

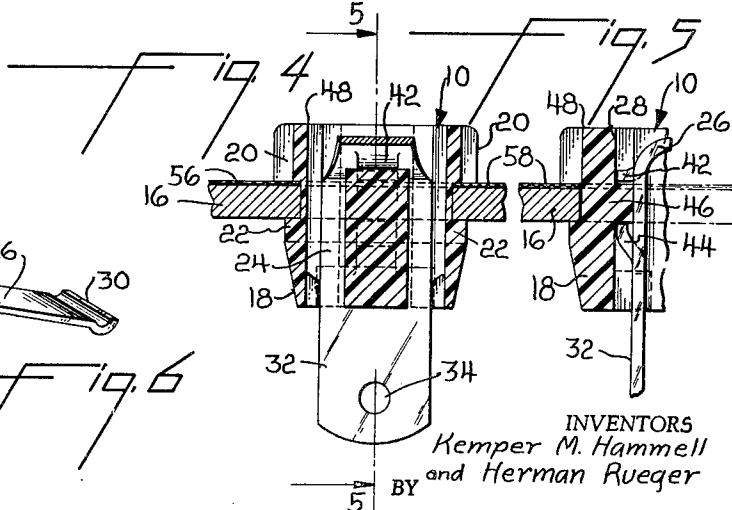
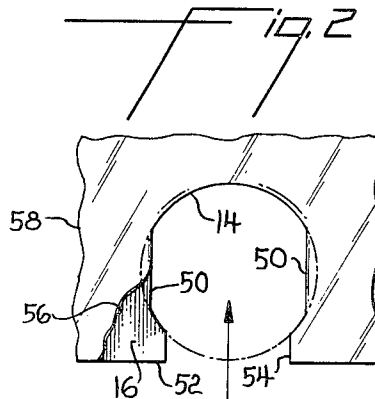
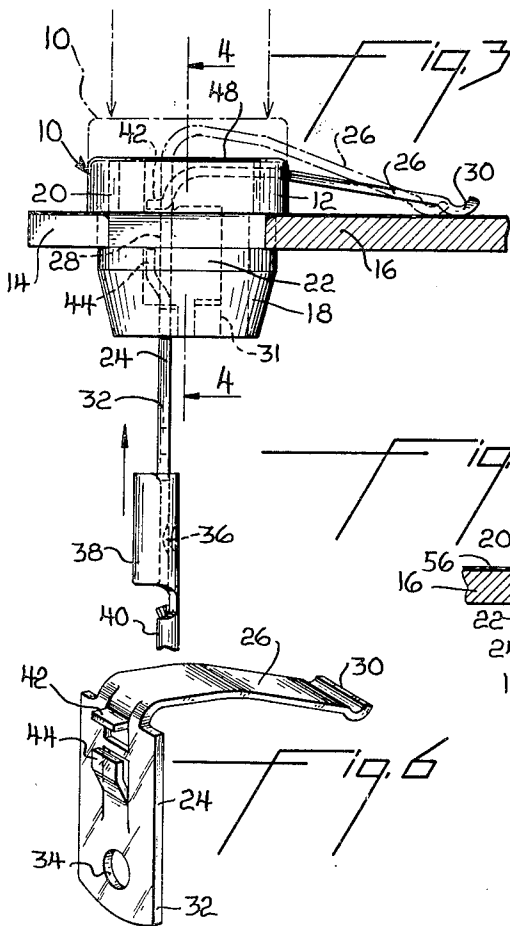
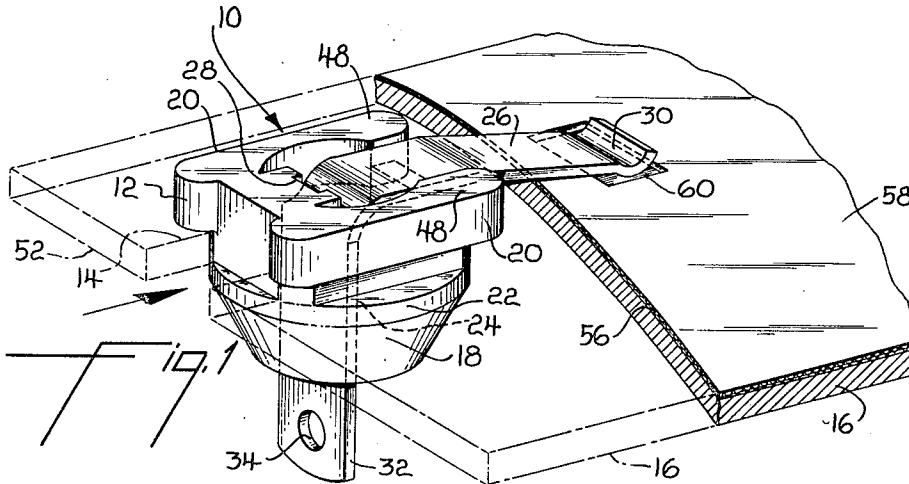
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TERMINAL UNITS FOR CIRCUIT PANELS

