Aug. 12, 1958 M. J. PEAK ET AL 2,847,560

LAMP SOCKET AND ASSOCIATED ELECTRICAL CONNECTING MEANS

Filed July 14, 1955 2 Sheets-Sheet 1

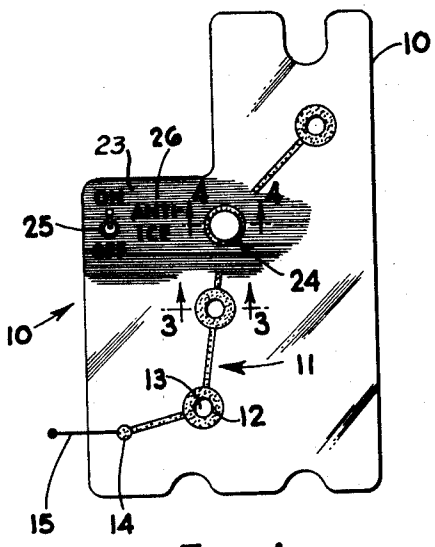


FIG. 1

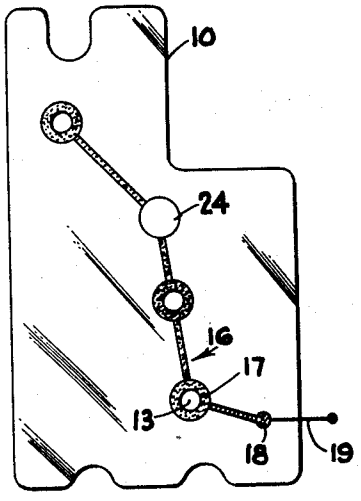


FIG. 2

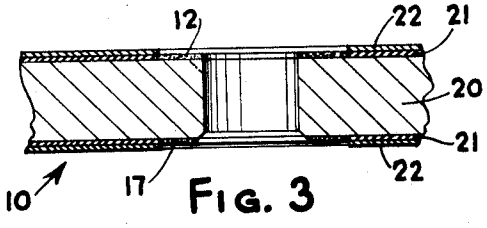


FIG. 3

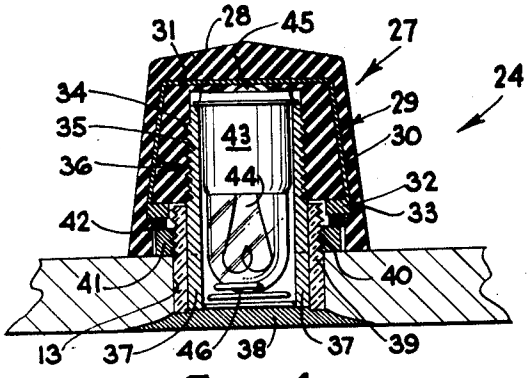


FIG. 4

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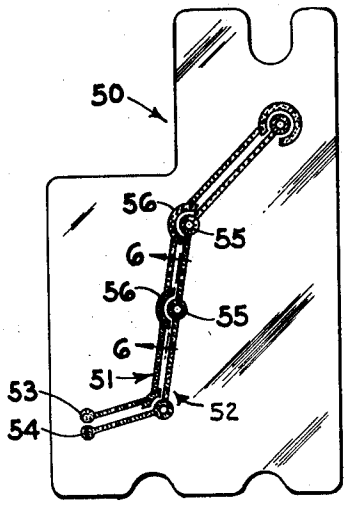


