March 30, 1965 R. H. JENSEN 3,176,255

LAMP SOCKET AND CONNECTOR FOR EDGE-LIGHTED PANEL

Filed Aug. 4, 1960 2 Sheets-Sheet 1

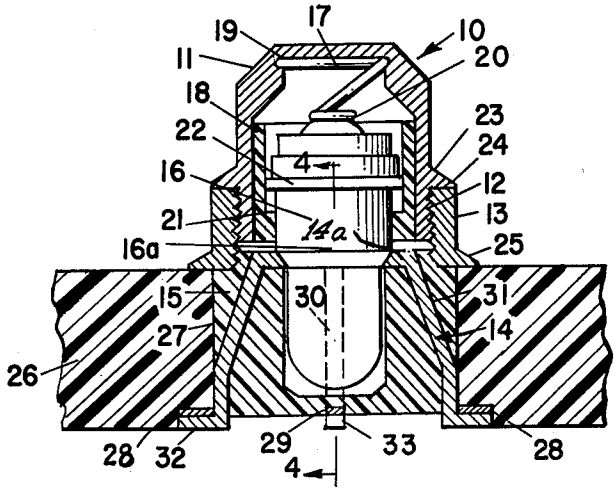


FIG. 1.

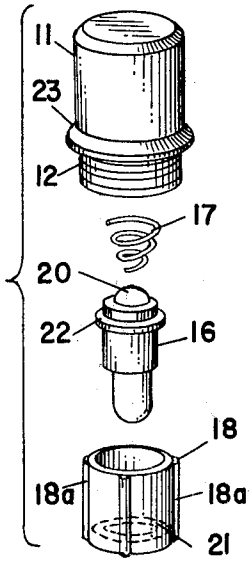


FIG. 2.

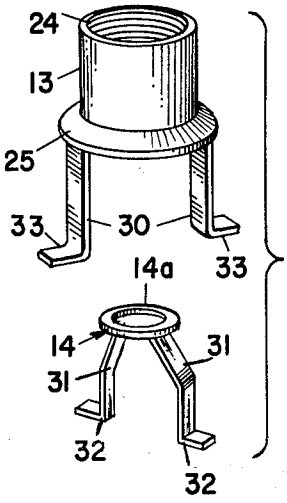


FIG. 3.

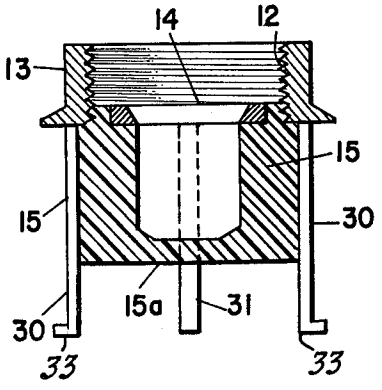


FIG. 4.

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LAMP SOCKET AND CONNECTOR FOR EDGE-LIGHTED PANEL

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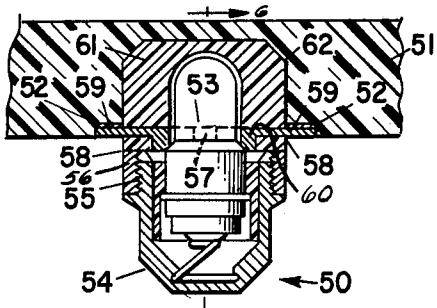


FIG. 5.

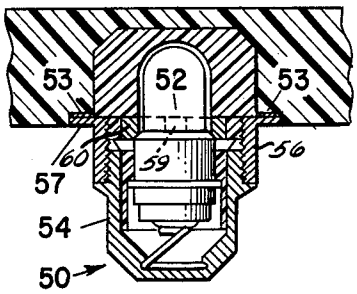
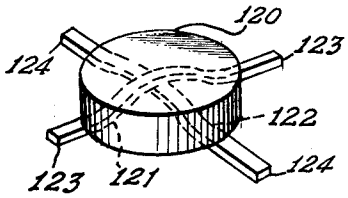


FIG. 6.

