

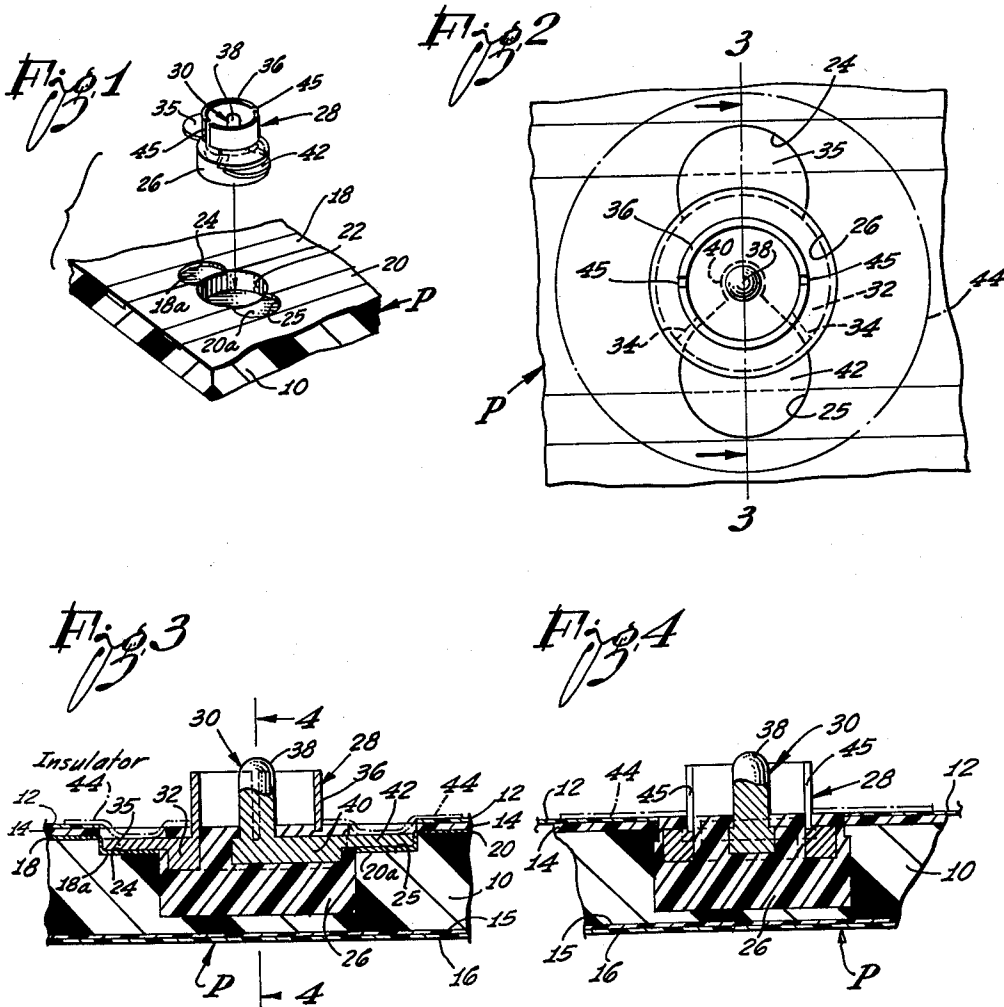
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ELECTRICAL CONNECTOR FOR ILLUMINATED PANEL

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1

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ELECTRICAL CONNECTOR FOR
ILLUMINATED PANEL

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5 Claims. (Cl. 339-17)

This invention relates to an illuminated panel of the type commonly used on aircraft. Such a panel is of laminar construction with a thick main layer of transparent plastic and with an outer opaque layer on both faces of the panel. Commonly a translucent layer underlies each of the two outer opaque layers. The opaque layer on the front face of the panel has indicia cut-outs which are illuminated by edge lighting, i.e. by light transmitted through the main transparent layer edgewise thereof from one or more lamps mounted in the plane of the main layer. Typically the circuit conductors for energizing the lamps are located between laminations of the panel.

The invention is directed to means for connecting the lamps of the panel with an E.M.F. source and, more particularly, relates to a connector means on the panel for plugging into a complementary connector means from the E.M.F. source. The problem is to provide a connector means that is efficient for its purpose, that is well insulated to avoid shorts, and, in addition, is of relatively simple and inexpensive structure.