FIG. 5

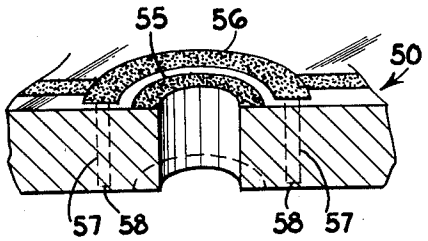


FIG. 6

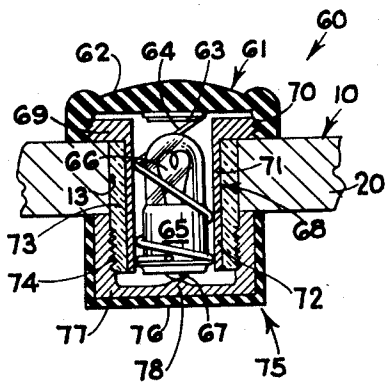


FIG. 7

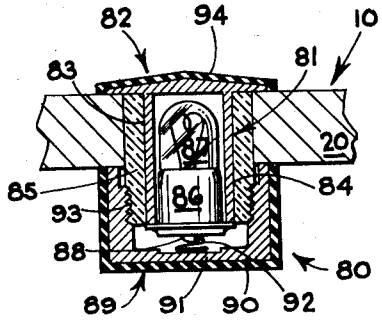


FIG. 8

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LAMP SOCKET AND ASSOCIATED ELECTRICAL CONNECTING MEANS

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Application July 14, 1955, Serial No. 522,141

2 Claims. (Cl. 240—8.16)

This invention relates generally to a lamp socket and its related electrical connections, and more particularly to an improved lamp socket for an edge lighted panel combined with improved means for connecting the socket to a source of electrical power.

Edge lighted panels are well known in the art and have wide applicability, particularly in the illumination of instrument, control, and console panels in aircraft. In such panels, light is usually transmitted through the edge of a plastic sheet. The sheet is provided with an opaque surface coating except for transparent areas in the shape of letter or numeral characters through which light is emitted. The letter or numeral characters form the nomenclature identifying the control positions of the switches, instruments, and other devices assembled on the panel.

A troublesome problem in the construction of such panels is the dimensioning and positioning of lamp sockets so that they won't unduly restrict the proper disposition of the control devices to be mounted on the panel. In present day panels, it is necessary to have a portion of the lamp socket project from the back surface of the panel in order to accommodate proper electrical connections. The wiring, itself, for making the electrical connections to the sockets necessitates the use of restricted space in a control box or other housing to which the panel is secured. It will further be appreciated, as a consequence of this type of construction that dimensional changes in the construction of the control devices mounted on the panel as well as actual changes in mounting locations must always be conditioned upon possible interference with the lamp sockets projecting from the back of the panel.

It is, therefore, an object of the present invention to provide a lamp socket and associated electrical connecting means for an edge lighted panel, which occupies substantially less space in the back of the panel than present day constructions.

Another object is to provide a lamp socket and associated electrical connecting means for an edge lighted panel, in which neither the lamp socket nor its electrical connecting means will present design limitations in the disposition of control devices used in conjunction with the panel.

A further object is to provide a lamp socket and associated electrical connecting means for an edge lighted panel, in which all interconnections in the form of separate physical wires for the lamp sockets are substantially eliminated.

A still further object is to provide a lamp socket and associated electrical connecting means for an edge lighted panel, in which the lamp socket has an appreciably lower weight and appreciably smaller overall dimensions as contrasted with lamp sockets presently available.

Briefly, these and other objects and advantages of the present invention are achieved by providing a printed circuit on at least one surface of the panel in combination with an improved lamp socket embodying conducting members adapted for connection to the printed circuit.

A better understanding of the invention will be had by reference to the following drawings wherein preferred embodiments are shown, and in which:

Fig. 1 is a front plan view of an edge lighted panel, including the improved lamp socket and associated electrical connecting means in accordance with a preferred embodiment of the present invention;

Fig. 2 is a back plan view of the panel of Fig. 1;

Fig. 3 is an enlarged sectional view through the panel in the direction of the arrows 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view through the panel and the lamp socket in the direction of the arrows 4—4 in Fig. 1;

Fig. 5 illustrates a modified embodiment of the electrical connecting means of the present invention;

Fig. 6 is an enlarged sectional view in the direction of the arrows 6—6 of Fig. 5;

Fig. 7 is a sectional view of another embodiment of the lamp socket portion of the present invention; and

Fig. 8 is a sectional view of still another embodiment of the lamp socket portion of the present invention.