FIG. 12



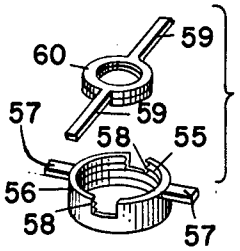
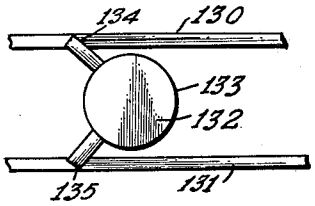


FIG. 7.

FIG. 13



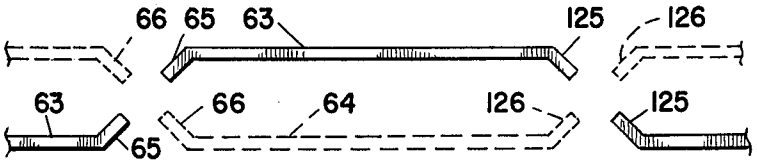


FIG. 8.

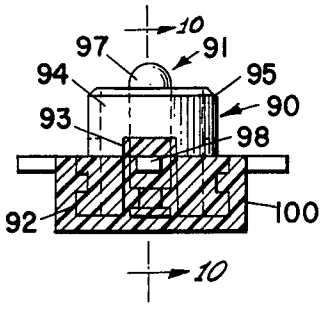


FIG. 9.

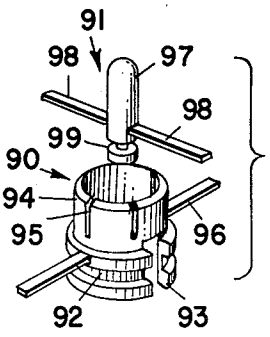


FIG. 11.

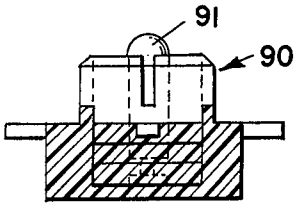


FIG. 10.

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3,176,255

LAMP SOCKET AND CONNECTOR FOR EDGE-LIGHTED PANEL

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Filed Aug. 4, 1960, Ser. No. 47,555
3 Claims. (Cl. 339—17)

This invention generally relates to a miniaturized apparatus for mounting in apertures or cavities of an edge-lighted panel, and more particularly concerns improved lamp sockets (or fixtures as they are sometimes denoted) and connectors designed primarily for employment with printed circuit type edge-lighted panels particularly of the type embodied in aircraft and missile ground support structures.

The method of forming and/or composition of the panel as such forms no part of the present invention except as to the printed circuitry thereof to the extent that it may cooperate in combination with the socket and connector of the present invention. Edge-lighted panels are well known in the art. Furthermore, the use of printed circuitry in connection with edge-lighted panels has recently become standard practice in applications towards which the present invention is directed. In this respect, reference is made to Patent No. 2,847,560, entitled "Lamp Socket and Associated Electrical Connecting Means," for example, as indicative of printed circuitry now employed with edge-lighted panels. Reference is also made to Patent No. 2,847,654, entitled "Lamp Socket for Edge-Lighted Panel," which indicates generally the state of the art with respect to lamp sockets or fixtures for edge-lighted panels. Although various companies use different structural details, the latter lamp socket is typical of conventional practice with respect to this component.

A need has developed, however, for lamp sockets of miniaturized dimensions which will effect a savings in space and weight in the overall edge-lighted panel structures in which they are embodied, a factor of considerable importance in aircraft and missile applications. Furthermore, to increase design flexibility, it is also desirable that the lamp socket be reduced to minimum dimensions whereby it may be more closely positioned adjacent the particular indicia, instrument or dial device it is required to illuminate. These and similar design problems are well known to those skilled in the art, and the advantages of the present invention will be readily appreciated by such individuals.

It is therefore an object of the present invention to provide an improved miniaturized apparatus for mounting in an aperture (or cavity, in certain instances) of an edge-lighted panel which is designed to simply and conveniently form relatively permanent electrical connections with printed circuitry thereon.

Another object of the present invention is to provide a miniaturized lamp socket for mounting in an edge-lighted panel, which may be employed to make electrical contact with two spaced circuits on one side of the panel.

Another object of the present invention is to provide a miniaturized lamp socket in which the cap may readily be removed from the socket for lamp replacement, and yet in which the cap will retain the lamp to avoid inadvertent breakage until it is manually withdrawn therefrom.

