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3,541,226

ELECTRICAL CONNECTOR FOR TERMINATING MULTILAYER CONDUCTIVE
FOIL AND CORRUGATED INSULATION THEREFOR

Filed Dec. 2, 1968

2 Sheets-Sheet 1

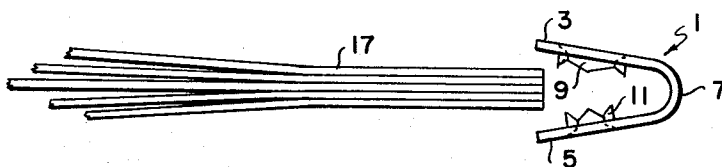


FIG. 1.

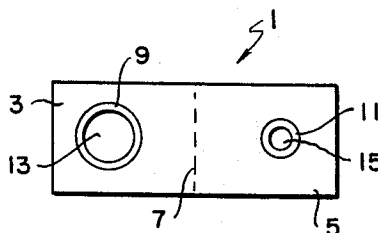


FIG. 2.

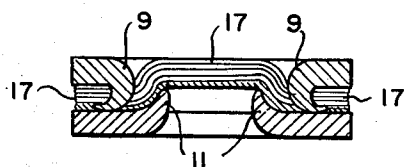


FIG. 3.

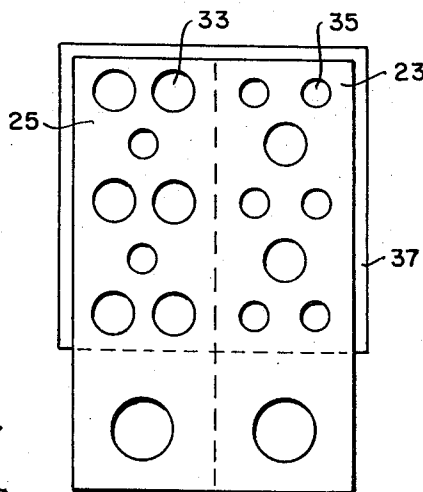


FIG. 4.

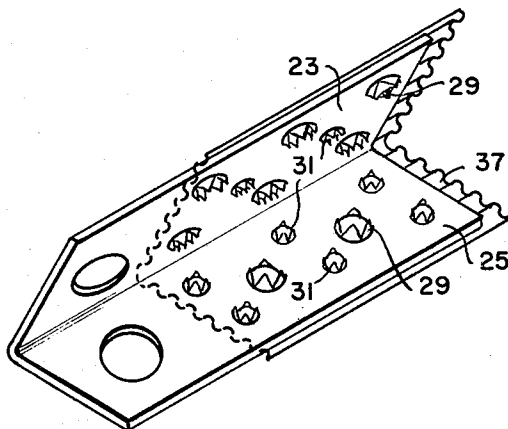


FIG. 5.

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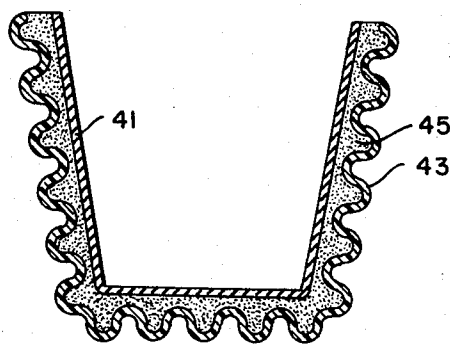


FIG. 6.

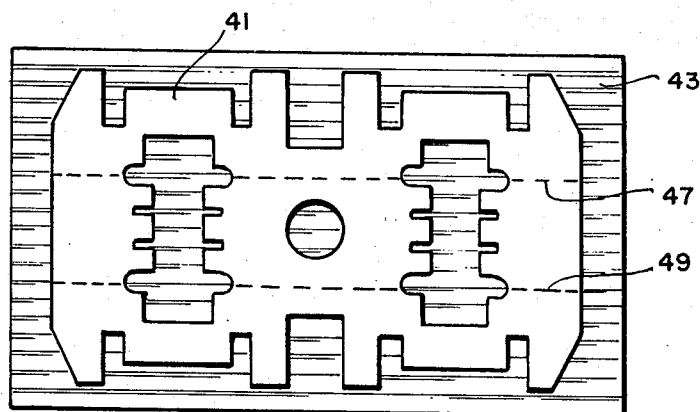


FIG. 7.