In Fig. 1, there is generally shown a typical edge lighted panel **10** illustrating a preferred embodiment of the lamp socket and associated electrical connecting means of the present invention. The panel **10** is formed from a plastic sheet and has affixed to its front surface a printed circuit **11**. The printed circuit may be etched, photoetched, silkscreened, printed, engraved or otherwise formed on the sheet according to techniques well known in the art. In practice, it has been found that a preferable substance for forming the printed circuit is a metallic paste such as "Dupont-Silver 4929." The circuit includesh annular connection portions **12**, concentrically disposed about apertures **13** extending through the thickness of the panel **10**. The connecting portion **12** connects with a terminal **14**, which is in turn adapted to receive a lead **15** connected to a source of electrical power.

A similar printed circuit **16** is formed on the back of the panel **10** to operate as a return circuit, as shown in the view of Fig. 2. Circuit **16** has similar connecting portions **17** disposed around the apertures **13**, and the circuit **16** may be provided with a terminal **18** for connection to a return lead **19**.

In Fig. 3, a portion of the panel **10** is shown prior to mounting of instruments and other components, as including a transparent plastic core **20** which is first covered with a translucent white substance or paint **21** and thereafter with an opaque coating **22**. The paint **21** and coating **22** cover the circuits **11** and **16** of Fig. 1 and Fig. 2 except for the connecting portions **12** and **17**. Thus, in its finished stage the panel **10** will appear as indicated by the shaded portion **23** of Fig. 1.

The shaded portion **23** is shown to illustrate in part how the completed panel assembly is formed. A lamp socket **24** is shown mounted in one of the apertures **13** so as to overlap the otherwise exposed connecting portion **12**. In proximity to the socket **24** there may be disposed, for example, a switch **25** having identifying lettering **26** engraved on the panel. The lettering may be formed in any conventional manner as by engraving or otherwise cutting away the coating **22** to expose he translucent white paint **21** in the shapes of the nomenclature desired.

The lamp socket **24** is shown more clearly by reference to Fig. 4. In this figure as well as subsequent Figures 7 and 8 portions **12** and **17** are not shown in order to avoid obscuring the drawing. The socket **24** includes a frustoconical insulating cap **27** which projects from the front surface of the panel **10**. The cap **27** has an associated upper surface **28** of conical shape in order to decrease possible light reflections. Imbedded in the walls of the cap is

a first conducting means **29** which comprises upright members **30** integrally formed with a horizontal member **31** and a ring member **32**. The horizontal conducting member **31** is positioned so as to be partially exposed within the interior of the cap. The ring conducting member **32** is also partially exposed and is firmly retained in a recessed section **33** within the cap **27**.

The cap **27** has inner threading **34** for screwing down on a cylindrical section **35** of a lamp retaining fixture **36** disposed in the aperture **13**. The fixture additionally comprises legs **37** integrally connecting the section **35** through the core **20** of the panel with a beveled base member **38**. The base member **38** is disposed in a countersunk portion of the aperture **13** so as to be substantially flush with and yet contact the connecting portion **17** of the printed circuit **16** on the back of the panel. For this purpose, it is desirable to have the connecting portion **17** extend inwardly into the countersunk portion of the aperture **13**.

The legs **37** of the fixture are imbedded in an annular plastic shell **39** having a threaded portion **40** adapted to extend beyond the front surface of the panel and receive an annular nut **41**. The nut **41** is screwed down into pressing engagement with the annular connecting portion **12**. Positioned immediately above the nut **41** is a resilient washer **42** which may be retained by hoop tension within the cap **27** below the ring conductor **32**. The nut **41** thus performs a double function. It serves first as a means in co-operation with the base member **38** of firmly securing the fixture **36** within the panel; second, it acts as a conducting link from annular connecting portion **12** through the washer **42** to the ring **32** of the conducting means **29**.