A still further object of the present invention is to

provide an improved miniaturized lamp socket for mounting in the aperture or cavity of an edge-lighted panel, in which a minimum number of parts are employed and in which most of the parts co-function in both the electrical circuitry and the structure of the apparatus.

Still another object of the present invention is to provide a miniaturized lamp socket for mounting in an aperture or cavity of an edge-lighted panel in which the lamp socket is so constructed that it may be readily manufactured and produced in sizes characterized by minimum overall dimensions, and yet which will be relatively rugged and maintenance-free in service and not requiring the need of skilled technicians for assembly or disassembly thereof.

These and other objects and advantages of the present invention are generally attained by providing a miniaturized apparatus designed for mounting in an aperture or cavity of an edge-lighted panel characterized by a pair of spaced circuits on one side thereof, the apparatus including a generally cylindrical fixture or first member having a pair of spaced arms designed to form a series connection with one of the circuits. A plastic shell is included and is adapted to be secured within the aperture and moulded about at least a portion of the cylindrical fixture. A second member is incorporated within the shell and is disposed in radially spaced relationship within the first member. The second member also includes a pair of radially extending arms having portions thereof in a plane with the arms of the cylindrical fixture and designed to contact the other of the circuits.

In one form, the miniaturized apparatus may additionally embody a metallic cap coupled to the generally cylindrical member and a lamp disposed therein. Furthermore, retaining means would be provided with the cap for coupling and partially insulating the lamp relative to the cap. In addition, means would be provided on the second inner member for connecting with one terminal of the lamp, and means provided on the first generally cylindrical member for connecting through the cap to the other terminal of the lamp.

In another form, the miniaturized apparatus would have the first member provided with spaced slotted portions through which the arms of the second member would be designed to radially extend.

A better understanding of the present invention will be had by reference to the drawings, showing merely illustrative embodiments, and in which:

FIGURE 1 is a sectional view of one form of a miniaturized apparatus for mounting in an aperture of an edge-lighted panel, the particular apparatus shown in FIGURE 1 being a lamp socket fixture for connecting to two circuits on the back side of the panel;

FIGURE 2 is an exploded perspective view of the cap assembly of the lamp socket shown in FIGURE 1;

FIGURE 3 is an exploded perspective view of the base socket shown in FIGURE 1;

FIGURE 4 is a sectional view of the base structure of the lamp socket of FIGURE 1 through a section taken in the direction of the arrows 4—4 thereof;

FIGURE 5 is a sectional view of a different embodiment of the miniaturized apparatus, illustrating another form of lamp socket in which both connections are made to the front side of the panel;

FIGURE 6 is another view of the lamp socket of FIGURE 5 taken in the direction of the arrows 6—6;

FIGURE 7 is an exploded perspective view of the positive insert and base nut of the lamp socket shown in FIGURES 5 and 6;

FIGURE 8 is a schematic view of one form of printed circuitry to be employed in conjunction with the miniaturized apparatus of the present invention;

FIGURE 9 is a sectional view of a connector formed in accordance with the miniaturized apparatus of the present invention for use with the circuitry shown in FIGURE 8;

FIGURE 10 is another view of the connector of FIGURE 9 taken in the direction of the arrows 10—10 thereof;

FIGURE 11 is an exploded view of the metallic parts of the connectors shown in FIGURES 9 and 10;

FIGURE 12 is a view of connector for making connections in cases in which the positive and negative circuits of the panel may cross; and,

FIGURE 13 is a schematic view of another form of printed circuit to be employed in conjunction with the miniaturized apparatus of the present invention.

Referring now to the drawings, there is shown in FIGURE 1 a lamp socket formed in accordance with certain of the features of the miniaturized apparatus of the present invention illustrating an embodiment in which a lamp socket is employed for making connection to two spaced circuits on the back side of the panel. Initially, it is to be noted that the drawings illustrate the parts in an enlarged scale, and that the overall diameter of the unit is only three-eighths of an inch and its overall length is less than one-half an inch.

