United States Patent

[11] **3,555,341**

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[73] Assignee **Wagner Electric Corporation**
a corporation of Delaware

[54] **REAR LOADING PANEL LAMP ASSEMBLY**
10 Claims, 7 Drawing Figs.

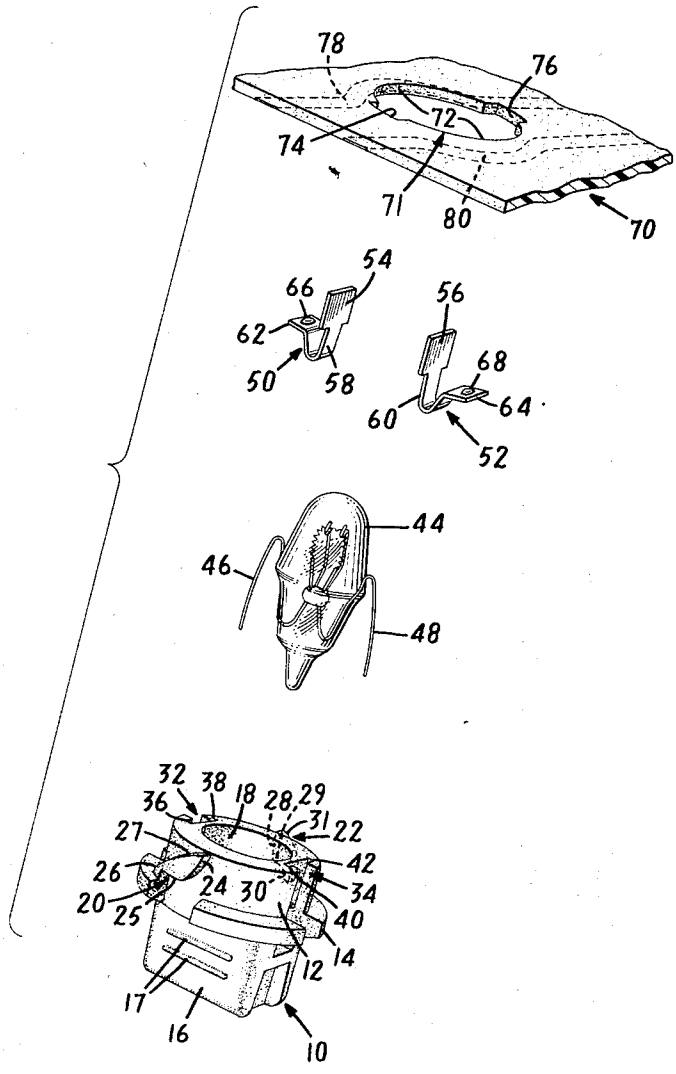
[52] **U.S. Cl.** **313/318,** 313/331, 339/145
[51] **Int. Cl.** **H01j 5/48,** H01j 5/50
[50] **Field of Search** 313/317, 318, 331, 332; 339/145, 50

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ABSTRACT: A permanently based lamp for mounting in an aperture in a circuit board includes a base consisting of a thermoplastic material and having a chamber in which a lamp envelope and leads are permanently sealed. The lamp leads extend out of the chamber and into separate slots exterior to the chamber. Terminals are inserted into the slots to engage the leads mechanically and electrically.



