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TERMINAL UNITS FOR CIRCUIT PANELS

Original Filed June 19, 1959

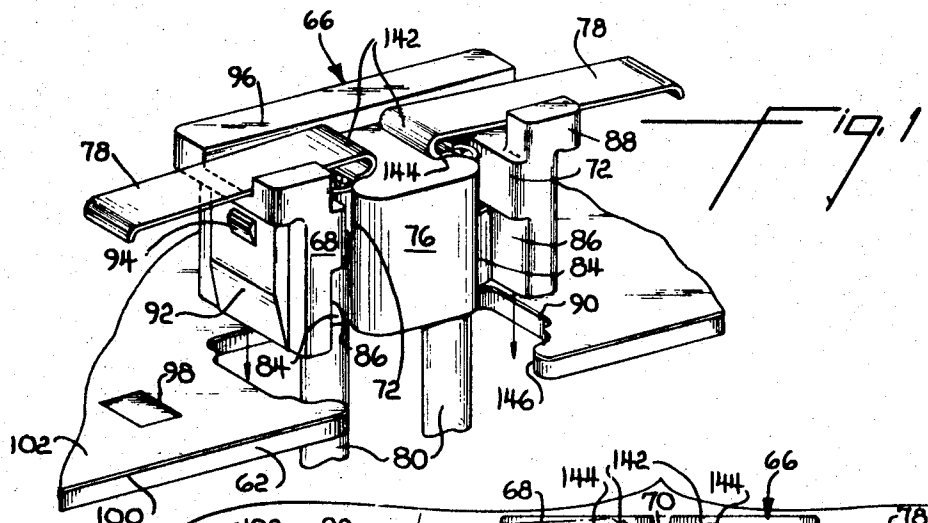


Fig. 1

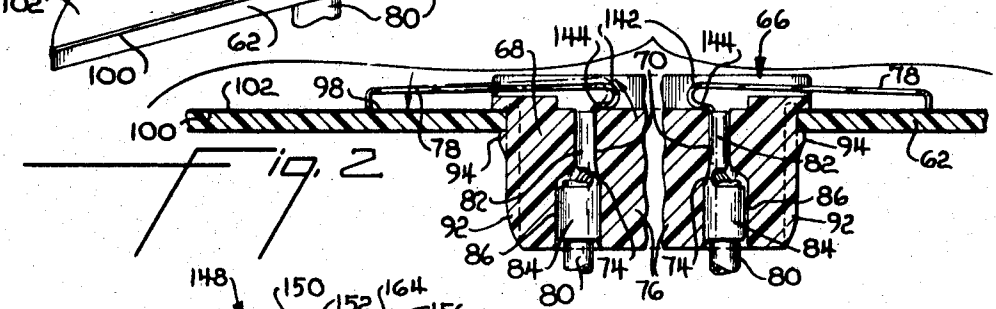


Fig. 2

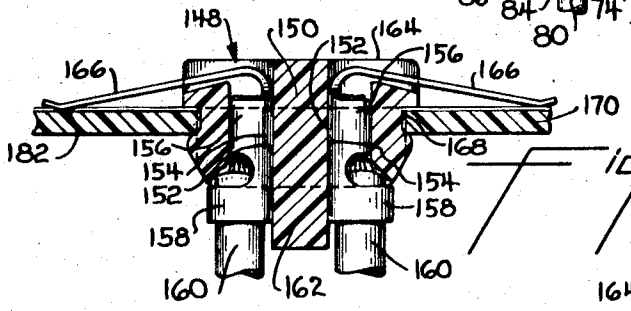


Fig. 3

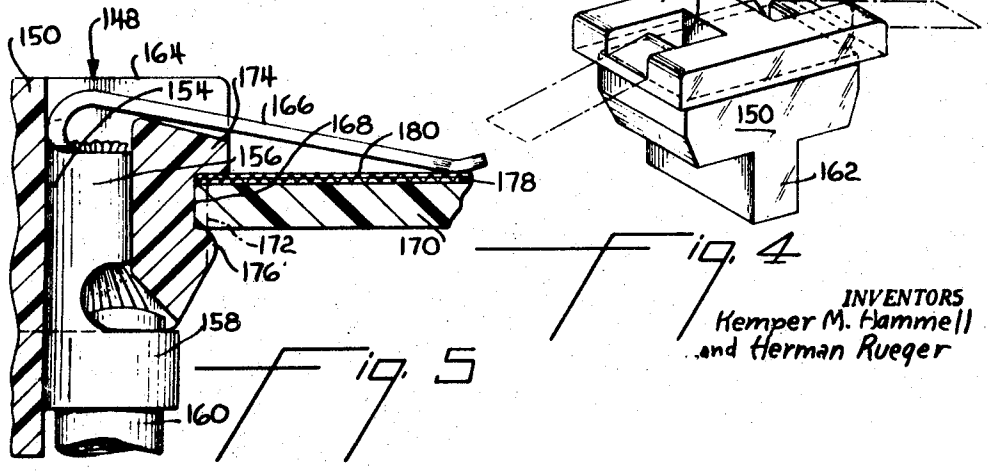


Fig. 4

Fig. 5

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TERMINAL UNITS FOR CIRCUIT PANELS

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Application Nov. 7, 1963, Ser. No. 329,934, now Patent No. 3,308,417, dated Mar. 7, 1967, which is a division of application Ser. No. 821,481, June 19, 1959, now Patent No. 3,138,419, dated June 23, 1964. Divided and this application Dec. 23, 1966, Ser. No. 628,180

1 Claim. (Cl. 339—17)

ABSTRACT OF THE DISCLOSURE

A terminal unit for attachment to an electrical panel is disclosed featuring an insulating housing member of deformable material having an opening extending axially therethrough with a terminal conductor extending through the opening. The terminal conductor has one end bent transversely to define a resilient contact. The bent portion of the terminal conductor extends partially in a reverse direction relative to the contact end of the conductor to define a heel engaging the insulating housing member so as to urge the contact into firm engagement with a panel surface.

This application is a division of our application S.N. 329,934, filed Nov. 7, 1963, now Patent No. 3,308,417, granted Mar. 7, 1967; and application S.N. 329,934 is a division of our application S.N. 821,481, filed June 19, 1959, and now Patent No. 3,138,419 granted June 23, 1964.

This invention relates to improvements in terminal units attachable to electrical circuit panels for purposes of connecting to circuit means upon the panel electrical conduits leading to and from a source of electrical power or control means therefor. Though not to be restricted thereto, the present invention finds effective application to panels utilized to produce electro-luminescence. Such panels are becoming widely used for many purposes including dials, register, recorders, and other utilitarian functions, as well as for illuminating and decorative functions in many fields. One substantial field in which panels for electro-luminescence substantially are expanding at present is the automotive field and