The lamp socket of FIGURE 1 is generally designated by the numeral **10** and includes as its main components a cap **11** which is threadedly coupled at **12** to a base nut **13**. Disposed within the base nut **13** is an insert **14**. The base nut **13** and insert **14** are held in spaced rigidized relationship by a transparent or translucent plastic shell **15**. Disposed within the cap **11** is a lamp **16** biased axially outwardly by a spring means **17** and radially spaced from the cap by an insulator **18**.

A detailed explanation of the foregoing components and their respective structural and electrical functions may now be described.

The cap **11** is preferably formed of an electrically conductive metal and includes a recessed portion **19** in its upper, closed end. The recess **19** is designed to accommodate one end of a spring **17** and retain it within the cap **11**. The other end of the spring **17** contacts one of the lamp terminals **20** such that the spring further functions as a conducting link between the terminal **20** and metallic cap **11**.

The insulator **18** is provided with a lower inner shoulder **21** which has an inner diameter less than the outer diameter of a flange **22** conventionally provided on the lamp **16**. The insulator **18** as more clearly shown in the view of FIGURE 2, is provided with radially spaced ridge portions **18***a* such that it may be frictionally forced into and retained within the inner side walls of the cap **11**. With such a construction, the insulator **18** will not only insulate the lamp (or more properly the metallic casing terminal thereof) from the cap **11**, but will also tend to axially limit movement of the lamp **16** outwardly of the cap **11**.

Cap **11** is further provided with a flange **23** of increased diameter which is designed to abut against the upper end **24** of the base nut **13** at such time as the cap **11** is threadedly coupled at **12** to the base nut **13**.

The nut **13** also terminates in a lower flange **25** which is designed to contact the front surface of the panel and act as a light seal.

The edge-lighted panel as such, which is generally designated by the numeral **26**, may be of conventional construction as employed with printed circuits, for example, as described in Patent No. 2,847,560, and has an appropriate aperture **27** drilled therethrough with spaced

circuits **28** and **29** exposed adjacent the aperture **27** for making electrical connections to the socket **10**.

The base nut **13** further includes, as shown in FIGURE 3, downwardly extending legs **30**. Similarly, the insert **14** radially disposed within the base nut **13** also embodies downwardly extending legs **31**. The legs **31** are bent back, as indicated at **32** in FIGURE 1, to contact the circuit **28**; and the legs **30** are bent back at **33** to contact the circuit **29**. Permanent circuit connections may thereafter be made in a conventional manner by silver-soldering or the like. Thus, the contacting portions **32** and **33** lie in the same plane.

Thus, the ground connections from the circuit **29** extend through the legs **30** of the base nut **13** to the cap **11** threaded thereto at **12**, and thereafter through the spring **17** to the terminal **20** of the lamp **16**. The positive "hot" circuit extends from the circuit **28** through the legs **31** of the positive insert **14** and, in turn to the other terminal **16***a* of the lamp **16** which is adapted to abut against the annular portion **14***a* of the positive insert **14**.

As shown in the view of FIGURE 4, the plastic shell **15** is closed off at its bottom end **15***a* and furthermore is moulded in such a manner that the legs **30** of the base nut **13** extend downwardly parallel to its outer side walls in substantially flush relationship thereto. On the other hand, the insert **14**, which is held in fixed inner radial spaced relationship to the base nut **13** by the plastic shell, has its legs angularly directed radially outwardly to thereafter terminate in substantially parallel and flush portions to the outer side walls of the plastic shell **15** before forming the connecting contact portions **32**. Thus, the plastic shell **15** retains at the upper end of its inner side walls the annular portion **14***a* of the insert **14**.

There is shown in FIGURE 5 another form of lamp socket constructed in accordance with the miniaturized apparatus of the present invention, in which the lamp socket is designed to be mounted from and have all connections made to the front side of the panel. Thus, there is indicated a lamp socket **50** adapted to be connected to an edge-lighted panel **51**, the panel **51** being provided with spaced circuits **52** and **53** on the front side thereof.

The socket **50** includes a cap assembly **54** of identical construction to the equivalent cap **11** and lamp retaining and insulating components thereof, as shown in FIGURE 2. The cap assembly **54** is threaded at **55** to a base nut **56**.