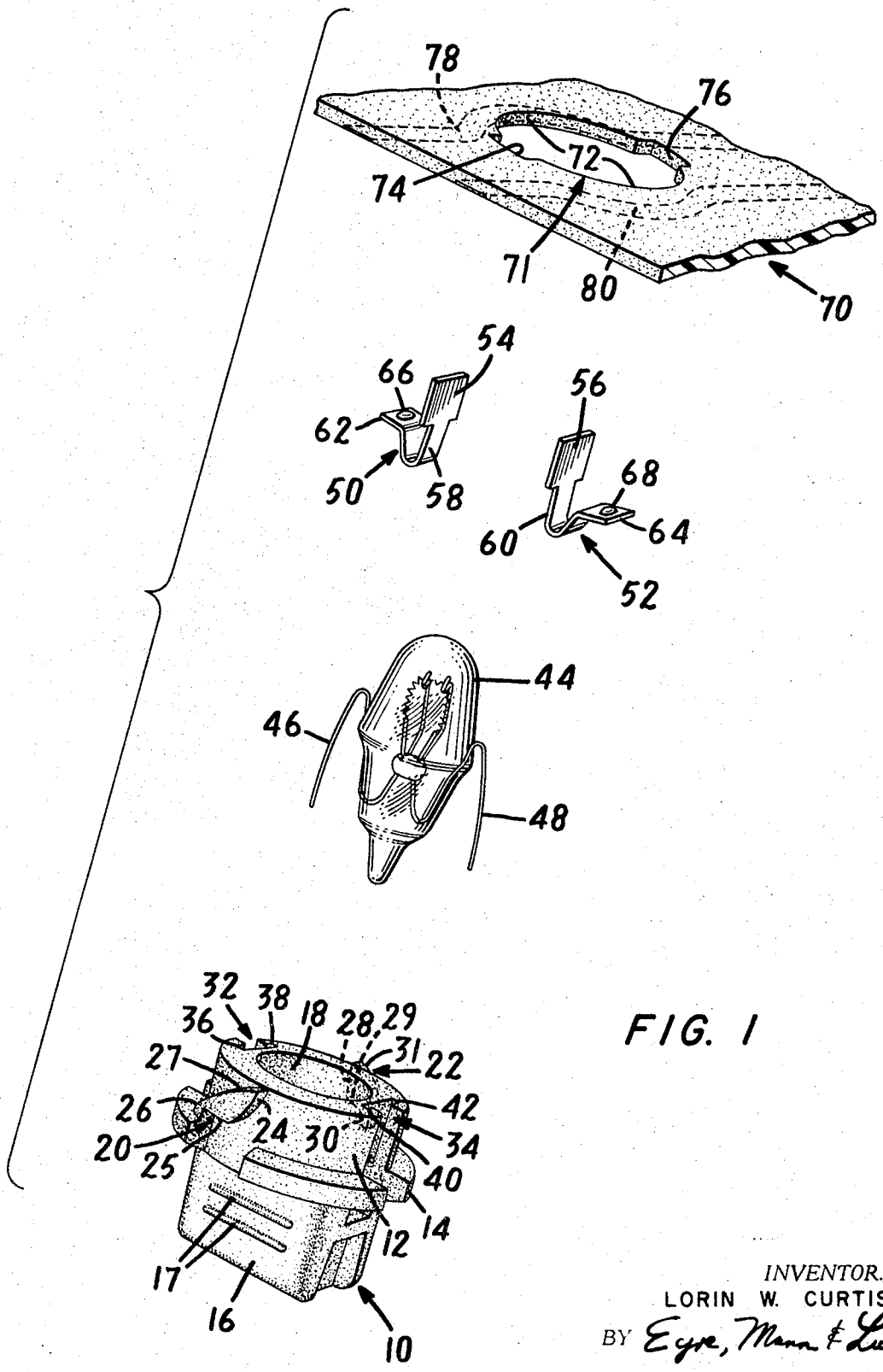


FIG. 1

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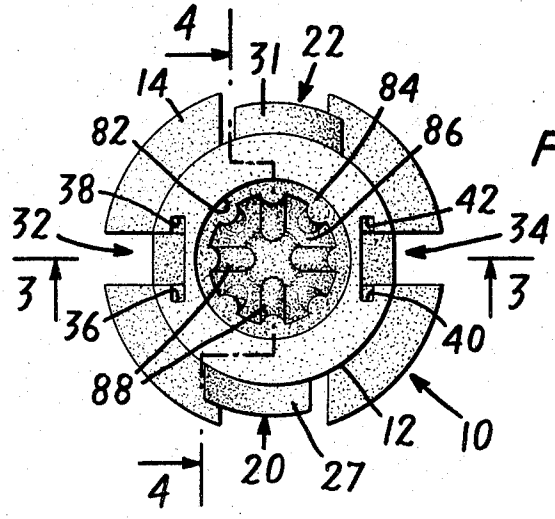


