

[54] ELECTRICAL TERMINAL

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P, 258 T, 259 R, 259 F, 217 J

[56]

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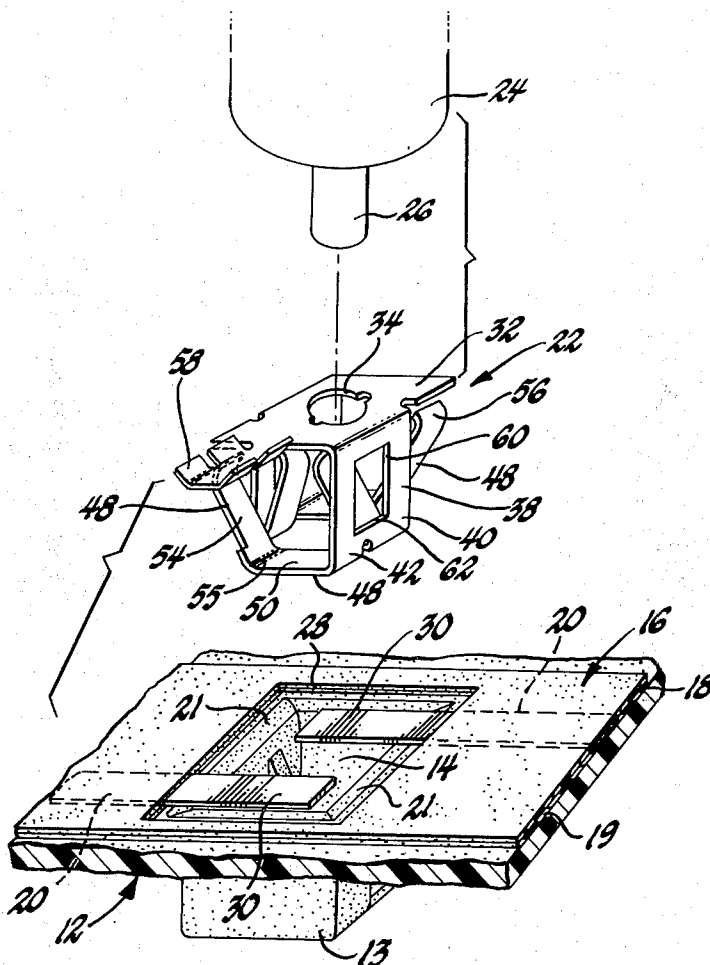
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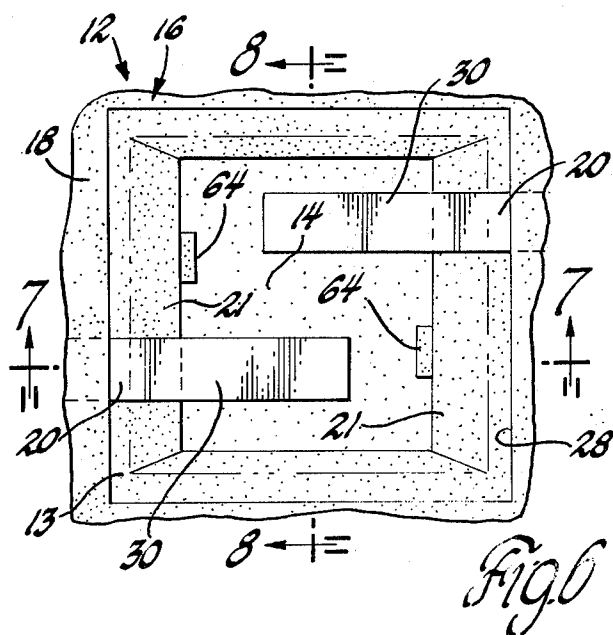