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ELECTRICAL CONNECTOR FOR TERMINATING MULTILAYER CONDUCTIVE FOIL AND CORRUGATED INSULATION THEREFOR

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12 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure relates to an electrical connector for terminating a multilayer conductive foil, a corrugated insulator and the use of a corrugated insulator in conjunction with an electrical connector or termination. The electrical connector or termination is formed from a flat blade which is bent over at its center portion to form two side portions, each forming an acute angle with the other. Each of the side portions includes tangs therein, the tangs on one side portion mating with the other, the mating tangs being of different diameter wherein one of the tangs will fit directly within the opposing tang on the opposite side. In use, the foil layers are positioned between the two sides of the acute angle formed by the terminal sides and a crimping action takes place. The larger tangs pierce and scrape oxides from the foil members and their ends become riveted against the surface of the opposing side. The smaller tangs pierce the underlayers of the laminated foil and press outwardly to provide tight engagement with the foil. The insulator includes a corrugated outer portion which is secured to the connector member by an adhesive. The corrugations flatten out during crimping at points of stress to avoid any weakening of regions which might be stretched during the crimping action.

The invention relates to an electrical connector for terminating multiple layers of conductive foil, a corrugated insulator and the use of a corrugated insulator in combination with a crimpable connector.

The extensive use of electrically conductive foil or very thin sheet metal members (e.g., aluminum) as an electrical conductor for electronic and miniature components has been complicated in the past by the difficulty in joining the foil to other electrical conductors. Because of the fragile nature of the foil, securing of the foil to a wire or a component tends to either tear the foil or make an imperfect electrical and/or mechanical connection. The prior art has attempted to overcome this problem and has made many advances therein as exemplified by patents to Weimer, 3,138,658 and 3,247,316. While these prior art devices have found great use, it is always desirable and necessary to improve electrical termination devices and especially such devices for use with multiple layer foils. In some cases, it is desirable to terminate many layers of thin conductive foil to a single terminal member. This is difficult to accomplish with the above noted prior art connectors because individual laminates have a tendency to shift laterally of each other during and after the terminating procedure. This usually results in a poor and uncertain termination.

Briefly, there is provided an electrical connector which provides good electrical termination for use with multiple layers of thin conductive foil and which includes tangs

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on both sides of a folded blade, the tangs on each side of the blade mating with tangs opposed thereto on the other side of the blade. Mating tangs are of different size wherein one of the tangs is capable of fitting within the other to form the desired electrical termination as is explained in more detail hereinbelow.

Prior art insulation materials have suffered the problem of being weakened at points of stress after crimping. This problem takes place in those areas of the insulation material which have been exposed to maximum stretching effect.

In accordance with the present invention, the problems incurred in prior art insulation for use with crimpable terminations is overcome by the use of a corrugated insulation member which is secured to the crimpable terminal by means of an adhesive. Upon crimping, the corrugations will flatten out but will leave no points of weakness through which short circuits and the like can take place.

It is therefore an object of the present invention to provide a foil terminal for use with a multilayer foil having pyramidal tangs or ears for penetrating the foil laminates.

It is a further object of this invention to provide a termination for a multilayer foil having opposed tangs capable of penetrating the foil and of different size wherein the opposed tangs can fit one within the other.

It is a yet further object of this invention to provide an insulating material which will overcome the weakening effect on the dielectric strength of the insulation material when it is stretched after crimping.

It is a still further object of this invention to provide an insulating material which will retain its bonding to the metal connector or termination after the connector has been crimped.