FIG. 2

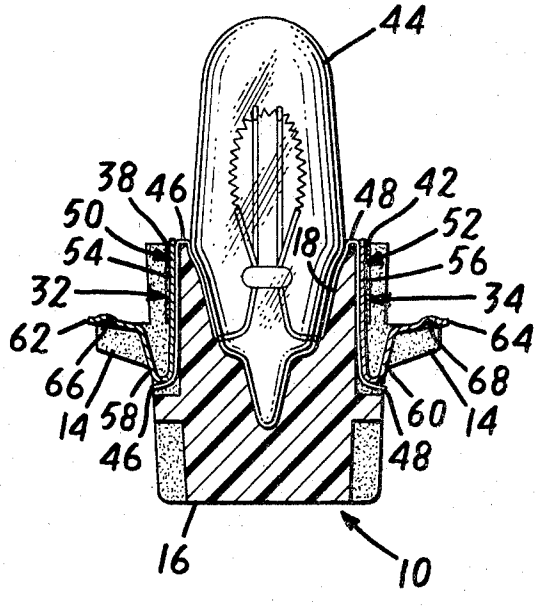


FIG. 3

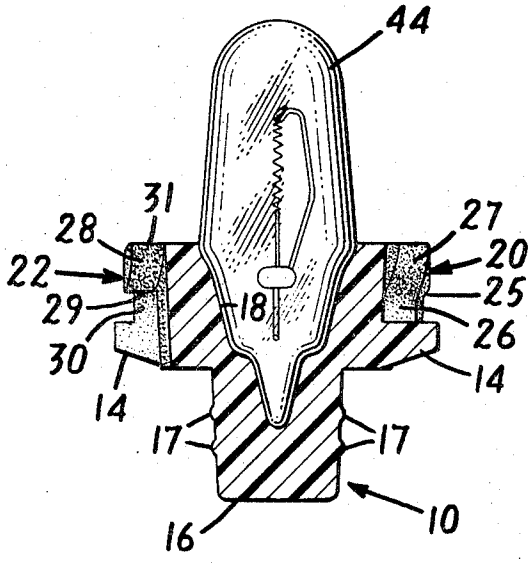


FIG. 4

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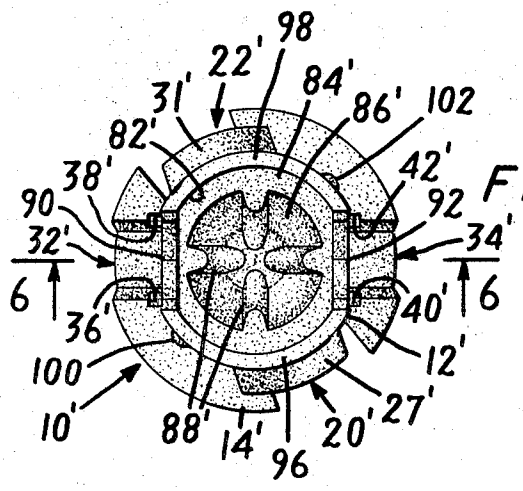