particularly the dash panels of automotive vehicles upon which various gauges and indicating devices are necessary to the effective operation of the vehicle and which panels must be illuminated when daylight is not available. Another field comprises the radio and television field wherein dials and indicating devices of various kinds are used and preferably are illuminated to facilitate the reading thereof.

In addition to the present invention being useful in applications of electro-luminescent panels, however, it is to be understood that the invention likewise readily is applicable to electrical structures such as capacitors, for example, or other devices wherein relatively flat circuits or current conductive sheets or films are carried by a panel and it is necessary to connect current supply leads to one or more lamina on the panel. Although the present invention is highly applicable to electrical devices employing electro-luminescent panels, it is to be understood that the invention is not to be restricted to use with such panels or any specific type of such panels.

A panel which is to be made luminescent for purposes of rendering certain data visibly intelligible such as by portions of the panel becoming visible through luminescence, as distinguished from indicia merely being printed upon an opaque or transparent panel which is illuminated by conventional electric lamps, for example, a suitable base panel is employed to support layers or laminae of

various materials superimposed upon one surface of said panel. A number of different types of material presently are employed to comprise such base panel, including, for example, glass, steel and aluminum. One basic structure which permits luminescence of the panel in desired areas comprises the provision of a carrier layer of suitable material having dispersed therethrough finely divided particles of a phosphorous-like material which will luminesce upon the imposition of an electric field between two conducting layers disposed on opposite surfaces of said carrier layer. Said carrier layer can be any one of a number of moldable synthetic resins of which polyvinyl-chloride is one example, or a layer of shape-retaining ceramic type material, such as a glass-type ceramic substance, and in which said aforementioned particles are dispersed which are capable of becoming luminescent.