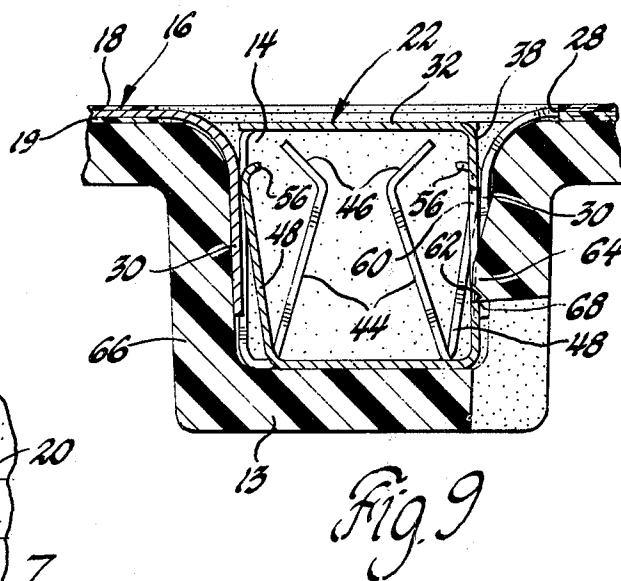
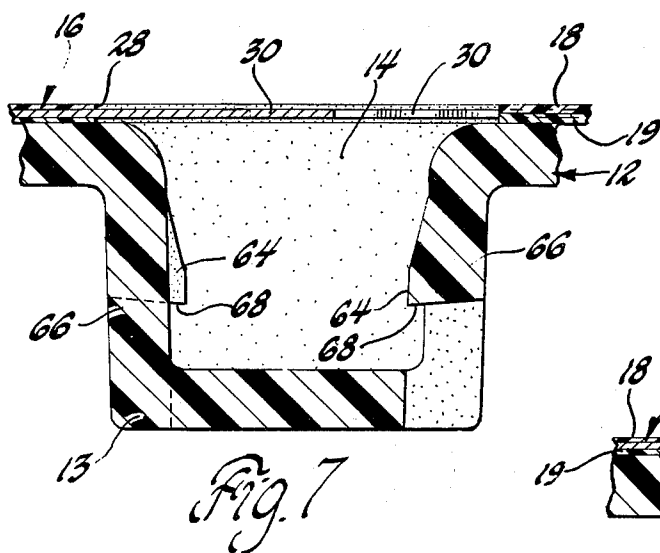
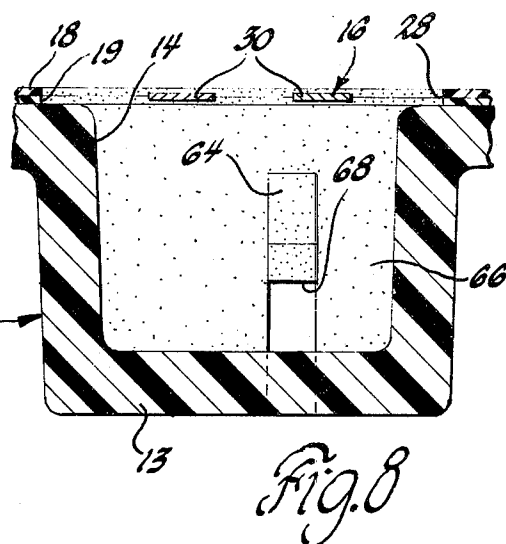
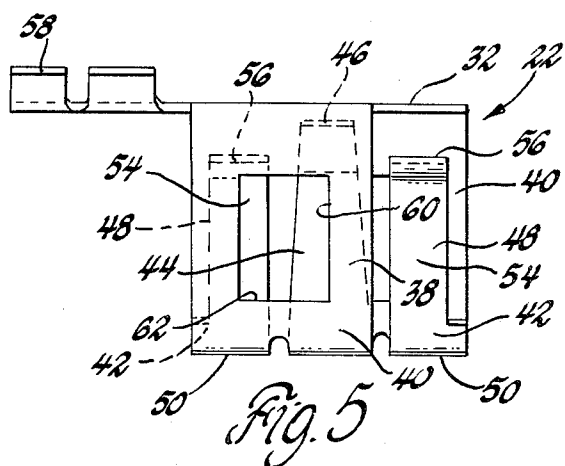
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ABSTRACT