The invention is characterized by the concept of meeting these problems by incorporating a plug-in connector into the structure of the panel itself so that the connector lies largely inside the panel and is, in effect, integral with the panel. In such a construction, the plug-in connector is largely protected by the panel itself and derives strength and durability from the panel itself. A further advantage is the saving of space since the major portion of the plug-in connector is in the space occupied by the panel with only a minimum portion of the connector necessarily protruding from the panel.

In the preferred practice of the invention, this concept is carried out by drilling three blind bores into one face of the panel, usually the back face. One blind bore is relatively deep and of relatively large diameter. The other two blind bores are of less depth and less diameter and overlap the deeper bore to open laterally into the deeper bore. The two circuit conductors of the panel are then extended into the two relatively shallow blind bores respectively.

An insulating plastic body dimensioned to fill the large bore is molded with two one-piece metal connector conductor bodies partially embedded therein, the two conductor bodies being spaced apart by the material of the plastic body for insulation from each other. The two conductor bodies have respectively exposed plug-in portions extending outward from one end of the plastic body and the two conductor bodies also have respective portions extending radially from the plastic body.

The molded plastic body is inserted into the large blind bore and bonded in place with the two radial portions of the two conductor bodies extending into the adjacent shallow blind bores, respectively, in contact with the corresponding extended circuit conductors therein. Finally, the two shallow blind bores and the radial portions of the conductor bodies therein are covered with a layer of insulating material.

The invention may be fully understood from the following detailed description and the accompanying drawing.

In the drawing, which is to be regarded as merely illustrative:

2

FIG. 1 is a perspective view of an unfinished portion of an illuminated panel with the three blind bores in the rear face thereof and with the presently preferred embodiment of the connector poised for installation in the three blind bores;

FIG. 2 is an enlarged fragmentary plan view of the completed panel with the connector seated in the three blind bores;

FIG. 3 is a transverse section taken as indicated by the line 3-3 of FIG. 2; and

FIG. 4 is a transverse section taken as indicated by the line 4-4 of FIG. 3.

The selected embodiment of the invention is incorporated in an edge-lighted panel, generally designated P. The panel P is of laminar plastic construction having a relatively thick main layer 10 of clear plastic. The front face of the panel P is covered with an opaque plastic layer 12 and a translucent layer 14 is interposed between the main layer and the opaque layer. The opaque layer 12 has cut-outs therein (not shown) forming indicia and other design elements which are illuminated from the interior of the panel. The back face of the panel has a translucent layer 15 bonded to the main transparent layer 10 for the purpose of reflecting light internally of the panel and the translucent layer 15 is covered with an opaque layer 16 which forms the back face of the panel.

The circuit conductors carried by the panel for energizing the lamps in the panel may be provided in any suitable manner. In the construction shown, two printed circuit conductors 18 and 20 are interposed between the rear translucent layer 15 and the rear opaque layer 16, the printed circuit conductors being depressed into the material of the main translucent layer 10.

In accord with the teachings of the invention, a relatively deep blind bore 22 of relatively large diameter is formed in the back face of the panel and extends into the clear lamination 10. Adjacent the deep blind bore 22 on diametrically opposite sides thereof are two shallow blind bores 24 and 25 of lesser diameter which, as best shown in FIG. 1, overlap the blind bore and open laterally into the interior of the blind bore. The two shallow blind bores 24 and 25 intersect the two printed circuit conductors 18 and 20 and the two printed circuit conductors are extended into the two shallow recesses onto the bottom surface thereof as indicated at 18a and 20a in FIG. 3. In the fabrication of the panel the two printed circuit conductors 18 and 20 may be applied to the main clear plastic layer 10 and embedded therein under pressure and then the circuit conductor extensions 18a and 20a may be formed in the respective shallow recesses before the translucent layer 14 and the opaque layer 12 are added. The extensions 18a and 20a of the two printed circuit conductors 18 and 20 into the two shallow recesses 24 and 25 respectively may be made after the printed circuit conductors are pressed into the main clear layer 10 and before the translucent layer 14 and the opaque layer 12 are added.

A solid plastic body 26 of non-conducting material substantially fills the relatively large and relatively deep blind bore 22. Preferably the plastic body is dimensioned to be substantially flush with the back face of the panel as shown in FIGS. 3 and 4. Partially embedded in the plastic body 26 is a first one-piece metal connector conductor body generally designated 28 and a second one-piece connector conductor body generally designated 30.