FIG. 5

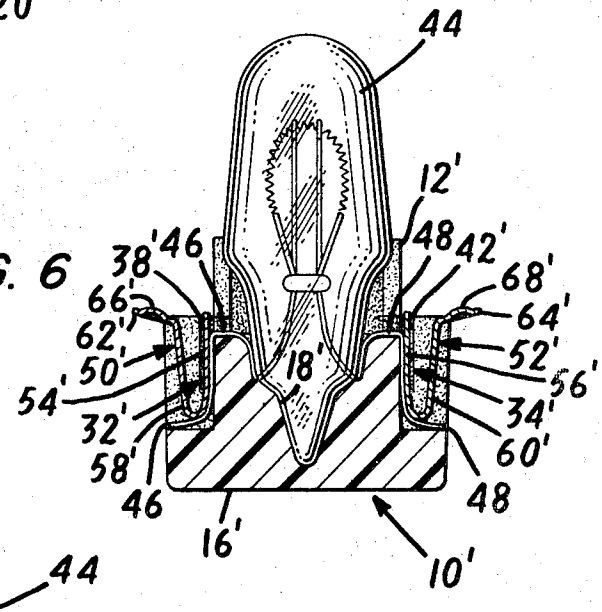


FIG. 6

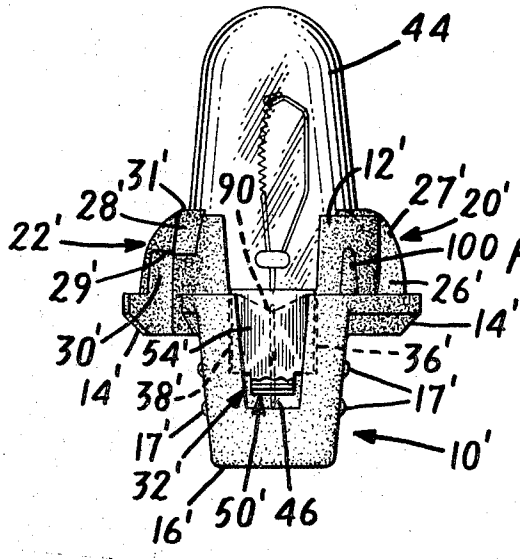


FIG. 7

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REAR LOADING PANEL LAMP ASSEMBLY

The present invention relates to an improved twist-lock lamp base, an improved twist-lock lamp assembly, and a method for making the latter. The lamp bases described herein consist of a thermoplastic material and include a chamber of relatively simple configuration for receiving the lower portion of a lamp envelope and terminal-mounting slots external to the chamber. In the completed lamp assembly, the leads extending from the lower portion of the lamp envelope enclosed within the chamber extend out of the chamber and into the terminal-mounting slots, where the leads are frictionally engaged between a surface of the slots and portions of terminals mounted in the slots. A physical connection is thus established between the leads and the terminals, the latter being adapted to engage conductive portions of a circuit board. The method for forming the completed lamp assembly consists of: heating the chamber of the lamp base sufficiently to soften the thermoplastic material of the interior chamber wall; heating the bottom portion of the lamp envelope to prevent hardening of the softened chamber wall upon contact with the lamp envelope; introducing the bottom portion of the lamp envelope into the chamber with the leads extending upwardly out of the chamber; bending the leads downwardly into the terminal mounting slots; and inserting the terminals into the slots.

In order to better understand the invention, reference should be made to the appended drawings, of which:

FIG. 1 is an exploded view of the disassembled base, lamp envelope-leads, and terminals shown beneath a section of printed circuit board having an aperture adapted to receive the completed lamp assembly;

FIG. 2 is a plan view of a first embodiment of the molded base along prior to formation of the completed lamp assembly;

FIG. 3 is a sectional view of the completed lamp assembly, including the first embodiment of the molded base, taken through the plane 3–3 shown in FIG. 2;

FIG. 4 is a sectional view of the completed lamp assembly taken through the planes 4–4 shown in FIG. 2;

FIG. 5 is a plan view of a second embodiment of the molded base alone prior to formation of the completed lamp assembly;

FIG. 6 is a sectional view of the completed lamp assembly, including the second embodiment of the molded base, taken through the plane 6–6 shown in FIG. 2;

FIG. 7 is a side view of the completed lamp assembly with the outer portion of the terminal shown broken away.