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1

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## TERMINAL UNITS FOR CIRCUIT PANELS

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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

2

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 suitably 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 a manner as to be viewable through the outer surface of the glass panel.

It also is 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 terminal unit which is readily 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 aperture 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 means projecting from one end of the insulator member in an

3

axial direction beyond the contact projecting from said end of the insulator member, whereby said projecting means can be utilized to receive pressure for pressing the terminal unit into the aperture formed in the base panel without interfering with the contact of the unit.

One further object of the invention is to provide preferably snap-acting positioning means on the conductor for engagement with a projection on the interior of the insulating member, whereby longitudinal movement of the conductor relative to the opening therefor in the insulating member is prevented.

Still 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 a perspective view of one exemplary embodiment of terminal unit embodying the present invention and shown mounted within an aperture in a base panel having electrical conducting means on one surface thereof which is interrupted to permit engagement of the outer end of the contact of the terminal unit with other electrical conducting means of the panel, a portion of said panel being illustrated in phantom so as to permit clear showing of details of the terminal unit.

FIGURE 2 is a fragmentary plan view showing an exemplary embodiment of aperture for the electric circuit panel into which a terminal unit is insertable in accordance with the principles of the invention.

FIGURE 3 is a side elevation of the terminal unit shown in FIGURE 1 mounted within an aperture of an electric circuit panel, said view illustrating in phantom the position of the terminal unit and contact thereof prior to full insertion of the unit within the aperture of the panel and, in full lines, showing the relative positions of all portions of the terminal unit relative to the panel when the unit is fully inserted in the aperture therefor in said panel.

FIGURE 4 is a fragmentary vertical sectional view taken on the line 4—4 of FIGURE 3.

FIGURE 5 is another fragmentary vertical sectional view taken on the line 5—5 of FIGURE 4; and

FIGURE 6 is a perspective view of the electrical conductor and contact thereon included in the embodiment of terminal unit illustrated in FIGURES 1 through 5.

Referring to the embodiment shown in FIGURES 1 through 6, the terminal unit 10 comprises a molded insulating member or housing 12 which is formed from suitable yieldable material which is resiliently deformable such as appropriate rubber compounds, pliable or

4

yieldable synthetic resins such as polyethylene, polyvinyl-chloride or other suitable yieldable material capable of momentarily being deformed from a predetermined molded shape and being self-restored quickly substantially to the as-molded shape after distortion therefrom. Such resins may be referred to by the more common vernacular, "plastic." For convenience of inserting the insulating member or housing 12 within an aperture 14 formed in a circuit panel 16, what will be regarded as the lower end of the insulating member, preferably is beveled as shown at 18.

A variety of different arrangements may be used to retain the molded insulating member or plastic housing 12 within the aperture 14 of the circuit panel, several fundamental ones being illustrated in FIGURES 1 and 3 through 5. These comprise lateral projections 20 extending from opposite sides of the housing 12 adjacent the upper end thereof, and lateral shoulders 22 projecting from opposite sides of the lower portion of the housing 12, walls of the aperture 14 of the panel 16 being received, preferably snugly, between the lateral projections 20 and lateral shoulders 22 so as to prevent ready axial movement of the plastic housing 12 relative to panel 16 as can be visualized from FIGURES 3 through 5. Due to the resilient yieldability of the material from which the housing 12 is formed, the lateral shoulders 22 are rather easily displaceable or deformable when pushing the housing 12 axially into the aperture 14 of the panel 16. When the housing 12 is fully inserted in the aperture, the lateral shoulders 22 readily and quickly are restored to the normal position such as shown in FIGURE 4, which is the locked position thereof.