It is necessary to provide electrical conducting means upon opposite surfaces of such carrier layer or panel. Examples of such electrical conducting layers are chemical salts such as tin chloride, and metals such as sputtered gold, or a thin, light coat or layer of aluminum. Such coats or layers of electric conducting material are satisfactory and preferably are exceedingly thin and, for example, of the order of 40 or 50 millionths of an inch. Where, for example, glass is used as the base panel, and one surface thereof is regarded as the viewing side of the panel, a current-conductive layer must be formed upon the opposite surface of the glass and the impregnated carrier layer is sandwiched between such conductive layer and another current-conductive layer, whereby upon the imposition of an electrical field thereupon or therethrough, said impregnated carrier layer will luminesce. Suitable bus bars of silver or the like, for example, are connected to the current-conductive layers and are separated suitable from each other, such as by masking when depositing the same. Then it is necessary to connect electric line conductors or leads to said bus bars, whereby switch or other control means connected to the electrical conductors can be operated to cause the impregnated carrier layer to luminesce in such manner as to be viewable through the outer surface of the glass panel.

It is also possible to utilize a suitable metallic sheet, such as steel or aluminum as a base panel, which panel may comprise one current-conductive layer or lamina for imposing current against one face of the impregnated carrier layer, as well as supporting said impregnated carrier layer. Hence, the impregnated carrier layer is placed in firm contact with one surface of said metallic supporting panel and another suitable conductive layer is placed in firm contact with the opposite surface of said impregnated carrier layer, following which a cover layer or suitable coating which is transparent is superimposed upon the other conductive layer. Bus bars are affixed to the other conductive layer for connection to suitable electric circuitry, and the metallic base sheet is grounded, for controlled imposition of electric fields upon the impregnated carrier layer to cause the same to luminesce as desired. It also is to be understood that suitable frame means are placed around the superimposed layers described above and the specific examples set forth above are merely illustrative since a number of additional examples may be used, all of which however employ relatively thin layers of electric conducting material such as tin chloride or thin sheets of aluminum to which electric circuit connections must be made by means of suitable terminals or terminal units. If the base sheet is metal, such terminals or terminal units must engage the same for circuit connections.

It is the principal object of the present invention to provide a plurality of embodiments of terminal units which readily are attachable to base panels having electric circuitry affixed to one surface thereof, for example, the basic principle of the invention comprising utilizing

an insulating member molded from resiliently yieldable material such as suitable resilient thermoplastic synthetic resin and capable of being momentarily distorted and quickly shape-restoring for insertion through an apertured formed in the base panel so as to be snap-fitted into said aperture to secure the insulating member to the panel. An electrical conductor extends axially through said insulating member and one end of said conductor extends transversely to the conductor to comprise a contact engageable with the circuitry on one side of said panel, whereas the other end of the conductor is provided with means connectable to line conductors or leads thereto. The electrical conductor extends through the insulating member within the perimetrical confines thereof so as to be insulated from the panel, particularly when the panel is formed from metal. If a plurality of conductors is carried by a single insulating member, a suitable portion of said member is disposed between said conductors to insulate them from each other. When a plurality of conductors is used in a common insulating member, it is to be understood that contacts thereon may extend in any desired relationship to each other.

Another object of the invention is to provide a projecting heel on the conductor which extends oppositely from the contact on one end of the conductor and said heel is engageable with the upper end of the insulating member to cause fulcruming of the heel in a direction to urge the outer end of the contact toward the circuit upon the base panel when the opposite end of the conductor is pulled longitudinally for example, either accidentally or intentionally.

Still another object of the invention is to provide a depending insulating extension on the insulating member in embodiments thereof containing a plurality of openings to receive respectively a plurality of conductors having contacts on one end of each and connections for electrical conduits on the other end of each, whereby said connections for electrical conduits will be insulated from each other effectively.

One further object of the invention is to provide in the base panel apertures adjacent one edge of the panel and opening through said edge, whereby the aperture comprises a notch through which electrical conduits connected to the terminal units may be passed without requiring the threading of the entire length of the conduits through said apertures in the panel incident to mounting the terminal units in the panel.

Details of the foregoing objects and of the invention, as well as other objects thereof, are set forth in the following specification and illustrated in the accompanying drawings comprising a part thereof.

In the drawings:

FIGURE 1 is an exploded perspective view illustrating an embodiment of terminal unit employing the principles of the present invention.

FIGURE 2 is a vertical sectional view taken midway of the terminal unit embodiment shown in FIGURE 1.

FIGURE 3 is a vertical sectional view of still another embodiment of dual type terminal unit employing the principles of the invention and illustrating an insulating projection to effectively separate crimped-type connecting means on the electrical conductors for securing electrical conduits thereto.