Referring now specifically to FIG. 1, an exploded view of the lamp assembly is shown along with a section of printed circuit board in which the assembled lamp is to be mounted. The base 10 comprises neck 12, collar portion 14 and elongated portion 16, the latter being adapted to be grasped between two fingers. Ribs 17 are provided on the elongated portion 16 to facilitate grasping. Within the base 10 is a chamber 18 within which the lamp envelope is retained. On the exterior surface of the neck 12 are diametrically opposite wing members 20 and 22. Wing member 20 has camming surface 24, retaining surface 25, a vertical portion 26 and a sloping upper surface 27. Wing member 22 has camming surface 28, retaining surface 29, a vertical portion 30 and a sloping upper surface 31. Camming surface 24 of wing member 20 is disposed at an angle with the collar portion 14 greater than 0° and less than 90°. Retaining surfaces 25 and 29 of wing members 20 and 22 are approximately parallel to the collar portion 14, and when mounted in the circuit board 70, are parallel to and in retaining contact with the upper surface of the circuit board over their entire retaining surface areas.

Diametrically opposed slots 32 and 34 are cut into the neck 12 and down through the collar portion 14. Each of these slots have vertical retaining grooves 36, 38 and 40, 42, which extend downward approximately to the level of the upper surface of collar portion 14.

Lamp envelope 44 has conductive leads 46 and 48 extending from the portion of the envelope which is to be fitted into chamber 18 of base 10. These leads are bent upwardly toward the portion of the lamp envelope 44 to be exposed, and when the lamp envelope 44 is inserted into chamber 18, leads 46 and 48 will be bent downward and placed in slots 32 and 34.

Terminals 50 and 52 have wide rectangular upper portions 54 and 56 respectively. Extending from these wide upper portions are narrowed U-shaped portions 58 and 60 respectively, from which extend tab portions 62 and 64. These tab portions 62 and 64 slope upwardly from the U-shaped portions 58 and 60, thus forming an acute angle with wide portions 54 and 56 respectively. Dimples 66 and 68 protrude upwardly from the surface of tab portions 62 and 64 respectively.

Terminals 50 and 52 are adapted to slide into slots 32 and 34, being retained therein by the engagement of wide portions 54 and 56 with the vertical retaining grooves 36, 38 and 40, 42. Terminals 50 and 52 are mounted in the slots 32 and 34 in this manner, after the leads 46 and 48 are first wrapped down into the slots. Thus, a friction lock is formed between slots 32 and 34, leads 46 and 48, terminals 50 and 52, and vertical retaining grooves 36, 38 and 40, 42, and electrical contact is also achieved between terminals 50 and 52 and leads 46 and 48. The bases of the vertical retaining grooves 36, 38 and 40, 42 provide seats for the wide portions 54 and 56 of terminals 50 and 52 to properly orient the tab portions 62 and 64 and prevent them from being situated below the upper surface of collar portion 14 of base 10. Thus, the tab portions 62 and 64 of terminals 50 and 52 respectively, are always in a position sufficiently elevated above the collar portion 14 to make electrical contact with the circuit on the bottom surface of the printed circuit board.