The above objects and still further objects of the invention will become readily apparent to those skilled in the art after consideration of the following disclosure of preferred embodiments of the invention which are provided by way of example and not by way of limitation wherein:

FIG. 1 is an elevational view of a connector in accordance with the present invention with a multilayer conductive foil adjacent thereto for later termination;

FIG. 2 is a top view of the connector of FIG. 1 in its flat stamped stage;

FIG. 3 is an enlarged view in section through a termination after the connector member of FIG. 1 has been crimped over the multilayer conductive foil;

FIG. 4 is a top view of a second embodiment of a connector in accordance with the present invention with a corrugated insulation thereon;

FIG. 5 is an elevational view of the connector of FIG. 4;

FIG. 6 is an end view of a connector having the corrugated insulating material of the present invention bonded thereto; and

FIG. 7 is a top view of the connector of FIG. 6 in its flat stamped stage with the corrugated insulation secured thereto.

Referring now to FIGS. 1 and 2, there is shown a first embodiment of the terminal or connector in accordance with the present invention. The terminal 1 includes a pair of sides 3 and 5 which are bent around and folded partially at the fold 7. The side 3 has an inwardly directed tang 9 and the side 5 has an upwardly directed tang 11 which is smaller in diameter than the tang 9 and is capable of fitting within the tang 9. The formation of the tangs leave perforations 13 and 15. Since the tang 9

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is of larger inside diameter than the tang 11, the tang 9 will be substantially longer than the tang 11. The tangs are positioned whereby, when the terminal is formed to a usable shape as shown in FIG. 1, the tang 9 will be disposed directly opposite the tang 11 so that they can mate with each other as stated hereinabove upon crimping.

In use, the layers of conductive foil are positioned within the terminal whereby the tangs are positioned above and below the multilayered conductive foil. A crimping action then takes place whereby the tangs pass against the laminate or multilayer conductive foil, one of the tangs piercing the foil and the other pressing thereagainst as described in more detail with regard to FIG. 3.

Referring now to FIG. 3, the sides of the terminal 1 are pressed onto the foil laminates 17 to form a sandwich-like structure with the foil disposed intermediately of the folded blade sides 3 and 5. The tang 9 pierces and scrapes oxides from all of the laminates 17 and its ends become riveted against a surface of the opposing side 5. Portions of the laminated foil become entrapped by the riveting action. During the pressing action, smaller tang 11 enters the perforation 13 (FIG. 2) and pushes the laminates 17 upwardly therein. The extreme end of tang 11 pierce the underlayers of the laminated foil 17 whereby the foil is then stretched across the tang 11. This arrangement holds the laminates in substantially tight engagement with each other and prevents their lateral movement. It can be seen from FIG. 3 that the tang 9 has completely pierced the multilayer conductive foil and rests against the opposing side member.

It is apparent from the above description that the action between the tangs and the multilayer foil, when the blade is flattened over against the foil and pressed down, causes the foil and the terminal to become securely engaged, both mechanically and electrically. If desired, a ferrule may be formed on the blade for terminating a lead wire to the foil or the blade may be extended from the tang sections and stud holes or perforations formed therein.

Referring now to FIGS. 4 and 5, there is shown a second embodiment of the invention wherein the termination includes a plurality of tangs in the opposing sides 23 and 25. The larger tangs are denoted as 29 whereas the smaller tangs which fit therein are denoted as 31. The perforations formed thereby are denoted 33 and 35. The termination of FIGS. 4 and 5 includes an additional feature of an insulating member 37 which is positioned on the external regions thereof. As shown in FIG. 5, the insulation 37 is corrugated and thereby provides advantages during crimping as will be described in greater detail hereinbelow.

The terminations of FIGS. 1 to 5 can be modified to provide end to end connection wherein the connector has capability of receiving flat conductors disposed on opposite sides thereof. The connector would then be cut lengthwise as shown in FIG. 2 but not entirely through the fold 7. The portions on opposite side of the cut would extend in opposite directions, each portion having inwardly extending tangs as above described. In this manner, two flat conductors can be connected together electrically with a single crimping step.