FIGURE 4 is a perspective view of the insulating member of the embodiment shown in FIGURE 3.

FIGURE 5 is a fragmentary vertical elevation on a larger scale than employed in FIGURE 3 and illustrating further details of the embodiment illustrated in FIGURES 3 and 4.

A beneficial refinement in the conductors and contact structure of a terminal unit is illustrated in FIGURES 1 and 2, wherein terminal conductor and contact structures are pre-formed prior to insertion thereof in a molded insulating housing, whereby the latter is formed with slots extending inward from one side for purposes of permitting the pre-formed terminal conductors and contacts to be snapped into operative position within the molded insulating member.

As best shown in FIGURE 2, the terminal conductors **74** extend upwardly above the upper end of the tongue member **76** and are then bent preferably at a substantially sharp right angle in one transverse direction, whereas the contact **78** is bent in an opposite direction, whereby a reverse bend **142** is provided in each of the combination conductor and contact members. The principal purpose and benefit of said reverse bends **142** is that if the electrical conduits **80** should be either intentionally or accidentally pulled in a direction away from the lower end of the housing **68** as viewed in FIGURES 1 and 2, the leg **144** of each reverse bend **142** will tend to bend upwardly in the direction of the arrow adjacent the reverse bend in the lefthand contact **78** in FIGURE 2, thereby resulting in a tendency to move the outer end of the contact **78** in the direction of the arrow shown adjacent the outer end thereof in FIGURE 2, whereby an even firmer engagement of the outer end of the contact **78** is made with either the panel or one of the laminae upon said panel, depending upon the circuit arrangement and the engagement of the contacts **78** therewith.

As will be seen from FIGURE 1, an additional exemplary modification is illustrated therein with the panel aperture **90** formed adjacent one edge of the panel **62** and an opening **146** is formed in said edge, whereby the aperture **90** actually comprises a notch extending inward from one edge of the panel **62** and through which line conductors or leads **80** may be quickly moved after the terminal conductors and contacts have been assembled with the insulating housing to form the terminal unit **66**, thereby eliminating any need to thread the conductors **80** for the entire length thereof, for example, through the aperture **90**, especially in the event said aperture is sufficiently small that it would not be possible to move the pre-formed contacts **78** therethrough prior to being inserted through the slots **72** in the housing **68**.

Still a further embodiment of the invention is shown in FIGURES 3 through 5 relative to several beneficial additions which, it is to be understood, could be applied to the embodiment shown in FIGURES 1 and 2. Referring to FIGURES 3 through 5, the terminal unit **148** comprises a molded housing **150** formed from insulating material similar to that employed in making the insulating housings of the preceding embodiments. The housing **150** has a pair of openings **152** extending axially therethrough to receive respectively terminal conductors **154** having pairs of crimping ears **156** and **158** thereon respectively firmly crimped in direct contact with the metallic wires of the insulated line conductors or leads **160**, while the ears **158** are firmly crimped about the insulated covering or sheath of the conductors **160**. The openings **152** in the lower ends thereof preferably are shaped to accommodate the terminal conductors **154** and particularly the crimped ears **156**, while the crimped ears **158** preferably are of the type which abut the lower end of the insulating housing **150**.

To insure that the portions of the terminal conductors **154** and crimped ears thereof which project below the lower end of the insulating housing **150** will effectively be insulated from each other, the housing **150** is formed with a depending integral insulating projection **162** which is sufficiently thick, and also sufficiently wide and long, to insure such insulation. The exemplary proportions of the projection **162** are best seen in FIGURE 4, but such illustration is not to be regarded as restrictive. Otherwise, the upper surface **164** of the housing **150** being at a level above the contacts **166** is for the same purpose as in the preceding embodiments.

A slightly different principle for maintaining the terminal unit **148** within the aperture **168** in panel **170** from those employed in the preceding embodiments is used in the instant embodiment. As will best be seen on a larger

