

[54] **SELF-LOCATING ELECTRICAL
CONNECTOR FOR LARGE PLANAR
SURFACES**

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339/192 R, 339/195 M, 339/218 M, 339/258 R
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[58] Field of Search **339/64, 132, 176 M, 176 MP,**
339/191, 192, 195, 196, 133, 134; 248/27; 24/221
A

[56]

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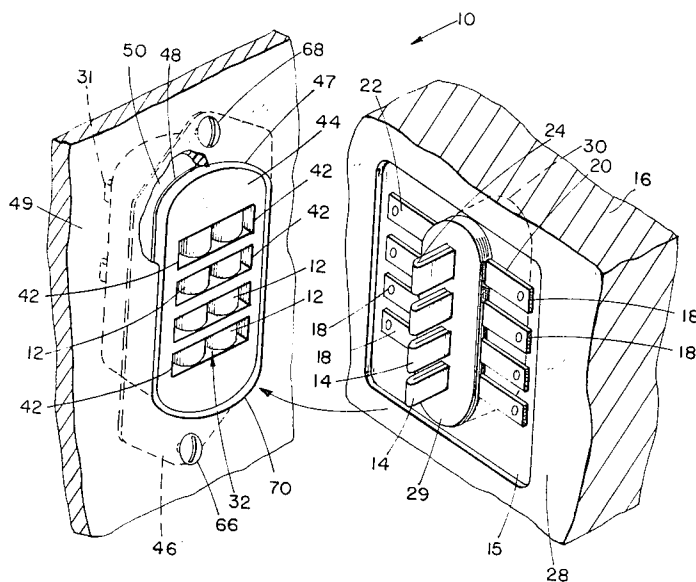
Attorney—Bryan, Parmelee, Johnson & Bollinger

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ABSTRACT

A self-locating male-female connector is shown which is utilized with an aerospace plastic lighting panel. The male element is embedded in the rear of the lighting panel, which bears operational information on the front thereof. The male element is generally T-shaped with the leg projecting outwardly from the rear surface of the panel. The female element is movably mounted, within an orifice in a metal backplate, to which the panel is to be secured. The female element is generally Y-shaped having a lead connecting portion and a resilient guiding portion extending upwardly therefrom whereby the resilient guiding portion is capable of compressibly engaging the projecting male portion when inserted therein.

