bulb mount having at least one contact pad;

   b) providing a light bulb having at least one solder ball contact;

   c) positioning the light bulb upon the light bulb mount such that the at least one solder ball contact is adjacent the at least one contact pad;

   d) elevating a temperature of the at least one solder ball contact until the at least one solder ball contact reflows, thereby forming a mechanical and electrical connection with the at least one contact pad;

   e) providing a lamp housing having an interior well formed therein;

   f) coupling the light bulb mount to the lamp housing such that at least a portion of the light bulb is positioned within the well; and

   g) substantially filling the well with a resilient material operative to dampen mechanical vibrations transmitted from the lamp housing to the light bulb.

2. The method of claim 1, wherein step (a) further comprises providing a light bulb mount having a proximal end and distal end having at least one contact pad, wherein the proximal and distal ends are coupled by at least one elongated flexible member, such that vibrations applied at the proximal end are substantially dampened before reaching the distal end.

3. The method of claim 1, wherein step (b) further comprises providing a light bulb having a bayonet base and two solder ball contacts.

4. The method of claim 1, wherein step (e) further comprises providing a lamp housing having a cylindrical interior well formed therein by an annular wall.

5. The method of claim 1, wherein step (g) further comprises substantially filling the well with silicone.

6. An assembly method for a light bulb mount for vehicle lamps, comprising the steps of:

   a) providing a light bulb mount having at least one contact pad;

   b) providing a light bulb having at least one solder ball contact;

   c) positioning the light bulb upon the light bulb mount such that the at least one solder ball contact is adjacent the at least one contact pad; and

   d) elevating a temperature of the at least one solder ball contact until the at least one solder ball contact reflows, thereby forming a mechanical and electrical connection with the at least one contact pad.

7. The method of claim 6, wherein step (a) further comprises providing a light bulb mount having a proximal end and distal end having at least one contact pad, wherein the proximal and distal ends are coupled by at least one elongated flexible member, such that vibrations applied at the proximal end are substantially dampened before reaching the distal end.

8. The method of claim 6, wherein step (b) further comprises providing a light bulb having a bayonet base and two solder ball contacts.

9. An assembly method for a light bulb mount for vehicle lamps, comprising the steps of:

a) providing a light bulb mount having a light bulb affixed thereto;
b) providing a lamp housing having an interior well formed therein;
c) coupling the light bulb mount to the lamp housing such that at least a portion of the light bulb is positioned within the well; and
d) substantially filling the well with a resilient material operative to dampen mechanical vibrations transmitted from the lamp housing to the light bulb.

10. The method of claim 1, wherein step (a) further comprises:

a.1) providing a light bulb mount having at least one contact pad;
a.2) providing a light bulb having at least one solder ball contact;
a.3) positioning the light bulb upon the light bulb mount such that the at least one solder ball contact is adjacent the at least one contact pad; and
a.4) elevating a temperature of the at least one solder ball contact until the at least one solder ball contact reflows, thereby forming a mechanical and electrical connection with the at least one contact pad.

11. The method of claim 10, wherein step (a.1) further comprises providing a light bulb mount having a proximal end and distal end having at least one contact pad, wherein the proximal and distal ends are coupled by at least one elongated flexible member, such that vibrations applied at the proximal end are substantially dampened before reaching the distal end.

12. The method of claim 10, wherein step (a.2) further comprises providing a light bulb having a bayonet base and two solder ball contacts.

13. The method of claim 9, wherein step (b) further comprises providing a lamp housing having a cylindrical interior well formed therein by an annular wall.