The fixture **36** is dimensioned to receive a standard lamp **43** which is inserted as shown in Fig. 4 so that the bulb portion **44** extends down between the legs **37** of the fixture within the aperture **13** in the panel. The upper metallic flanged end of the lamp is adapted to rest on the upper edge of the cylindrical section **35** of the fixture **36**, whereby an insulated contact **45** of the lamp **43** will contact the exposed portion of the conducting member **31** when the cap **27** is screwed onto the fixture. To further assure proper connection between the contact **45** and the member **31**, a spring **46** may be disposed on the inner surface of the base **38** so as to bias the lamp **43** upwardly.

It will thus be apparent that current will flow through the printed circuit **11** to the annular connecting portion **12** and then through the nut **41**, the washer **42**, and thereafter through the members **32**, **30**, and **31** of the conducting means **29** to the contact **45** of the lamp. The return circuit will be from the metallic flange of the lamp **43** down through the fixture **36** to the base member **38** in contact with the annular portion **17** of the printed circuit **16** on the back of the panel. The plastic shell **39** in addition to its conventional purpose of filtering light into the core **20**, also serves as a means of insulating the nut **41** from the return circuit through the fixture **36**.

Although in a preferred construction, printed circuits **11** and **16**, respectively, are provided on each side of the panel, it will be readily appreciated that both printed circuits may be formed on one side of the panel. For example, in the view of Fig. 5 there is shown a panel **50** having a first printed circuit **51** and a second printed circuit **52**, the circuits having respective terminals **53** and **54**. Circuit **52** is provided with annular connecting portions **55**, adapted to come into engagement with the nut **41**, for example, in the embodiment of Fig. 4. Circuit **51** in this instance includes semi-annular connecting portions **56**, which are formed in this shape to avoid cross-overs between circuits **51** and **52**. As shown in Figure 6, with this type of circuit arrangement, it is necessary to include an additional conducting means in the form, for example, of members **57** connected to the portion **56** and extending through to the back surface of the panel. These conducting members **57** may be formed integrally with the core **20** and are dimensioned so as to have exposed end faces **58** on the back surface of the panel. The end faces **58** are adapted to contact the base **38** of the fixture **36**, thereby completing the circuit through the socket up to the printed circuit **51**. Of course, with such a modification, the outer diameter of the base **38** must be designed proportionately greater in order to be vertically aligned with the connecting portion **56**.

The socket **24** shown in Fig. 4 is particularly desirable for use where design advantages are achieved by not having the socket project beyond the back surface of the panel. In such instances, the conventional backing plate may be positioned in close proximity to the back of the panel. However, in certain applications, the design requirements may be different. In this regard, Fig. 7 and Fig. 8 are illustrative of other possible embodiments of the present invention.

In Fig. 7, there is shown a lamp socket **60**, which may be advantageously employed where it is essential that the socket project a minimum distance from both the front and back surface of the panel. The socket **60** is provided with a front insulating cap **61** which has an upper surface **62** contoured as shown to minimize light reflection. The cap **61** has an inner post **63** extending a short distance to enable fastening thereto of one end of a spring **64**. The spring **64** is used as a means of resiliently retaining a standard lamp **65** having a bulb portion **66** and an insulated contact **67**.

Disposed within the aperture **13** is a fixture **68** having an increased diameter threaded flange **69** adapted to contact, for example, the annular portion **12** as in Fig. 1. The cap **61** is provided with internal threading at **70** for connecting to the flange **69**. The fixture **68** comprises, in addition to the flange **69**, conducting legs **71** extending through the thickness of the core **20**, and a cylindrical section **72** projecting beyond the back surface of the panel. Formed integrally with and encircling the legs **71** and section **72** of the fixture is an annular plastic shell **73** provided with a threaded end **74** where it extends from the back of the panel.