A section of printed circuit board 70 is shown having an aperture 71 which includes circular portions 72 and diametrically opposed notches 74 and 76. On the bottom side of the printed circuit board 70 are conductive strips 78 and 80. When the base 10, lamp envelope 44 and terminals 50 and 52 are assembled, the neck 12 may be passed through the circular opening 72, with wing members 20 and 22 passing through notches 74 and 76. A twisting motion imparted to the lamp assembly will bring retaining surfaces 25 and 28 of wing members 20 and 22 into sliding contact with the upper surface of printed circuit board 70, and will move tab portions 66 and 68 of terminals 50 and 52 into frictional engagement with conductive strips 78 and 80 respectively. By abutting one outwardly extending surface of notches 74 and 76, vertical portions 26 and 30 of wing members 20 and 22 limit the angle through which the lamp assembly may be rotated after insertion into circular opening 72. Tab portions 62 and 64 ensure that the lamp assembly will be securely locked in place by providing a spring pressure against the bottom surface of printed circuit board 70. The additional downward displacement of the tab portions 62 and 64 caused by dimples 66 and 68, which are positioned to contact conductive strips 78 and 80, increases this pressure and ensures a good physical connection as well as enhancing the frictional lock between the retaining surfaces 25 and 29 and the upper surface of the circuit board 70.

Referring now to FIG. 2, this is a plan view of the molded base 10 alone prior to combining same with the lamp envelope 44 and terminals 50 and 52. In this view, chamber 18 may be seen to comprise an upper cylindrical portion 82 which terminates at a ledge 84 at approximately the level of the collar portion 14. Chamber 18 further comprises a conical portion 86 extending downwardly from the inner rim of ledge 84 into the elongated portion 16 of base 10. This conical portion 86 has extending inwardly from its surface a number of ribs 88, some extending all the way from the inner rim of ledge 84 to the bottom of chamber 18 and others extending only part way toward the bottom of chamber 18. In the embodiment illustrated in FIG. 2, there are eight ribs, with alternate ribs extending to the bottom of chamber 18.

This view also illustrates the slots 32 and 34 extending downwardly from the top of neck portion 12 and through collar portion 14 to a ledge below the collar portion 14. Vertical retaining grooves 36, 38 and 40, 42 may be seen as extending laterally from the slots 32 and 34 respectively, and

downwardly from the top of neck portion 12 to bases which are positioned at approximately the level of the upper surface of collar portion 14.

Wing members 20 and 22 may be seen to have upper surfaces 27 and 31 rising and sloping toward the same direction as the direction that the base 10 is rotated when being mounted to circuit board 70. Thus, the sloping surfaces 27 and 31 facilitate introduction of wing members 20 and 22 into notches 74 and 76 of aperture 71 in the circuit board 70.

Referring now to FIG. 3, a sectional view taken through the plane 3–3 shown in FIG. 2, the contours of chamber 18 are shown as they exist after formation of the complete lamp assembly. As shown, chamber 18 extends downward into the elongated portion 16. In the process of forming the completed assembly, sufficient heat is applied to the interior of chamber 18 to cause softening of the thermoplastic base material in the region of ribs 88, and the lower portion of lamp envelope 44 is also heated to a temperature below the melting point of the envelope material. Then, with the leads 46 and 48 turned upward, the lower portion of the envelope 44 is introduced into the chamber 18. The soft thermoplastic base material flows around the irregularly tapered lower portion of envelope 44 and thereby forms a mechanical lock between the base 10 and the lamp envelope 44. The upwardly extending leads 46 and 48 are bent down into slots 32 and 34, and terminals 50 and 52 are introduced into slots 32 and 34 with their broad portions 54 and 56 fitting into vertical retaining grooves 36, 38 and 40, 42, of which only grooves 38 and 42 may be seen in this FIG. Leads 46 and 48 are thus frictionally engaged between the terminals 50 and 52 and slots 32 and 34 respectively. The lower shoulders of broad portions 54 and 56 of terminals 50 and 52 abut against the bases of vertical retaining grooves 36, 38 and 40, 42, thus positioning the upwardly sloping tab portions 62 and 64 so that they will extend above the plane through the upper surface of collar portion 14. The excess length of leads 46 and 48 extending out beneath the U-shaped portions 58 and 60 of terminals 50 and 52 may be cut off. Alternatively, any excess length of leads 46 and 48 may be folded into the slots 32 and 34 prior to introduction of terminals 50 and 52, thereby obviating the need to trim away the excess length.