5 Claims, 4 Drawing Figures



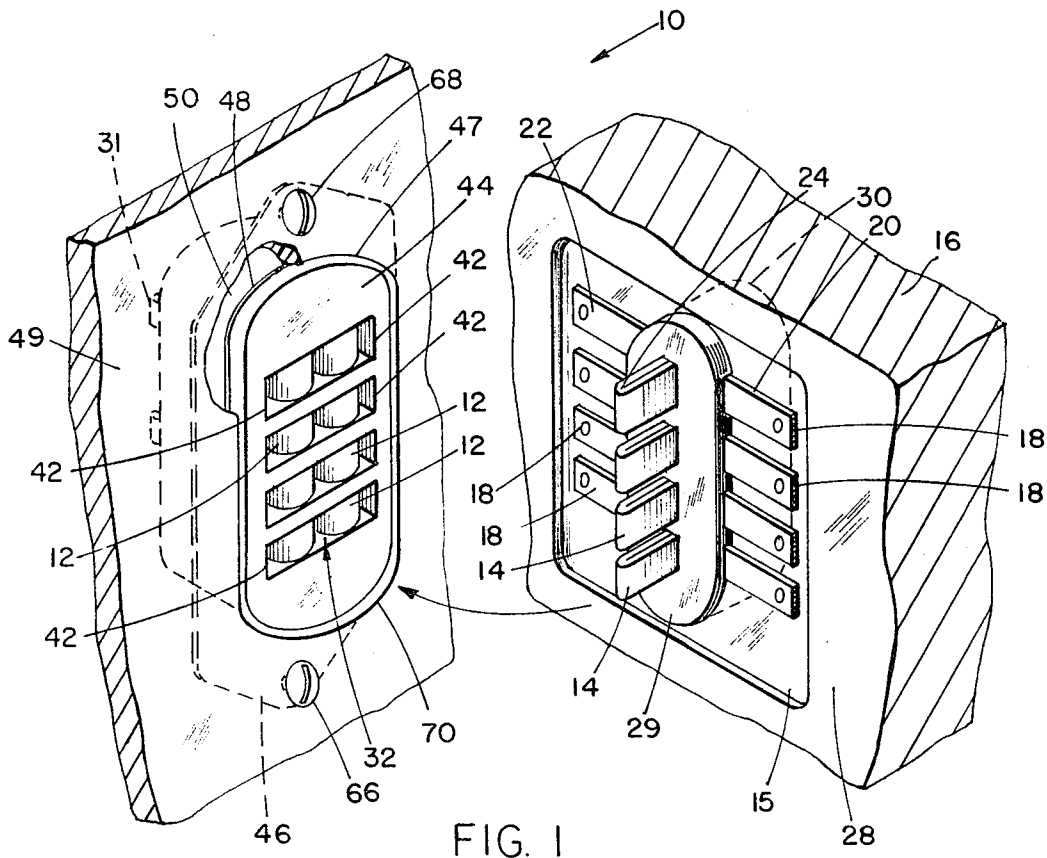


FIG. 1

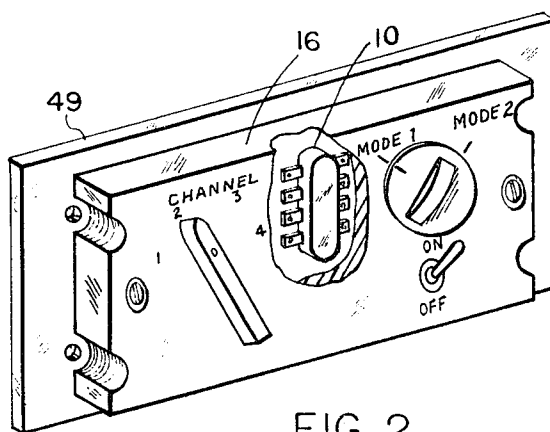


FIG. 2

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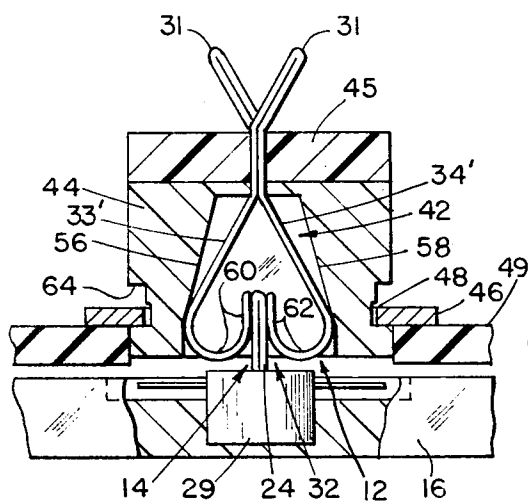


FIG. 4

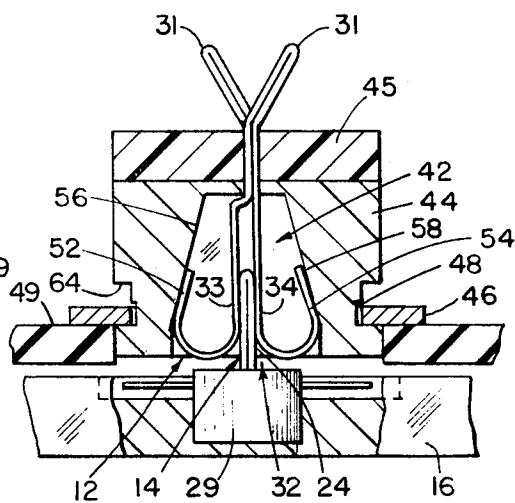


FIG. 3

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SELF-LOCATING ELECTRICAL CONNECTOR FOR LARGE PLANAR SURFACES

BACKGROUND OF THE INVENTION

A novel self-locating male-female connector, capable of providing electrical connection between large planar surfaces is herein disclosed.

In modern flight deck lighting panels there are lighting panels of transparent plastic having lighted information indicia located on the front. Problems have been encountered in alignment in initially mounting the panel and also in binding when the panel must be removed from the backplate for servicing.

The light sources in the plastic lighting panel require electrical connections between the lighting panel and the mounting or backplates to which the plastic panel is mounted.