The first conductor body 28 has a base portion 32 (FIG. 3) having the configuration of a segment of a ring, the ring having a gap formed by two ends 34 indicated in dotted lines in FIG. 2. Diametrically opposite from the gap, the ring-shaped base portion 32 has a radial extension in the form of a tongue 35. When the plastic body 26 is bonded in its assembled position as shown in

3

FIGS. 2, 3 and 4, the tongue 35 fits into the shallow blind bore 24. The tongue conforms to the shallow recess in plan and overlies the circuit conductor 18a in the recess. Both the ring-shaped base portion 32 and the radial portion or tongue 35 are spaced inward from the outer end of the plastic body 26 so that both are covered and protected by a layer of the material of the plastic body. The first conductor body 28 is further formed with a thin-walled cylindrical plug-in portion 36 which extends outward from the outer end of the plastic body 26 and outward from the plane of the rear face of the panel P. The cylindrical portion 36 is concentric of the base portion 32 and in this instance has the same inside diameter.

The second conductor body 30 has an exposed prong portion 38 which extends outward from the plastic body inside the cylindrical portion 36 of the first conductor body and preferably concentrically thereof. The second conductor body 30 has a base portion 40 (FIG. 3) which extends radially of the prong portion 38 and this base portion 40 has a thinner radial extension 42 in the form of a tongue. Both the base portion 40 and the radial extension 42 are spaced inward from the outer end of the plastic body 26 to be covered and protected by a layer of the material of the plastic body. The radially extending portion of the second conductor body 30 which comprises the base portion 40 and the radial tongue 42, extends through the gap between the two ends 34 of the ring-shaped base portion 42 of the first connector conductor 28, and the cylindrical portion 36 of the first connector conductor is cut away or recessed to provide a liberal clearance between the two conductor bodies in this region. The two conductor bodies are insulated from each other in the region of the gap by the material of the plastic body 26. When the plastic body 26 is installed in the larger blind bore 22 of the panel the radial tongue 42 extends into the second shallow blind bore 25. The radial tongue 42 conforms to the configuration in plan of the shallow blind bore 25 and is in overlying contact with the circuit conductor 20a therein.

It is contemplated that the two radial portions or tongues 35 and 42 of the two conductor bodies 28 and 30 respectively will be covered with a layer of suitable insulating material. In this particular practice of the invention an insulating ring 44 of thin plastic material covers the two tongues 35 and 42, the plastic ring being adhesively bonded to the outer surfaces of the two tongues and being also adhesively bonded to the adjacent annular region of the back face of the panel P. The plastic ring 44 may, for example, be made of a vinyl resin.

It is apparent that the two plug-in portions of the two conductor bodies, which plug-in portions comprise the cylindrical portion 36 and the prong portion 38 are adapted to cooperate with a complementary electrical connector means. The complementary electrical connector means (not shown) is of the well known type having an axial socket to receive the prong 38 and an annular socket to receive the cylindrical portion 36, both sockets having conductors exposed therein to carry current from an E.M.F. source. Preferably the cylindrical wall portion 36 of the first conductor body 30 is longitudinally split or slotted for flexibility. In the construction shown the cylindrical portion 36 has two relatively deep longitudinal slots 45 which extend inward from its outer edge.

In an initial practice of the invention the plug-in connector is relatively small, the diameter of the plastic body 26 and the deep blind bore 22 in which it is mounted being approximately $\frac{3}{8}$ ". The diameter of the two shallow blind bores 24 and 25 is at least on the order of one-half of the diameter of the deeper bore. In this instance, the diameter of the two shallower bores is $\frac{1}{4}$ " or two-thirds of the diameter of the deeper bore.

The described plug-in connector is of rugged durable construction in itself and when it is installed it gains strength from reinforcement by the panel. The ruggedness of the connector is increased by the relatively large

4

areas of the two radial tongues 35 and 42 lying snugly against corresponding areas of the corresponding shallow bores. The plastic body cooperates with the two metal connector bodies 28 and 30 by both supporting the two connector bodies and by insulating the two conductor bodies from each other. The radial projection of the second connector body 30 is of small cross section at its root as may be seen in FIG. 2, but it is relatively thick vertically as may be seen in FIG. 3, and is amply reinforced by the solid plastic body.