In this embodiment of Fig. 7, there is additionally provided a cup-like rear cap **75** having an outer insulating surface **76** and an inner conducting surface **77**. The inner surface **77** is threaded for connection to the threaded end **74** of the shell **73** and is adapted to engage the lamp contact **67** when the socket **60** is assembled. Towards this objective, the inner surface **77** may be provided with a contact head **78**.

In assembling socket **60** onto the panel **10**, the fixture **68** is first positioned in the aperture **13**. The rear cap **75** may then be connected to the threaded end **74** of the shell **73**. Thereafter, the cap **61** is threaded down onto the flange **70** resulting in the positioning of the lamp **65** within the fixture **68**. As the latter step is taking place, the contact head **78** on the inner surface will come into engagement with the lamp contact **67**, urging the lamp towards the post **63** and overcoming the opposite biasing action of the spring **64**. The spring **64** will consequently be compressed and urged radially outward into contact with the fixture **68**.

In a preferred construction, the spring **64** is designed to have one high pitch spiraling turn about the bulb **66** portion of the lamp and several low pitch turns encircling the base portion of the lamp. By having only one turn about the bulb **66**, there is a minimum of interference with light dispersal into the core **20**. The outer peripheral diameter of the spring **64** is slightly less than the inner diameter of the fixture in order to allow non-frictional positioning of the lamp **65** within the fixture **68**. As stated previously, when the cap **75** is screwed on, the spring **64** will expand radially as it is compressed; however, the greater proportion of this expansion will take place in the lower pitch turns about the base of the lamp where there is the least resistance.

It will be apparent, therefore, that one path of current will flow from the connecting portion **12** (in Fig. 1)

through the flange **69**, and thereafter through the legs **68** and contacting surface of the lamp **65**. The return path will be from the lamp contact **67** to the inner surface **77** and up to the connecting portion provided on the back surface of the panel **10**. With the embodiment of Fig. 7, it is not necessary, of course, to provide a countersunk area in the aperture **13**.

In Fig. 8, there is shown a lamp socket **80** of a design preferably used on panels where the socket projections from the front surface of the panel are to be kept to a minimum. The socket **80** is provided with a fixture **81** acting as a conducting means and including a crown face **82** and legs **83**. The crown face **82**, as in the other embodiments, is provided in order to minimize light reflection which might adversely affect the viewing of the panel. Although the crown face **82** is shown as projecting above the front surface of the panel a slight distance, it will be evident that the face **82** could be modified to be flush with the front surface in a manner similar to the construction used for the base **38** in Fig. 4.

The legs **83** extend through the thickness of the panel to integrally connect with a cylindrical section **84** of the fixture **81**. In a construction similar to the previous embodiments, an annular plastic shell **85** surrounds the legs **83** and the section **84** of the fixture. There is shown disposed in the fixture a standard lamp **86** having a bulb portion **87** positioned so as to emit light into the core **20**. The insulated lamp contact is indicated at **88**.

The socket **80** further includes a cap **89** mounted on the back face of the panel and comprising an outer insulating surface **90** and an inner conducting surface **91**. Secured to the inner surface **91** of the cap **89** is a spring-like conducting member **92** positioned to engage the lamp contact **88** and bias the lamp **86** upwardly within the fixture **81**. The cap **89** may be threaded onto the plastic shell **85** as at **93**.

When the lamp socket **80** is mounted on panel **10**, as in Fig. 1, the flow of current will be through the connecting portion **12** to the crown face **82**, which may be provided with an insulated cover **94**, and then down through the legs **83** to the metallic base flange of the lamp **86**. The return circuit will be from the lamp contact **88** through the conductor **92** and thereafter on the conducting surface **91** to the printed surface provided on the back of the panel.