14. The method of claim 9, wherein step (d) further comprises substantially filling the well with silicone.

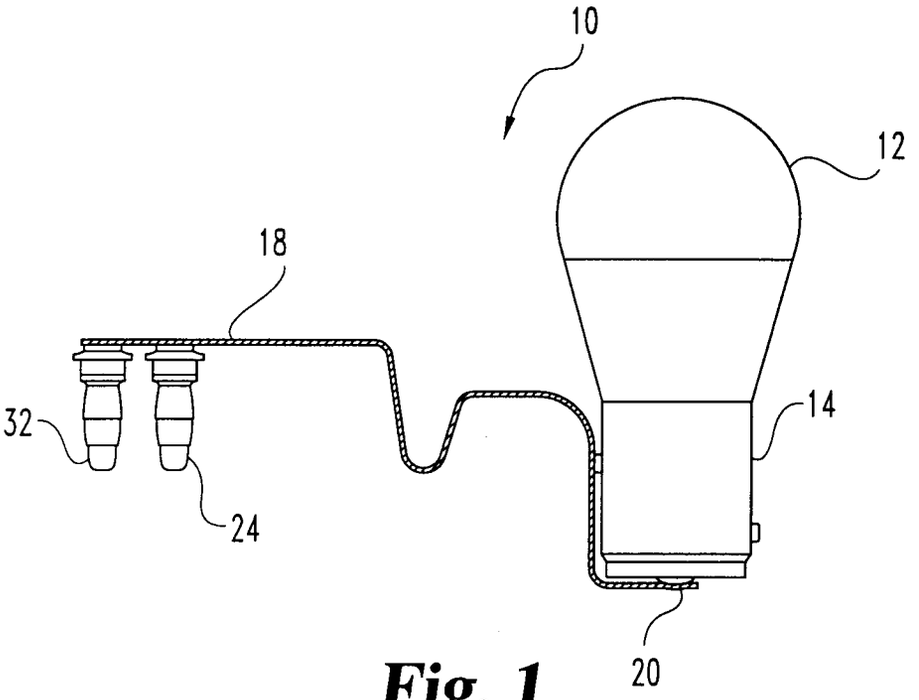

Fig. 1

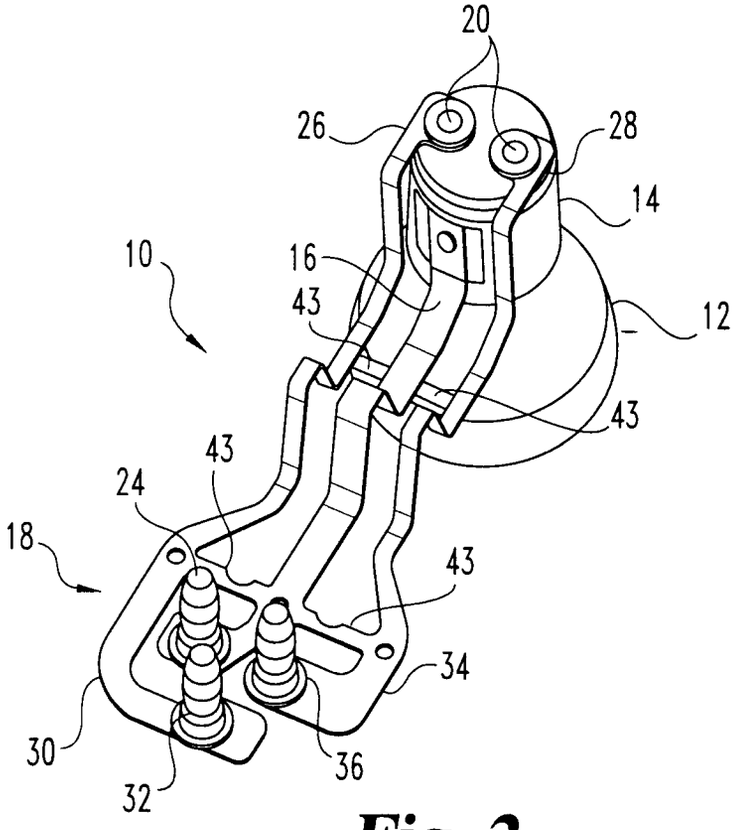

Fig. 2

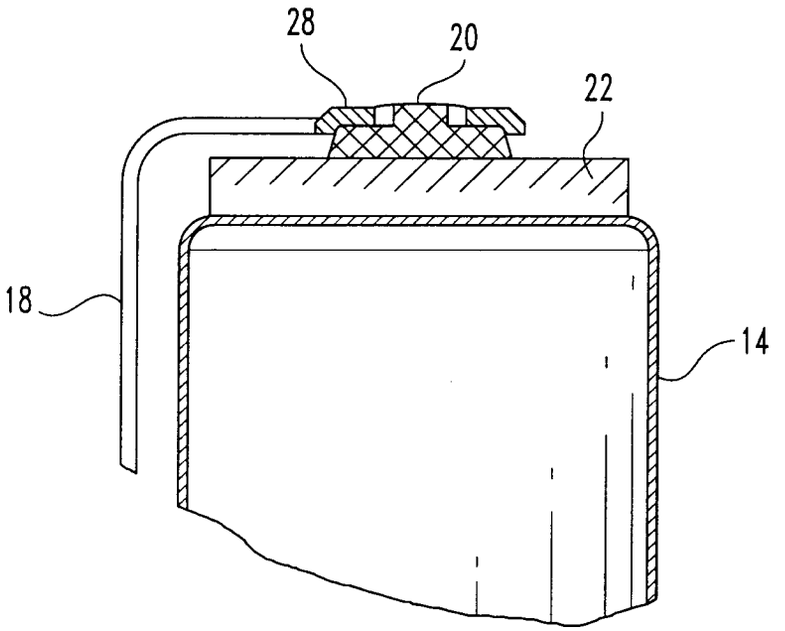

Fig. 3

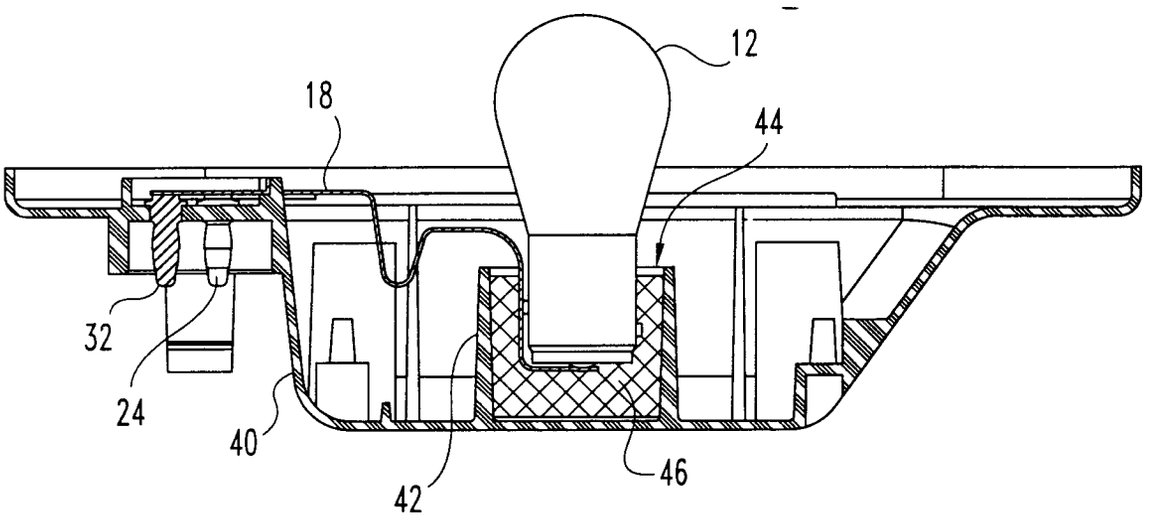

Fig. 4