An instrument panel assembly includes an electrical terminal which secures a flexible printed circuit to the instrument panel and mounts an electrical apparatus on the instrument panel. The terminal is of unitary sheet metal construction and has a first pair of aligned spring arms biasingly engaging a stud terminal of the electrical apparatus. The terminal is disposed in a cavity in the support panel and has a second pair of diagonally spaced spring arms which respectively bias offset overhanging strip end portions of the printed circuit wiped into the cavity.

8 Claims, 9 Drawing Figures





ELECTRICAL TERMINAL

This invention relates generally to electrical terminals and more particularly to electrical terminals for printed circuits.

In the past, various lights, indicators and gauges mounted on automotive instrument panels have been powered via one or more wiring harnesses comprising bundles of insulated coded lead wires with terminals connected to the various gauges, lights and indicators. More recently, it has been proposed to reduce the complexity and number of wiring harnesses with either hardboard printed circuits comprising a plurality of flat conductor strips carried on a rigid self-supporting substructure or flexible printed circuits comprising a plurality of flat conductor strips sandwiched between two thin bonded sheets of flexible insulating material.

A known technique for making electrical contact with the flat conductor strips at least insofar as hardboard printed circuits are concerned is by use of a terminal which wipes an overhanging conductor strip end into a cavity in the rigid self-supporting substructure upon insertion of the terminal into the cavity.

An object of my invention is to provide a terminal of unitary sheet metal for wiping an overhanging conductor strip end into a cavity of a rigid self-supporting substructure, such as an instrument panel, and providing a means for mounting a light, indicator, gauge or the like thereon in electrical connection with the conductor strip.

Another object of my invention is to provide a unitary sheet metal terminal which is adapted for retention in a cavity of an instrument panel or the like to receive a male terminal of a gauge or the like and which has at least one spring arm of maximized flexibility for biased engagement with the end of a conductor strip wiped down into the cavity.

Yet another object of my invention is to provide a unitary sheet metal terminal of the wipe-in type which may be inserted into a front opening cavity of an instrument panel or the like and thereafter receive a male terminal inserted into the front opening.

Still yet another object of my invention is to provide a terminal of unitary sheet metal construction which may be used to secure a flexible printed circuit to an instrument panel or the like and provide a means for mounting a gauge or other electrical apparatus on the instrument panel in electrical connection with the flexible printed circuit.

The exact nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawings in which:

FIG. 1 is an exploded perspective view of an instrument panel assembly employing a terminal in accordance with my invention.

FIG. 2 is a plan view of a flat sheet metal blank which may be used to form the terminal shown in FIG. 1.

FIG. 3 is a plan view of the terminal shown in FIG. 1.

FIG. 4 is a front view of the terminal shown in FIG. 3.

FIG. 5 is a side view of the terminal shown in FIGS. 3 and 4.

FIG. 6 is a fragmentary plan view of the instrument panel and flexible printed circuit shown in FIG. 1.

FIG. 7 is a section taken along the line 7—7 of FIG. 6.

FIG. 8 is a section taken along the line 8—8 of FIG. 6.

FIG. 9 is a section similar to FIG. 7 showing the terminal of FIGS. 3, 4 and 5 connected to the instrument panel and securing the flexible printed circuit thereto. The terminal is sectioned in substantially the same plane as the instrument panel and flexible printed circuit.

Referring to the drawing and more particularly to FIG. 1, an instrument panel 12 or like support of rigid molded plastic material has a box-like rear protrusion 13 providing a rectangularly shaped terminal receiving cavity 14 opening to the front of the instrument panel. A flexible printed circuit 16 comprises two thin sheets 18 and 19 of a generally flexible material, such as a polyester, of a few thousandths thickness bonded together to hold a plurality of flat thin conductor strips 20 of copper or other suitable conducting material in a predetermined circuit pattern. The flexible printed circuit 16 is secured to the front of the instrument panel 12 by a terminal 22 which makes an electrical connection between the flexible printed circuit 16 and an electrical apparatus 24 (such as a light, indicator or gauge) which in this particular instance has a pin terminal 26 received by the terminal 22. More particularly, the flexible printed circuit 16 has a hole 28 preferably slightly larger than the outline of the cavity 14 cut through the thin sheets 18 and 19 exposing the ends 30 of the offset flat thin conductor strips 20. The hole 28 is aligned with the cavity 14 so that the ends 30 of the conductor strips 20 overhang the edges 21 of the cavity 14 which are preferably rounded. When the terminal 22 is pushed into the cavity 14 through the hole 28, the ends 30 of the conductor strips 20 are wiped down into the cavity 14 securing the flexible printed circuit 16 to the instrument panel 12. In its operative position the terminal 22 also provides a conductive path between the offset conductor strips 20 and consequently a means for electrically connecting the electrical apparatus 24 to the flexible printed circuit 16 when the pin terminal 26 is plugged into the terminal 22.

Referring now additionally to FIGS. 2, 3, 4 and 5, the terminal 22 is of unitary sheet metal construction and comprises a flat rectangular body portion 32 having a central aperture 34. As best illustrated in FIGS. 1 and 3, the central aperture 34 is generally circular and preferably includes diametrically opposed slot portions 36 adapting the terminal to receive blade terminals as well as the pin terminal 26 illustrated in FIG. 1.

The unitary sheet metal terminal 22 further includes two identical side pieces 38 bent downwardly from the opposite side edges of the flat body portion 32. The side pieces 38 while identical are laterally offset to provide first portions 40 aligned with each other and the central aperture 34 as well as second portions 42 which are diagonally spaced from each other. The aligned first portions 40 of the side pieces have a first pair of spring arms 44 bent upwardly from their lower edges. The spring arms 44 extend upwardly toward the body portion 32 and inwardly toward each other as best shown in FIG. 4 so that a portion of the spring arms 44 underlie the central aperture 34 of the body portion 32 to biasingly engage the pin terminal 26 when it is inserted through the aperture 34. The spring arms 44 may have diverging free end portions 46 to prevent injury to the spring arms 44 and guide the pin terminal 26 into operative position between the spring arms 44.