The present electrical connectors are of the rigid coaxial type which require careful alignment during mounting, if damage thereto is to be avoided; and tight fit of the elements to insure good electrical contact.

Further, the presently used coaxial connectors, which contain one circuit, require the use of several independent electrical coaxial connectors to obtain more than one circuit. This imposes the restriction of exact alignment for each of them. Thus, the difficulty of connector alignment rises directly in proportion to the number of coaxial connectors used.

The plastic lighting panels are also subject to damage during disconnection of the connector because the slightest non-uniformity in withdrawal pressure from the backplates may cause the male portions of the connectors in the lighting panel to bend and/or break loose from the panel. This further compounds the alignment problem when the panel is sought to be remounted.

All of the above problems are further aggravated when the panel is large because the person doing the mounting has difficulty exactly aligning the mounting screws and the coaxial connector.

The invention illustrated herein allows panel mounting and removal without the extreme care presently required thereby eliminating the high incidence of connector and panel damage.

SUMMARY OF THE INVENTION

An advantageous self-locating electrical male-female connector is provided for large planar surfaces, having the further advantage that the male elements are compressibly held in position to prevent any deformation thereof. This advantage arises because the female elements are resilient, providing transverse movement thereof, thereby allowing the projecting portions of the male elements to be guided therein even if they are not precisely aligned therewith. Further, a channel mounting technique allows a plurality of electrically insulated male-female elements to be longitudinally movable so as to further adjust for misalignment of the panel and backplate to which each part is respectively mounted. Thus, the male-female connector is self-locating in that it will adjust to accommodate a misaligned panel and backplate.

The self-locating male-female planar surfaces connector for use with a modern aerospace lighting panel as herein described includes a generally T-shaped male element, which is preferably formed from one continuous strip of beryllium copper, having a T-top or longitudinal portion serving as a two wire terminal portion and a transverse, double thickness, projecting portion. The T-shaped male element is invertedly mounted, with the top of the T embedded within the plastic flight instrumentation panel, being retained therein with cement.

The female element, which is also preferably formed from one continuous strip of beryllium copper, is generally Y-shaped and includes a lead connecting or base portion and a resilient guiding portion which includes resilient arm-like members extending upwardly from the base portion. Thus, upon insertion, the projecting portion of the male element is

compressibly retained between the resilient arm-like members, each of which has movement to adjust to any transverse or crossways misalignment.

The connector is fabricated so that the female element is oriented within an insulated housing which is movably mounted to the metal backplate, such that the guiding portion is facing outwardly therefrom to receive the projecting portion of the male element.

The means for movably mounting the insulated housing to the backplate includes a flange which is loosely fitted within a channel extending around the periphery of the housing. Such an arrangement allows longitudinal movement of the housing relative to the backplate when the flange is fixedly attached thereto.

During installation, the plastic panel and backplate are brought together, enabling the guiding portion of the female element to move slightly into position even if the projecting portion of the male element is not properly aligned. That is, the projecting portion of the male element exerts pressure on the guiding portion so as to allow the projecting portion to be guided therein even though the elements may be initially misaligned.

The various other objects and advantages provided by the present invention will be more apparent when the detailed description is considered in conjunction with the following figures:

DESCRIPTION OF THE FIGURES

FIG. 1 is an enlarged perspective view of the male and female elements mounted to their respective planar surfaces;

FIG. 2 is a perspective view of the light panel mounted to the backplate;

FIG. 3 is a cross-sectional view of a female and male element mounted in position;

FIG. 4 shows an alternate configuration for the female element with the male element mounted in position.

DETAILED DESCRIPTION

Referring to FIG. 1, a connector 10 is illustrated having a plurality of female elements 12 adapted to receive a plurality of male elements 14. As shown, each male element 14 has a generally T-shaped configuration. The male element 14 has an inverted T-shape when mounted in a shallow recess 15 of a plastic panel 16. The individual male elements 14, which may be made of beryllium copper, include a longitudinal portion 18 having lead connecting portions 20, 22 and a projecting portion 24 which extends transversely outwardly therefrom as a double thickness of metal. The individual male elements 14 are laterally spaced and moulded into a plastic base layer 29. Thus, all the T-shaped elements 14 are rigidly held in place with the proper orientation and spacing. The plastic base layer 29 is then cemented into a bored out section or deep seat 30 formed in the panel 16. The depth of the bore controls the depth of the male elements 14. Further, with a deep seat 30 the cement applied to the base layer 29 has a large holding surface to assure that the male elements 14 continue to be properly held in position during a lifetime of usage.