The base nut **56**, as more clearly shown in the view of FIGURE 7, includes a pair of radially extending arms **57** and slotted portions **58**. The slotted portions **58** are designed to accommodate arms **59** of a positive insert **60** which is held in radially inwardly spaced relationship from the base nut **56** by a transparent or translucent plastic shell **61** extending into a pocket or cavity **62** of the panel **51**. In a preferred construction, the arms **59** are oppositely disposed and are positioned at right angles to the arms **57**. However, the arms **59** and **57** would all lie in the same plane for contacting the circuits **52** and **53** on the front side of the panel. The ground connection would be from the spring connected terminal of the lamp through the cap **54**, through the base nut **56**, to the arms **57**, and thereafter contact the circuitry **53**. The other electrical connection would be from the other terminal (metallic casing) of the lamp to the annular positive insert **60** (in the same manner as from **16***a* to **14***a* as described in conjunction with FIGURES 1 and 3), and thereafter through the arms **59** to the circuit **52**.

FIGURE 8 is merely illustrative of a schematic arrangement of circuitry which might be employed in conjunction with the lamp sockets of the miniature apparatus of the present invention. Thus, in conjunction with the lamp socket structure of FIGURE 1, there would be disposed on the back side of the panel **26** circuits **63** and **64** equivalent to circuits **28** and **29**, respectively. In consequence, the portions **32** of the legs **31** would contact the portions **65** of the circuit **63**. Similarly, the portions **33** of the legs **30** would contact the portions **66** of the cir-

cuit 64. Of course, other types of circuit arrangements could be employed, and the showing of FIGURE 8 is merely illustrative of a particular form of printed circuitry that may advantageously be used with either of the lamp sockets shown in FIGURES 1–4 and FIGURES 5–7, respectively. With the socket of FIGURE 5, the circuits 63 and 64 would be on the front side of the panel 51 and would be equivalent, respectively, to the circuits 52 and 53. Thus, the arms 57 would contact the portions 65 of the circuit 63, and the arms 59 would contact the portions 66 of the circuit 64. Of course, portions 65 and 66 would be provided at each aperture where connections to a lamp socket were to be made. Any form of a conventional connection could be employed to conduct electricity to the circuits 63 and 64, although a preferred form of connector is shown in FIGURES 9–11 in accordance with another feature of the present invention.

As shown in FIGURE 9, the connector generally comprises an outer annular terminal 90 or female connector and an inner terminal 91 or male connector. These parts are perhaps more clearly shown in the perspective view of FIGURE 11.

The terminal 90 includes a spool-shaped portion 92 adapted to fit within a panel opening. The spool-shaped portion 92 has formed therein cutouts or slots 93 and terminates at its lower end in a reduced diameter connecting portion 94 provided with slits 95.

Disposed radially within the female terminal 90 is the male member 91, previously referred to, which includes a pin male connection portion 97 and radially extending arms 98. The member 91 terminates at its upper end in a flange portion 99 adapted to be aligned with the spool portion 92 of the female connector portion 90.

As indicated in the views of FIGURES 9 and 10, the male terminal 91 and female terminal 90 are integrally moulded in a plastic core 100 for mounting in an aperture of an edge-lighted panel. Towards this end, the spool portion 92 of the female terminal 90 and the flange portion 99 of the male terminal 91 serve to securely retain these members in the plastic core 100.

In assembling the various lamp sockets and connectors previously described, it should be noted that the plastic shell or core, as the case may be, is fitted closely within the corresponding aperture of an edge-lighted panel. Thereafter, a liquid cement is applied which is attracted by a capillary action to tightly and securely hold the plastic material within the aperture. Of course, other means of retaining the plastic shell or core could be employed so long as the lighting desired is not impaired.

It will be evident however that in the event the lamp need be replaced (for example in conjunction with the lamp socket shown in FIGURE 1 and FIGURE 5) it is only necessary to unscrew the cap and manually grip and force the insulator from the interior thereof. The lamp may then be readily removed from the inner end of the insulator and a new lamp placed therein; and the insulator and lamp may thereafter be forced back into the cap unit.

It will be appreciated that in certain instances it may be necessary to have the positive or "hot" circuit cross over the negative or ground circuit at locations where light sockets or fixtures are not disposed. Towards this objective a cross-connector of the form illustrated in FIGURE 12 could be employed.