It will be apparent that many changes and modifications may be made in the lamp socket and associated electrical connecting means of the present invention. For example, the socket structures shown in Figs. 4, 7, and 8 could be reversed in assembly on the panel to conform with spatial limitations of the particular design. It will also be evident that the socket shown in Figs. 7 and 8 could with slight modification be adapted for use with the panel construction of Figs. 5 and 6. Preferably, a suitable indexing means in the form of a key and keyway, respectively, on the fixture and sidewalls (not shown) of the aperture **13** might be provided in order to assure that the legs of the fixture would always be disposed so as to result in minimum light obstruction to the proper illumination of the particular corresponding nomenclature. Consequently, the invention is not to be thought of as limited to the particular printed circuit and lamp socket embodiments shown on the drawings for illustrative purposes.

In addition, although the current flow has been described as from the front surface of the panel through the sockets to the rear surface, wherein the rear surface may be at ground potential, it is clear that the front surface printed circuit may be grounded and current applied to the rear surface.

From the foregoing description, it will be seen that the improved lamp socket and associated electrical connecting means of the present invention results in more flexible edge lighted panel constructions. In addition, the features of this invention enable substantial reduction in the overall weight and spatial requirements of edge lighted panels.

We claim:

1. An edge lighted panel comprising, in combination: a light transmitting core in the form of a flat sheet having a plurality of apertures in predetermined spaced relationship with respect to each other; printed circuit means consisting of a first and a second series of narrow paths of electrically conductive material coated on portions of opposite faces of said sheet and extending between said apertures, said paths having a width less than the diameter of said apertures, and means for connecting said paths adjacent said apertures on both faces of said sheet, said connecting means being shaped about said apertures to define circular connecting portions concentric with said apertures; and a plurality of lamp sockets mounted, respectively, in said apertures, each of said lamp sockets being provided with a first and a second terminal and including: an opaque insulating cap having an open end engaging said sheet and surrounding and covering both the adjacent circular connecting portion of the printed circuit means on one face of said sheet and the adjacent open end of the corresponding aperture; a first annular conducting member electrically connected to said first terminal and disposed wholly within said cap in engagement with said adjacent circular connecting portion; a second annular conducting member concentric with said first annular member and constituting said second terminal; insulating means intermediate said first and second annular members; and a conducting base member electrically connected to said second annular member, said base member engaging the adjacent circular connecting portion of the printed circuit means on the other face of said sheet, and said base member being flush with said other face of said sheet.

2. An edge lighted panel comprising, in combination: a light transmitting core of insulating material in the form of a flat sheet having a plurality of apertures in predetermined spaced relationship with respect to each other; printed circuit means including a first series of narrow paths of electrically conductive material coated on portions of one face of said sheet and extending between said apertures, said paths having a width less than the diameter of said apertures, means for connecting said paths adjacent said apertures, said connecting means being shaped about said apertures to define circular connecting portions concentric with said apertures, and said printed circuit means further including a second series of narrow paths of electrically conductive material coated on portions of said one face of said sheet in spaced but adjacent relation to said first series of paths and also extending between said apertures and having a width less than the diameter of said apertures, means for connecting said paths of said second series adjacent said apertures, said last-named connecting means being defined by arcuate connecting portions spaced outwardly from said apertures and said first-named connecting portions, an electrically conductive element extending from each of said arcuate connecting portions through said sheet to the other face thereof; and a plurality of lamp sockets mounted, respectively, in said apertures, each of said lamp sockets being provided with a first and a second terminal and including: an opaque insulating cap having an open end engaging said sheet and surrounding and covering the adjacent connecting portions of said printed circuit means and the adjacent open end of the corresponding aperture; a first annular conducting member electrically connected to said first terminal and disposed wholly within said cap in engagement with the adjacent circular connecting portion of said first series of narrow paths; a second annular conducting member concentric with said first annular member and constituting said second terminal; insulating means intermediate said first and second annular members; and a conducting base member electrically connected to said second annular

member, said base member engaging the adjacent electrically conductive element on the other face of said sheet, and said base member being flush with said other face of said sheet.

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