The shallow recess 15 provides working clearance around the lead connecting portions 20, 22 of the male elements 14, so that wires (not shown) can be easily attached and soldered. The wires, embedded in the panel 16 lead to the lamps (not shown), also embedded in the panel 16.

Each female element 12, which may also be made of beryllium copper, has a lead connecting portion 31 and a guiding portion 32 made up of two resilient arm-like members 33 and 34, respectively, extending upwardly therefrom in opposed relationship. (See FIG. 3.) The female elements 12 are positioned within slots 42 formed in a pre-molded housing 44. After the female elements 12 are inserted in the housing 44, a layer of plastic 45, such as diallyl phthalate, is moulded as shown to hold the female elements 12 in place.

A flange 46, which may be made of cadmium plated steel, is clipped into a channel 48 extending around the periphery of the housing 44. The flange 46, includes a recess 47 formed therein to accommodate the housing 44 and allow the same to be loosely clipped therein, allowing longitudinal movement of the housing 44 relative to the flange 46. The flange 46 is then fixedly mounted to the backplate 49 with the female elements 12 positioned in an orifice 50 located therein; the female elements 12 assuming a receiving position relative to the projecting portions 24.

FIG. 2 illustrates the large plastic panel 16 and connector 10 mounted thereto and to a backplate 49. The plastic panel 16, as shown, bears operational information.

As shown in FIG. 3, a female element 12 is mounted within a slot 42 in housing 44 and the projecting portion 24 of the male element 14 is inserted in the guiding portion 32 of the female element 12. The female element 12 is held mounted within the slot 42 in the housing 44 by means of a plastic layer 45 moulded against the housing 44, partially around the lead connecting portion 31, to secure the female element 12 therein. The lead connecting portions 31 are alternatively bent slightly outward such that the lead connecting portions 31 extend outwardly in opposite directions, facilitating any lead connections to be made thereto. The guiding portion 32 of each female element 12 has two resilient arm-like members 33 and 34 which extend upwardly from the lead connecting portion 31. The arm-like members 33 and 34, shown in FIG. 1 and 3, have end portions 52 and 54 respectively, which curve outwardly therefrom and toward the base portion 31, providing an easily enterable and releasable compressive guiding portion 32.

Each slot 42 includes side walls 56 and 58 adjacent to the end portions 52 and 54, respectively, such that when a projecting portion 24 of the male element 14 is sought to be inserted in the guiding portion 32, transverse movement of the guiding portion 32 will occur to accommodate the projecting portion 24. When the projecting portion 24 is inserted, the wall 56 and 58 exert a compressive force on the end portions 52 and 54, respectively, to aid in compressively holding the projecting portion 24 within the guiding portion 32 to provide conditions for an excellent electrical connection.

Referring to FIG. 4, there is shown an alternate embodiment of the Y-shaped female element 12. The guiding portion 32, as shown, has arm-like members 33' and 34' which extend acutely upwardly from the lead connecting portion 31 in opposed relationship. The arm-like elements 33' and 34' have end portions 60 and 62, respectively, which curve inwardly toward the base connecting portion 31. The projecting portion 24 of the male element 14 being compressively retained, upon insertion therein, but further being increasingly compressively retained during withdrawal.

Each slot 42 includes side walls 56 and 58 adjacent to the rounded end portions 60 and 62, such that when the projecting portion 24 is inserted into the guiding portion 32, the walls 56 and 58 exert a compressive force on the arms 33' and 34' respectively, aiding in compressively holding the projecting portion 24 therein.

During construction, the female elements 12 are first oriented within slots 42, which are generally trapezoidal in shape, with the lead connecting portions 31 extending outwardly therefrom in the opposite direction to the guiding portions 32. A plastic layer 45 is then adhesively bonded to the housing 44 holding the lead connecting portion 31 of the female element 12 in a fixed orientation while allowing the resilient guiding portion 32 to move transversely in the slot 42. The housing 44 has an oversized channel 48 extending around the periphery thereof. The channel 48 is adapted to allow a flange 46 to be movably fitted therein. The flange 46 rests against a ledge 64 until after bonding of the female element 12 to the housing 44. Thereafter it is forced into channel 48. The oversized channel 48 enables the housing 44 to be longitudinally movable relative to the flange 46, so that the projecting portions 24 of the male elements 14 can be more readily in-

serted within the guiding portions 32 of the female elements 12. The flange 46 is then fixedly fastened to the backplate 49, with screws or rivets 66 and 68, so that the housing 44 and female elements 12 are positioned within the orifice 50 in the backplate 49 and are longitudinally movable relative to the backplate 49.