Referring now to FIGURE 12, the cross-connector may comprise a plastic core 120 having embedded therein cross-members 121 and 122. The members 121 and 122 cross each other within the plastic core 120, and to achieve this end have intermediate portions, respectively, of different arcuate forms. Cross member 121 terminates in contacting end portions 123, similarly, the cross member 122 terminates in contacting end portions 124.

With such a construction, the end portions 123 could be employed to contact circuit portions 125 (referring to FIGURE 8) and the end portions 124 could be employed to contact circuit portions 126.

By moulding the conductors directly in the plastic material, the possibility of short circuits is substantially eliminated, and the unit will give satisfactory maintenance-free operation over a long period of time.

Since the standards and electrical specifications relative to the detailed structure of the panel are well known to those skilled in the art, no effort has been made to more than generally refer to the panel fabrication or layered composition.

It will be appreciated that many variations and changes may be made in the miniaturized apparatus of the present invention as will be obvious to those skilled in the art.

Thus, there is shown in FIGURE 13 an illustrative embodiment in which only a single pair of conducting arms or legs are employed to make circuit connections from the lamp socket fixture. In such instance, the aperture or cavity for the lamp socket would be disposed between one circuit 130 and another circuit 131. Plastic shell or core is indicated by the numeral 132 and would be disposed within an aperture or cavity 133. The portions 134 and 135 contacting, respectively, circuits 130 and 131 are equivalent to a contacting portion 32 and contacting portion 33 of 90 degree spaced legs of FIGURE 1, for example. Also, as will be obvious, the portions 134 and 135 are equivalent, respectively, to a contacting portion 59 and portion 57 of FIGURE 5.

In consequence, with the circuit of FIGURE 13, only one conducting arm or leg of the base nut and one conducting arm or leg of the positive insert would be required. It is also apparent that the connectors of FIGURE 11 and FIGURE 12 could also be modified for use with the circuit of FIGURE 13 by eliminating one of the conducting arms or legs of each terminal.

It will furthermore be appreciated that in the event one of the circuits were on the front side of the panel and one of the circuits on the back side of the panel, the flange 25 of the base nut (as seen in FIGURES 1 and 3) could be employed to make connection with the circuit on the front side of the panel, thereby eliminating the necessity of legs 30.

From the foregoing, it will be seen that according to the specific application requirements, various features of the present invention for miniaturized apparatus for mounting in an edge-lighted panel could be modified and varied. The present invention is therefore not deemed to be limited to the specific illustrative embodiments shown and described, but rather as defined by the scope of the following claims.

What is claimed is:

1. A miniaturized lamp socket for mounting in an aperture of an edge-lighted panel having spaced circuits on one side thereof, said lamp socket comprising: a first conductive generally cylindrical member having a first pair of spaced legs with portions designed to extend through said aperture and contact one of said circuits; a plastic shell designed to be secured within said aperture, said legs of said first member being molded into said plastic shell; a second conductive member radially disposed within said shell and having a second pair of legs with portions thereof designed to extend through said aperture and contact the other of said circuits, said legs of said second member being molded within said plastic shell; a metallic cap member connected to said first member; a lamp disposed within said camp member, said lamp having an angulated annular terminal flange adjacent the bulb portion thereof; lamp-retaining means within said cap for retaining said lamp within said cap; spring means axially interposed between the pin terminal of said lamp and said cap to form an electrical connection therebetween; and an annular portion formed on said second member for contacting said annular terminal of said lamp, said spring means also serving to axially urge said angulated annular terminal of said lamp against said annular portion of said second member to form the other electrical connection.

2. A lamp socket, according to claim 1, and cylindrical insulating means disposed within said cap, said insulating means functioning as said lamp-retaining means and being further designed to insulate one electrical connection from the other electrical connection.

3. A lamp socket, according to claim 2, in which said lamp is provided with a radially outwardly-extending flange near the pin terminal end thereof, and in which said insulating means is provided with a radially inwardly-extending flange, whereby said insulating means is designed to have its inner flange limit movement of said lamp outwardly of said cap by engaging said outwardly-extending flange.

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