A second pair of spring arms 48 are bent from the lower ends of the diagonally spaced second portions 42. The spring arms 48 comprise bridge portions 50 extending from the lower end of the respective side pieces 42 in a coplanar, parallel fashion across the mid plane 52 of the terminal to a location inwardly of the opposite side piece. The second spring arms 48 further include diverging portions 54 connected to the bridge portions 50 by obtuse bends 55 providing a rounded exterior surface for initially engaging the conductor strip ends 30 and sliding therealong during wipe-in. The diverging portions 54 extend upwardly toward the body portion 32 and diverge outwardly away from each other to locations outwardly of the side pieces 38 in the free unflexed state of the terminal as best shown in FIG. 4. Preferably the diverging portions 54 are slightly narrower to space their outer edges inwardly of the outer edges of the bridge portions 50 and obtuse bends 55 and thus reduce the effects of side forces on the spring arms during assembly. The free ends 56 of the diverging portions may be bent inwardly to provide a smooth surface for holding the conductor strips in a wiped-in position in the instrument panel cavity 14 as shown in FIG. 9.

The terminal 22 may also include a ferrule portion 58 extending from the body portion 32 for connecting the terminal 22 to a lead wire in a conventional manner thus adapting the terminal 22 for multiplicity of uses, such as a primary or secondary power input to the flexible printed circuit or a power output from the flexible printed circuit.

The side pieces 38 also have rectangularly shaped holes 60 which provide upwardly facing retention edges 62 for securing the terminal to the instrument panel 12.

As mentioned previously the terminal 22 secures the printed circuit 16 to the instrument panel 12 while establishing a conductive path between the offset strip conductor 20 by a simple plug-in operation. More particularly the flexible printed circuit 16 is placed on the instrument panel 12 with the hole 28 aligned with the cavity 14. The terminal 22 is then inserted into the cavity 14 through the hole 28 lower end first. As the terminal is shown inserted into the cavity 14, the diverging portions 54 of the second pair of spring arms 48 engage the overhanging conductor strip ends 30 and wipe them downwardly into the cavity to the position shown in FIG. 9 where the conductor strip ends 30 are biasingly engaged by the spring arms 48. The cavity 14 has ramp latches 64 protruding from the opposite side walls 66 which are preferably slotted below the ramp latches to facilitate molding. The ramp latches 64 are laterally offset for disposition in the respective laterally offset holes 60 of the side pieces 38 and have lower transverse faces 68 for engaging upwardly facing retention edges 62 of the holes 60 to retain the lower portion of the terminal 22 in the cavity 14. The terminal 22 thus retained secures the flexible printed circuit 16 to the instrument panel and is ready for assembly of the electrical apparatus 24 which may then be simply plugged into the terminal by inserting the pin terminal 26 into the central aperture 34 for biased gripping engagement by the resilient arms 44. The side pieces 38 are substantially more rigid than the flexible pair of arms 48 in the lateral direction perpendicular to their minimum thickness while the spring arms 44 themselves are substantially more rigid in a lateral direction parallel to their

minimum thickness. Thus the terminal 22 is sufficiently rigid to withstand significant lateral forces which may be imposed by plugging in the electrical apparatus.

At the same time, the spring arms 48 have a nearly maximum length in relation to the size of the terminal in a plane perpendicular to the center plane 52 and thus the spring arms 48 have nearly maximum deflection characteristics for gently wiping-in the conductor strip ends 30 and biasingly engaging them with forces sufficient to insure good electrical contact but not so great as to permanently deform the wiped-in conductor strip ends 30. While most of the inward deflections are attributable to the diverging portions 54 of the spring arms 48, the inward deflection is enhanced by the cantilevered bridge portions 50 and the obtuse bend between the bridge portions 50 and the diverging portions 54.

As mentioned previously, terminal 22 is of unitary sheet metal construction. FIG. 2 shows a flat sheet metal stamping 22b from which the terminal 22 may be constructed by bending various portions of the stamping. Portions of the stamping corresponding to portions of the completed terminal 22 are identified with corresponding numerals with those of the stamping also having the letter designation b.