The male elements 14 are moulded into a base layer 29 to retain their alignment. The base layer 29 is shaped so as to fit within the deep seat 30, extending downwardly from the recess 15 in panel 16 and cemented therein. The male elements 14 are thus held fixedly in position for insertion into the respective guiding portions 32 of the female elements 12.

It should be understood that various configurations of the female element 12 and male element 14 described may be devised by those skilled in the arts of which the described embodiments are representative, without departing from the spirit or scope of the invention and appended claims.

What is claimed is:

1. An electrical connector for electrically connecting large planar articles such as lighting panels to a source of electric power, wherein said articles provide a substantially planar surface for mounting a first electrical connector element, said surface being substantially larger than the element, and said panel is to be fastened and electrically connected to a substantially planar support means furnishing means for mounting a second electrical connector element to mate with the first electrical connector element, with fastener means positioned independently of said electrical connector elements to fasten the panel to the support means, said electrical connector being characterized by:
 - a plurality of conductive male elements capable of being attached to the lighting panel, each of said male elements having a generally transverse projecting portion extending outwardly from the rear surface of the lighting panel;
 - a plurality of conductive female elements, each of said female elements including a resilient guiding portion; insulated housing means for orienting each of said resilient guiding portions therein to allow transverse movement of said resilient guiding portions in said housing for reception of said transverse projecting portions of said male elements;
 - said insulated housing having a channel extending around the periphery thereof;
 - flange means capable of loosely engaging said channel and allowing longitudinal movement of said housing relative to said flange; and
 - means for fixedly mounting said flange to said support means;
 - whereby misaligned male and female elements in large planar surfaces may be easily interconnected to form an electrical connection therebetween.
2. An electrical connector for electrically connecting removably articles such as lighting panels as claimed in claim 1 wherein:
 - said insulated housing means includes a plurality of electrically insulated slots, each slot capable of receiving one of said female elements;
 - said slots having side walls spaced adjacent to said resilient guiding portions to exert pressure thereon when said guiding portions receive said transverse projecting portions, thereby aiding in compressively retaining an individual transverse projecting portion therein.
3. An electrical connector for electrically connecting removable articles such as lighting panels as claimed in claim 1 wherein:
 - said conductive male elements are generally T-shaped, including a generally longitudinal portion, said T-shaped male conductive elements being invertedly mounted to the surface of the lighting panel with said transverse projecting portions extending outwardly therefrom, whereby electrical elements in the lighting panel may be electrically connected to said longitudinal extending portions.

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4. A method for electrically connecting removable articles such as lighting panels to a source of electric power, wherein said articles provide a substantially planar surface for mounting a first electrical connector element, which surface is substantially larger than said element, and said panel is to be fastened and electrically connected to a substantially planar support means providing means for mounting a second electrical connector element to mate with the first electrical element, with fastener means positioned independently of said connector elements to fasten said panel to said support, said method being characterized by the steps of:

forming a resilient T-shaped male element from a single strip of conductive material;

orienting a plurality of the male elements at spaced intervals within a plastic layer;

mounting the oriented male elements rigidly to the lighting panel;

forming a resilient female element from a single strip of conductive material;

positioning a plurality of said resilient female elements in

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spaced slots within an insulated housing for transverse movement;

forming a channel extending around the periphery of said insulated housing;

loosely engaging a flange in said channel to allow longitudinal movement of said housing relative to said flange and fixedly engaging said flange to said support means;

whereby the male and female elements in large planar surfaces may be easily electrically connected even if they are initially misaligned.

5. A method of electrically connecting removable articles such as lighting panels as claimed in claim 4 including the additional steps of:

bonding a portion of the female elements fixedly within the slots to said housing;

positioning said plastic layer within a deep seat formed in the panel; and

bonding the plastic layer within the deep seat to the panel.

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