The terminal unit 10 also comprises a terminal conductor 24 which is not to be confused with the line conductors referred to hereinafter and which is formed conveniently from suitable metal such as rolled brass, Phosphor-bronze, or the like, so as to be resilient. Such terminal conductors are inexpensively formed by automatic stamping machines and, depending upon whether or not line conductors or leads therefrom are to be permanently or detachably connected thereto, the conductors 24 may either be pre-formed with an electrical contact 26 extending transversely from one end thereof or the contact portion of the conductor 24 may be formed initially substantially within the same plane as the conductor until the contact portion 26 thereof has been inserted through an opening 28, which extends axially through the housing 12, and the contact 26 then is bent transversely preferably at an acute angle to the conductor 24. The outer end of the contact 26 preferably is shaped to form a suitable contact foot 30 for engagement with circuit means on one surface of the panel 16, details of which circuit means are set forth hereinafter.

In the specific embodiment of the invention shown in FIGURES 1 through 6, the electrical conductor 24 is of the type which may be pre-formed with a transversely extending contact 26, if desired, in that the opposite end 32 from the contact end of the terminal conductor is arranged to be connected detachably to line conductor means leading to and from a source of electric current. For example, the end 32 comprises a tab having an aperture 34 therein which conveniently may receive a dimple 36 formed in one wall of a socket 38 which slidably receives the tab 32 with a relatively tight frictional fit. The socket 38 is connected by crimped ears 40 or the like to a line conductor or lead such as a conventional wire which may be solid, stranded, or braided and usually insulated on the exterior. If desired, the socket 38 may be covered by suitable insulation means such as a molded shroud of insulating material to render the connection shock-resistant during application and also to prevent short-circuiting as in the event of displaced wires.

In this embodiment of the invention, the terminal conductor 24 is positioned longitudinally within the opening

5

28 preferably by flexible positioning means comprising tongues 42 and 44 which are struck from the sheet metal from which the conductor 24 is formed and respectively engage opposite sides of a projection 46 as shown in FIGURE 5 for example. Particularly if the conductor 24 is pre-formed to the shape shown in FIGURE 6, the tab 32 may be inserted endwise into the upper end of the opening 28 and when the tongue 44 engages projection 46, the tongue 44 will be flexed and cammed past the projection 46 until the tongue 42 engages the upper surface of the projection, whereupon the lower tongue 44 snaps past the projection 46 and engages the lower surface thereof to securely position the conductor within the opening 28. Such positioning of the conductor within the opening 28 takes place preferably before the assembled terminal unit is mounted within the aperture 14 in the panel 16.

Initially the contact 26 extends at an acute angle to the conduit 24 as shown in phantom in FIGURE 3. The foot 30 is shown in phantom in FIGURE 3 as just engaging the upper surface of panel 16. Upon depression of the assembled terminal unit 10 from the phantom position to the full line position shown in FIGURE 3 however, the contact 26 is flexed so as to place the foot 30 thereof in even more firm engagement with the circuitry on the panel or upon the panel 16 per se. The locked arrangement of the conductor 24 relative to the insulating plastic housing 12, and the interlocking of the shoulders 22 with the lower surface of the panel 16 insures the firm engagement of the foot 30 of contact 26 with the panel 16 or circuitry thereon. To facilitate the temporary deformation of the housing 12 when inserting it within aperture 14, the housing may advantageously be provided with one or more additional axial openings 31 of suitable cross-sectional area, as shown in FIGURE 3.