scale in FIGURE 5 from that employed in FIGURES 3 and 4, the intermediate portion of the insulation housing **150** is molded to conform substantially to the broken line **172** in FIGURE 5. The transverse dimension of said intermediate portion in a direction parallel to the plane of panel **170** is slightly greater than the transverse dimension of the aperture **168** in panel **170** which is to receive the intermediate portion of the housing **150**. However, because of the resiliently deformable nature of the material from which the housing **150** is formed, the intermediate portion **172** of housing **150** is compressible into the aperture **168** so as to assume the full line position thereof illustrated in FIGURE 5, which results not only in compressing the intermediate portion of the member **150** against the crimped ears **156**, but upon the laterial projections **174** abutting the uppermost surface of the laminated panel **170** as shown in FIGURE 5, the material which is compressed by reason of the intermediate portion **172** of member **150** being squeezed into aperture **168** will migrate and result in a bulge **176** being formed which substantially extends in a lateral direction adjacent the lower surface of panel **170**, thereby effectively locking the terminal unit **148** relative to panel **170** so as to hold the outer ends of the contacts **166** in form engagement with the desired surface of the laminated panel **170**. The transformation of the material of housing **150** into the bulge **176** formed thereon takes place rapidly and usually in a matter of only a second or so. To prevent undue shaving of any of the material during such insertion, the sides of portion **172** may be undercut toward the upper end as viewed in FIGURE 5 to insure firm seating.

Further, especially in forming apertures in the base panel by piercing or punching, as when the panel is metallic, adequate punch and die clearance is used to insure pull-down or marginal bevelling at the upper end of the aperture to accommodate any slight shaving which might occur from inserting housing **150**. Also, a slight burr usually is formed on the lower rim of the aperture, which serves as a locking means preventing retracting movement of the housing relative to the panel aperture.

Inasmuch as the embodiment shown in FIGURES 3 through 5 employs axially extending openings **152** which are within the confines of the insulating member **150**, and particularly when the line conductors or leads **160** are connected to the terminal conductors **154** by permanent means such as crimping ears **156** and **158**, the terminal conductors **154** upon which the contacts **166** are in straight, unbent condition relative thereto are inserted upwardly through the openings **152** until the crimped ears **158** engage the lower ends of the member **150**, whereupon the contacts **166** are bent laterally and preferably at an acute angle to the conductors **154** in a manner illustrated and described relative to the preceding embodiment. Further, it is to be understood that the panel **170** has an impregnated carrier layer of suitable material such as phosphor-plastic **178** and a superimposed current conductive layer **180** thereon as in regard to the preceding embodiments, certain of said laminae having an opening **182** therethrough as seen in FIGURE 3. In the last two embodiments respectively illustrated in FIGURES 1 and 2, and in FIGURES 3 through 5, it is to be understood that although both of said embodiments pertain to dual conductor constructions in a single terminal unit, the reverse bend **142** arrangement of FIGURES 1 and 2 may obviously be applied to a single conductor type of terminal unit. Further, the deformable, locking arrangement comprising the bulge portion **176** of the embodiment shown in FIGURES 3 through 5 likewise may be applied to a terminal unit incorporating a single conductor and contact structure.

Although the specific illustrations of the laminated panel arrangements in the various embodiments illustrated and described hereinabove primarily have contemplated a metallic base panel and an impregnated carrier layer and electric conducting layer superimposed thereupon, it is to be understood that other types of laminated panel arrangements are contemplated and possible in accordance with the scope of the present invention, some suitable alternative structures being referred to in the preliminary portion of this specification. Still further, it is to be understood that although certain specific features have been illustrated and described in regard to each of the various embodiments illustrated and described hereinabove, most of said features may be used interchangeably with other embodiments than those in which they are specifically illustrated and described without departing from the spirit of the invention. In addition, however, although the various embodiments have some common basic principles, there are nevertheless certain details in at least some of the embodiments which characterize them over other embodiments, whereby the various embodiments are not to be regarded as complete equivalents of each other in that certain of said characteristics render said embodiments individually desirable over others in application to certain panel and circuit situations, while still other embodiments are preferably in other circuit and panel situations.

While the invention has been described and illustrated in its preferred embodiments, and has included certain details, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways falling within the scope of the invention as claimed.

We claim:

1. A terminal unit for attachment to an electrical panel having circuit means thereon, said unit comprising an insulating housing member molded from resiliently deformable material and having an opening extending axially therethrough, an electrical terminal conductor extending longitudinally through said opening in said insulating member, one end of said conductor being bent transversely thereto at an acute angle to said conductor adjacent one end of said insulating member to comprise a resilient contact, said bent portion of said conductor extending partially in a reverse direction transversely to said contact end of the conductor to comprise a heel engaging said one end of said insulating member and being operable to urge said contact into firmer engagement with one surface of a panel when said unit is inserted within an aperture therein and the opposite end of said conductor is pulled longitudinally away from the opposite surface of such panel, and means on said opposite end of said conductor connectable to a current supply circuit.

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