Referring now to FIG. 4, a sectional view taken through the planes 4–4, the camming surface 28 of wing member 22 may be seen. Retaining surface 29 is horizontal and appears in this view as a line. The vertical portion 30 of wing member 22 is also visible, extending downwardly from the rear extremity of retaining surface 29 to the collar portion 14 and being integral with both. The sloping upper surface 27 and one surface of vertical portion 26 of wing member 20 are also shown.

In this view, as well as in FIG. 3, it may be seen that the melted thermoplastic material of the base 10 flows around the irregularly tapered portion of envelope 44 so as to leave virtually no air pockets and to establish a strong bond with the surface of the envelope 44 over a maximum area thereof. The elongated portion 16 of base 10 may be seen to be relatively thin in comparison with its transverse dimension shown in FIG. 3. Ribs 17 are horizontally disposed on opposite sides of elongated portion 16 to facilitate grasping.

Referring now to FIGS. 5, 6 and 7, these views show a modified form of the base and the lamp assembly shown in FIGS. 1, 2, 3 and 4. The primed numbers in FIGS. 5, 6 and 7 designate parts which are substantially identical to parts designated by the same unprimed numbers in FIGS. 1, 2, 3 and 4.

The plan view of FIG. 5 illustrates the altered orientation of wing members 20', 22' in the second embodiment of the invention. As may be seen in FIG. 2, the diametrical axis through the retaining surfaces of wing members 20, 22 on the first embodiment is oriented approximately perpendicularly to the diametrical axis through slots 32 and 34. In the second embodiment, the wing members 20', 22' have been rotated approximately 22° in a counterclockwise direction from their position in the first embodiment. This results in the terminals of the completed lamp assembly being disposed at an angle of approximately 90° from the notches 74, 76 of aperture 71 in circuit board 70 after the lamp assembly has been rotated in the aperture and mounted on the board. The ribs 88' in this second embodiment are four in number, all four extending from the ledge 84' down to the bottom of conical portion 86'.

The notches 90 and 92 across which leads 46 and 48 are bent down into slots 32', 34' may be seen between the two arcuate sections 96 and 98 of neck portion 12'. These notches 90 and 92 are at a level just below the upper surface level of collar portion 14', thus positioning the uppermost portions of leads 46 and 48 below the circuit board 70, when the completed lamp assembly is mounted therein. The tapered ribs 100 and 102 on the arcuate sections 96 and 98 of neck portion 12' are to prevent an excessively loose fit of the lamp assembly when it is inserted into aperture 71 of circuit board 70. The radial dimension of the ribs 100 and 102 decreases as they extend upward from the collar portion 14', thus providing a relatively large differential between the diameter of aperture 71 and the diameter of the neck portion 12' at the upper part of neck portion 12', and a relatively small differential at the lower part of neck portion 12'.

The sectional view of the completed lamp assembly shown in FIG. 6, taken through plane 6–6 in FIG. 5, illustrates the modified position of terminals 50' and 52', and the modified configuration of the terminals. Vertical retaining grooves 38' and 42', and their complementary grooves 36', 40' not shown in this view, extend downward from the level of the upper surface of collar portion 14' to bases below the collar portion 14' and above the bottoms of slots 32' and 34'. Terminals 50' and 52', when slid into place in the slots 32' and 34' and held therein by the engagement of wide portions 54' and 56', with grooves 36', 38' and 40', 42', will be entirely located below the level of the upper surface of the collar portion 14' except for the tab portions 66' and 68', which extend laterally from the upwardly extending portions 58' and 60' and above the aforementioned surface in order to make electrical contact with conductors 78 and 80 on the circuit board 70. Leads 46 and 48 are disposed entirely below the aforementioned surface, extending outward from chamber 18' across notches 90 and 92 and down into slots 32' and 34' and being centered in these slots by the notches 90 and 92.