The manner in which the invention serves its purpose may be readily understood from the foregoing description. It is an exceedingly simple matter to drill the blind bores 22, 24 and 25 in the panel P, the larger deeper blind bore 22 being drilled last. The plastic body 26 may be bonded in place by means of a suitable adhesive that is cured by heat. In the preferred practice of the invention, the plastic body is mounted in the panel by means of uncured epoxy potting resin before the outer opaque layer 12 is cured and then the whole panel is heated to cure both the outer opaque plastic layer and the potting resin. After this curing operation, the plastic ring 44 which is shown in phantom in FIGS. 2, 3, and 4 is assembled to the panel.

My description in specific detail of the preferred practice of the invention will suggest various changes, substitutions and other departures from my disclosure within the spirit and scope of the appended claims.

I claim:

1. A combination for plugging into an E.M.F. source comprising: an edge-lighted panel having a relatively deep recess in one face of the panel and two relatively shallow recesses adjacent said deep recess in communication therewith; two spaced circuit conductors on the panel for energizing a lamp means on said panel, said conductors extending into said recesses, respectively; an insulating plastic body substantially filling said deep recess and anchored therein; a first one-piece metal connector conductor body partially embedded in said plastic body, said conductor body having an exposed generally cylindrical portion extending outward from said face of the panel and having a radial portion protruding from the plastic body into one of said shallow recesses in contact with the corresponding circuit conductor therein; and a second one-piece metal connector conductor body partially embedded in said plastic body in spaced relation to the first conductor body, said second conductor body having an exposed prong portion extending outward from said face of the panel inside said cylindrical portion of the first conductor body, said second conductor body having a radial portion protruding from the plastic body into the other of said shallow recesses in contact with the corresponding circuit conductor therein; said first conductor body being recessed to clear said radial portion of the second connector conductor in spaced relation thereto.

2. A combination for plugging into an E.M.F. source comprising: an edge-lighted panel having in one of its faces a relatively deep recess and two relatively shallow recesses adjacent the deep recess in communication therewith; two spaced circuit conductors between laminations of the panel for energizing a lamp means on said panel, said conductors extending into said two shallow bores respectively and overlying the bottom surfaces of the shallow bores; an insulating plastic body substantially filling said deep bore and anchored therein; a first one-piece connector conductor body partially embedded in said plastic body, said conductor body having an exposed plug-in portion extending outward from said face of the panel and having a radial portion protruding from the plastic body into one of said shallow bores in contact with the corresponding circuit conductor therein; a second one-piece metal connector conductor body partially embedded in said plastic body in spaced relation to the first conductor body, said second conductor body having an

5

exposed plug-in portion extending outward from said face of the panel, said second conductor body having a radial portion protruding from the plastic body into the other of said shallow bores in contact with the corresponding circuit conductor therein; and a layer of insulating material overlying said radial portions of the two conductor bodies.

3. A combination as set forth in claim 2 in which the diameter of each of said shallow blind bores is more than half the diameter of the deep bore; and in which said radial portions of the two conductor bodies conform with the two shallow blind bores to fill the shallow bores as viewed in plan.

4. A combination as set forth in claim 2 in which one of said plug-in portions of the two conductor bodies is of thin-walled cylindrical configuration and is longitudinally slotted.

5. A combination for plugging into an E.M.F. source comprising: an edge-lighted panel having in its back face a relatively deep blind bore and two relatively shallow blind bores adjacent the deep bore and overlapping the deep bore for communication therewith; two spaced circuit conductors on the panel for energizing a lamp means on said panel, said conductors extending into said shallow bores respectively and overlying the bottom faces of the shallow bores; an insulating plastic body substantially filling said deep bore substantially flush with the back face of the panel, said plastic body, being anchored to the panel; a first connector conductor body partially embedded in said plastic body; said conductor body having a base portion of the shape of a segment of

6

a ring with a gap between the two ends of the ring, said conductor body having an exposed generally cylindrical plug-in portion extending outward from the outer end of the plastic body, said conductor body further having a radial portion extending from said base portion into one of said recesses in overlapping contact with the corresponding circuit conductor therein; a second connector conductor body partially embedded in said body in spaced relation to said first conductor body, said second conductor body having an exposed plug-in prong portion extending outward from the outer end of the plastic body inside said cylindrical portion of the first conductor body, said second conductor body having a radial portion extending through said gap in the ring-shaped base portion of the first conductor body, said radial portion of the second connector conductor extending into the other of said two shallow bores in overlapping contact with the corresponding circuit conductor therein, said base portion and said radial portion of the first conductor body and said radial portion of the second conductor body being spaced inwardly from the outer end of the plastic body; and insulating material extending over said shallow bores and covering said radial portions of the two conductor bodies.

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