The terminations of FIGS. 1 to 5 can also be modified to receive a round wire by providing a ferrule portion similar to the ferrule portion 12 as shown in the patent to Weimer (3,138,658).

Referring now to FIG. 6, there is shown a cross section of an electrical termination 41 having a corrugated insulator thereon labeled 43. The corrugated insulator is secured to the metal termination by means of an adhesive 45. By using the corrugated insulator 43, a means is obtained for eliminating stress points and offering more contact area for adhesives when bonding the insulator to a metal connector. The corrugation permits the insulating material to move with the metal connector,

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thus eliminating stress points when the assembly is U shaped as shown in FIGS. 1 and 5 in particular. As the metal connector 41 takes on a different configuration, the corrugated portions of the insulator 43 tend to straighten out but do not break the adhesion to said metal connector 41 because of the additional adhesive material 45 between the insulator 43 and metal surface 41. For example, with reference to FIG. 7, crimping action of the connector known therein will take place on the score lines 47 and 49, thereby placing extreme stress on the outlying insulator 43. However, by use of the corrugated insulator of the present invention, the corrugations will merely flatten out rather than cause ruptures or weakened portions in the insulation through which short circuits and other undesirable problems may arise. The invention is therefore applicable to any pre-insulated connector wherein crimping pressure is to be applied through the insulating means.

Though the invention has been described with respect to certain preferred embodiments thereof, many variations and modifications thereof will immediately become apparent to those skilled in the art. It is therefore the intention that the appended claims be interpreted as broadly as possible in view of the prior art to include all such variations and modifications.

What is claimed is:

1. An insulated crimpable electrical connector, which comprises, a layer of adhesive material disposed on said connector and an insulating material secured to said adhesive material, said insulating material having a plurality of parallel grooves and ridges defining corrugations, whereby the corrugations of said insulating material will tend to flatten out without rupture when said connector is subjected to crimping.

2. An insulator as set forth in claim 1 wherein said adhesive material is resilient and capable of movement with said insulating material.

3. An insulator as set forth in claim 1 wherein said corrugations are positioned normal to the direction of stress in said connector due to crimping thereof.

4. An insulator as set forth in claim 2 wherein said corrugations are positioned normal to the direction of stress in said connector due to crimping thereof.

5. An electrical connector for making a connection between a connector and plural superposed foil conductors, said connector including a blade portion, said blade folded about a center line to form opposed surfaces adapted to receive the foil conductors therebetween, at least one aperture in one of the opposed surfaces, a first tang surrounding said aperture, said tang directed toward the other opposed surface, at least one aperture in said other opposed surface, a second tang surrounding said aperture in said other surface, said second tang being smaller in cross section than said first tang and fitting within said first tang, said foil conductors being adapted to be impaled upon said tangs so that at least one of said tangs scrapes and pierces said conductors to form an electrically conductive relationship between at least one tang and a conductor surface.

6. An electrical connector as set forth in claim 5, wherein each said surface includes a plurality of opposed tangs.

7. An electrical connector as set forth in claim 6 wherein the opposed pairs of tangs are of different cross section whereby one of an opposed pair of said tangs is adapted to fit within the other opposed tang.

8. An electrical connector as set forth in claim 7 wherein each of said surfaces includes tangs of different cross section.

9. An electrical connector as set forth in claim 5 further including, a layer of adhesive material disposed on said connector and an insulating material secured to said adhesive material, said insulating material having a plurality of parallel grooves and ridges defining corrugations

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whereby the corrugations of said insulating material will tend to flatten out without rupture when said connector is subjected to crimping.

10. An insulator as set forth in claim 9 wherein said adhesive material is resilient and capable of movement with said insulating material.

11. An insulator as set forth in claim 10 wherein said corrugations are positioned normal to the direction of stress in said connector due to crimping thereof.

12. An insulator as set forth in claim 9 wherein said corrugations are positioned normal to the direction of stress in said connector due to crimping thereof.

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DARRELL L. CLAY, Primary Examiner

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29—628; 174—94, 138; 339—95, 276