The side elevation of the lamp assembly shown in FIG. 7 illustrates (in phantom) the notch 90 with lead 46 being centered therein and bending down into slot 32 behind the terminal 50, part of which is broken away. It may be seen that the retaining surface 29' of wing member 22' slopes upwardly from its intersection with camming surface 28'. This provides a clearance at the intersection of retaining surface 29' with the vertical portion 30'. This clearance prevents interference with the insertion and positioning of the lamp assembly in circuit board 70 by any burring at the upper edge of notches 74 and 76 of aperture 71.

The position of the vertical retaining grooves 36', 38' relative to slot 32' is shown, and the lead 46 is shown in phantom behind the wide portion 54' of terminal 50'. In the manufacturing process, lead 46 is centered in the slot 32' by being drawn down into notch 90.

It will be understood that all changes and modifications of the preferred embodiments of the invention described above which do not depart from the spirit and scope of the invention are intended to be encompassed by the claims appended hereto.

I claim:

1. A rear loading panel lamp comprising:
   1. first and second electrical terminal means;
   2. a lamp including an envelope and first and second leads extending from said envelope; and
   3. a base member including:
      a. a wall defining a chamber in which a portion of said envelope is secured;
      b. first and second retaining means with which said first and second electrical terminal means, respectively, are slidingly engaged, said first and second leads being en-

gaged between said first and second electrical terminal means and retaining means, respectively; and

c. locking means operative in cooperation with said electrical terminal means to secure said lamp assembly to a circuit board.

2. A lamp according to claim 1 wherein said locking means include means for engaging said circuit board to restrain said lamp assembly in a predetermined position in which said first and second electrical terminal means are in contact with first and second conductors on said circuit board.

3. A lamp according to claim 1 wherein said retaining means of said base member are exterior to said chamber of said base member, and said first and second leads of said lamp envelope extend from said chamber and are frictionally engaged between said first and second electrical terminal means and one surface of said first and second retaining means, respectively.

4. A lamp according to claim 1 wherein said first and second retaining means comprise diametrically opposite vertical slots in the exterior portion of the wall of said chamber, each slot having a pair of laterally extending vertical grooves disposed between the exterior and interior surfaces of said wall of said chamber.

5. A lamp according to claim 4 wherein said diametrically opposite vertical slots extend downwardly to a level below the lower limits of said laterally extending vertical grooves.

6. A lamp according to claim 5 wherein said first and second electrical terminal means each comprise:

1. a relatively wide upper portion;
2. a relatively narrow portion extending downwardly from said wide upper portion, forming a pair of shoulders at the intersection therewith; and
3. then extending upwardly to a tab portion which extends laterally away from said narrow portion, with said wide upper portions engaging said laterally extending vertical grooves and said shoulder pairs abutting the lower limits of said grooves, and said narrow portions extending downward in said vertical slots.

7. A base for a rear-loading panel lamp comprising:

1. a wall defining a chamber for receiving a portion of a lamp envelope;
2. a plurality of retaining means external to said chamber, each being operative to secure an electrical terminal which is slidingly engageable with said retaining means; and
3. locking means operative to secure said base to a circuit board.

8. A base according to claim 7 wherein said wall includes a lower external portion which is laterally elongated.

9. A base according to claim 7 wherein said chamber includes a lower conical portion having ribs extending inwardly between the base and the apex of said conical portion.

10. A base according to claim 7 wherein said retaining means comprise diametrically opposite vertical slots in the exterior portion of the wall of said chamber, each slot having a pair of laterally extending vertical grooves disposed between the exterior and interior surfaces of said wall of said chamber.

Notice of Adverse Decision in Interference

In Interference No. 97,849 involving Patent No. 3,555,341, L. W. Curtis, REAR LOADING PANEL LAMP ASSEMBLY, final judgment adverse to the patentee was rendered Dec. 11, 1973, as to claims 1, 2, 3, 7 and 8.

[*Official Gazette May 21, 1974.*]