The cross-sectional dimensions of the conductor 24 are selected to be adequate to carry the amount of current to be conducted thereby. Further, the cross-sectional dimensions of the opening 28 preferably are selected so as to firmly and frictionally engage the conductor 24 even if locking and positioning means, such as tongues 42 and 44, are not employed. The cross-sectional dimension of the portion of the plastic housing 12 which is disposed within the aperture 14 of the panel 16 also preferably is slightly greater initially than the dimensions of the aperture 14, whereby when the housing 12 is mounted within said aperture, said housing will be placed under compression in frictional engagement with the walls of the aperture of the panel and thus will more firmly grip the conductor 24 subsequent to insertion of the terminal unit within the aperture 14. If preferred, the conductor 24 may be arcuate in cross-section not only to stiffen the same but also afford a multi-surface contact with the interior of opening 28 whether there is otherwise a snug fit therewith or not.

Another advantage of the present invention resides in the fact that the upper end of the housing 12 projects above the contact 26 as is evident particularly from FIGURES 1 and 3, whereby the upper surface 48 of the housing 12 may be engaged by the human finger or thumb, or by suitable tools with which to push the assembled terminal unit into the aperture 14 of the circuit panel 16. Such an arrangement will prevent injury to or mis-shaping of the contact 26 during such operation. Further, contact 26 otherwise will be protected against injury from other elements or items which may be placed upon the upper surface 48 of the housing 12, after the units have been connected thereto.

Referring particularly to FIGURE 2, it will be seen that the aperture 14, though generally circular in plan view, preferably is provided with a plurality of constricting surfaces, such as a pair of opposing, parallel side portions of flats 50 which are merely exemplary of various outline patterns which could be used, thus affording suitable areas to be abutted by the lateral shoulders 22 of

6

housing 12 when the terminal unit is pushed axially through the aperture 14 into final position relative to panel 16 as shown in full lines in FIGURE 3. Further, the aperture 14 may be provided adjacent the edge 52 of panel 16 and an opening 54 may be formed through said edge to communicate with the aperture 14, whereby the aperture 14 then actually comprises a notch through which electrical conductors either permanently or detachably connected to the terminal conductor 24 may be moved laterally through the opening 54 prior to axial insertion of the terminal unit into the aperture 14, thereby eliminating the need for completely threading the line conductors or leads through the aperture 14, hence resulting in great saving of time of assembly and injury to insulation.

In the embodiment of the invention illustrated in FIGURES 1 through 6, it is assumed that the panel 16 is a sheet of metal to which a carrier layer 56, comprising resin, ceramic material, or the like, is firmly affixed, said layer being impregnated with material, such as phosphors, capable of fluorescing when an adequate electrical field is imposed upon or through said layer of resin in accordance with principles employed in producing electro-luminescence. Superimposed upon the upper surface of the resin layer 56 is a layer 58 of current conducting material such as tin chloride or a thin aluminum coating of film. It is assumed that the terminal unit 10 shown in FIGURE 1, for example, is to be connected to metallic base panel 16 which is not connected to a common ground, whereby an opening 60 is formed in the resin layer 56 and conductor layer 58 so that the foot 30 of contact 26 of the terminal unit directly and firmly engages the upper surface of the metallic panel 16. Where panel 16 is connected to a common ground, no terminal unit will be required for such side of the circuit. It also will be understood, of course, that the same terminal unit may be utilized to contact the upper electrical conductor layer or sheet 58 by directly engaging the same, in which instance the opening 60 will not be employed unless, for example, a protective coating covers the conductive layer 58, in which event an opening is required in such coating.

Although the specific illustrations of the laminated panel arrangements in the embodiment 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.

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:

A panel having electric circuit means thereon and an aperture extending therethrough, in combination with a terminal unit comprising a molded insulating housing member of resiliently deformable material and having an opening extending axially therethrough and perimetricaly within the outline of said member, a substantially flat electrical terminal conductor extending longitudinally through said opening in said insulating member and having a resilient contact on one end extending laterally thereto and means on the other end connectable to a supply of current, said insulating member having in its relaxed state a securing portion of greater cross-section than the transverse dimension of said aperture and having an internal dimension approximating the thickness of said conductor, the said member being inserted through said aperture to compress said member against said flat conductor normally to the plane thereof and position said

unit operatively and firmly relative to said panel and thereby place said contact under tension and in firm engagement with said circuit means carried by said panel.

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