While the terminal 22 has been illustrated in conjunction with a flexible printed circuit, it may also be used in conjunction with a hardboard printed circuit with substantially the same benefits. Further, in some applications, the ferrule 58 or one of the spring arms 48, or both, might not be necessary. In other words, I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

What is claimed is:

1. A unitary sheet metal terminal for wiping an overhanging conductor strip and a printed circuit into a cavity of a rigid support panel, comprising:
 - a generally rectangular body portion having a central aperture,
 - a pair of side pieces depending downwardly from opposite side edges of said body portion for engaging opposite side walls of the cavity,
 - said pair of side pieces having first portions aligned with each other and the central aperture in said body portion, at least one of said side pieces having a second portion laterally offset from another of the side pieces,
 - first spring arms extending upwardly from lower ends of said first portions toward said body portion and inwardly toward each other, said first spring arms having portions underlying said central aperture whereby said first spring arms are adapted to biasingly engage a male terminal inserted down through said central aperture, and
 - a second spring arm extending from a lower end of said second portion, said second spring arm having a diverging portion extending upwardly toward said body portion and diverging away from said second portion to a location adjacent said other side piece whereby said last mentioned portion is adapted to wipe a flexible conductor strip overhanging a cavity down into the cavity and biasingly engage the same therein when the side pieces of the terminal are inserted into the cavity of said support panel for engagement with opposite side walls of the cavity.

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2. The terminal as defined in claim 1 wherein said side pieces have upwardly facing retention edges spaced from said body portion for retaining the side pieces in the cavity of the support panel.

3. The terminal as defined in claim 1 further including an integral ferrule portion extending from said body portion for connecting a lead wire to the terminal.

4. A unitary sheet metal terminal for wiping an overhanging conductor strip end of a printed circuit into a cavity of a rigid support panel, comprising:

a generally rectangular flat body portion having a central aperture,

a pair of side pieces depending downwardly from opposite side edges of said body portion for engaging opposite side walls of the cavity,

said pair of side pieces being laterally offset from each other to provide first portions aligned with each other and the central aperture in said body portion and second portions diagonally spaced from each other,

first spring arms extending upwardly from lower ends of said first portions toward said body portion and inwardly toward each other, said first spring arms having portions underlying said central aperture whereby said first spring arms are adapted to biasingly engage a male terminal inserted down through said central aperture, and

second spring arms extending from lower ends of said second portions across a mid plane of the terminal, said second spring arms having diverging portions extending upwardly toward said body portion and diverging outwardly away from each other to locations outwardly of said side pieces when said second spring arms are in a free unflexed state whereby said diverging portions are adapted to wipe laterally offset flexible conductor strips overhanging a cavity down into the cavity and biasingly engage the same therein when the side pieces of the terminal are inserted into the cavity of said support panel for engagement with the opposite side walls of the cavity.

5. The terminal as defined in claim 4 wherein said side pieces have apertures providing upwardly facing retention edges for engaging cooperative downwardly facing latch surfaces in the cavity of the support panel to retain said side pieces of the terminal therein.

6. The terminal as defined in claim 5 further including an integral ferrule portion extending from said body

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portion for connecting a lead wire to the terminal.

7. A unitary sheet metal terminal for securing a flexible printed circuit to a support panel which flexible printed circuit has a hole aligned with a cavity in the support panel and flexible conductor strips overhanging the cavity of the support panel, comprising:

a generally rectangular flat body portion having a central aperture,

a pair of planar, substantially parallel side pieces depending downwardly from opposite side edges of said body portion,

said pair of side pieces being laterally offset from each other to provide first portions aligned with each other and the central aperture in said body portion and second portions diagonally spaced from each other.

first spring arms extending upwardly from lower ends of said first portions toward said body portion and inwardly toward each other, said first spring arms having portions underlying said central aperture whereby said first spring arms are adapted to biasingly engage a male terminal inserted down through said central aperture, and

second spring arms having substantially coplanar bridge portions extending from lower ends of said second portions across a mid plane of the terminal and diverging portions connected thereto by obtuse bends inward of said side pieces, said diverging portions extending upwardly from said bridge portions toward said body portion and diverging outwardly away from each other to locations outwardly of said side pieces when said second spring arms are in a free unflexed state whereby said diverging portions are adapted to wipe laterally offset flexible conductor strips overhanging a cavity down into the cavity and biasingly engage the same therein when the side pieces of the terminal are inserted into the cavity of said support panel and the aligned hole of said flexible printed circuit for engagement with the opposite side walls of the cavity, said planar side pieces having apertures providing retention edges for engaging cooperative upwardly facing latch surfaces in the cavity of the support panel to retain the planar side pieces therein.

8. The terminal as defined in claim 7 further including an integral ferrule portion extending from said body portion for connecting a lead wire to the terminal.

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