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A. J. COUTU ETAL

3,303,267

ELECTRICAL CONNECTOR FOR CLOSELY SPACED TERMINALS

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FIG. 1.

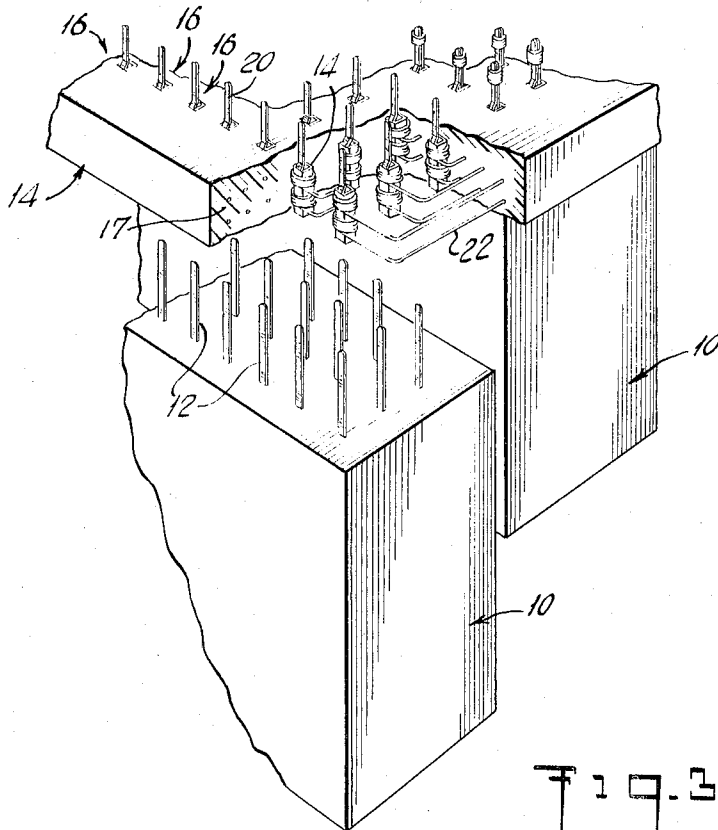


FIG. 3.

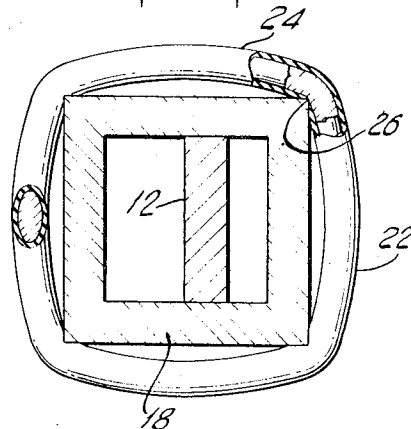
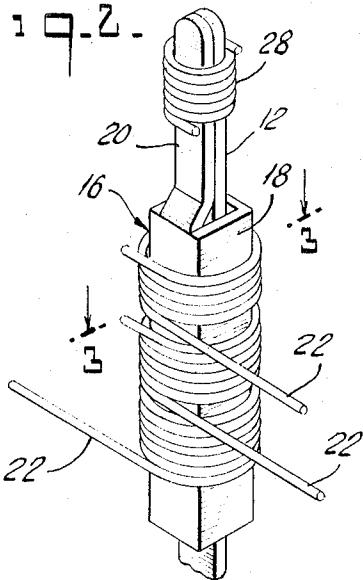


FIG. 2.



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1

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ELECTRICAL CONNECTOR FOR CLOSELY SPACED TERMINALS

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5 Claims. (Cl. 174—88)

This invention relates to electrical connectors in general and in particular, to an improved apparatus and method for making a connector of the type having a plurality of electrical conductors interconnecting the various terminals thereof in a predetermined circuit pattern.

The present invention is an improvement upon U.S. Letters Patent 3,083,261, having an assignee in common with the assignee of the present application. In the foregoing patent, the electrical interconnection of the various terminals of the connector was accomplished through the use of complex matrices of prewired insulating films which were secured by welding to the various terminal pins of the connector. The present invention eliminates the need for essentially all the welded connections and expensive insulating films required in the prior art as typified by this patent.

In accordance with the present invention, the interconnection between the various terminals of the connector is accomplished by spirally wrapping insulated conductors directly about the terminals. The conductors are insulation covered to prevent electrical shorting with adjacent wires. However the insulating film thereon is made sufficiently thin and penetrable so that it is ruptured by the sharp corner edges of the rectangular or polygonal terminal pins about which they are wrapped. In this way, the electrical interconnection between an insulated wire and a sharp edged terminal pin of the connector is automatically accomplished in the wrapping operation and the need for intricate welded prewired circuit assemblies is totally eliminated. Furthermore, there is no need to remove the insulation from the ends of the wire prior to wrapping. In addition, the winding operation may be performed by presently available hand operated power wrapping tools and is readily adaptable to presently used automated wire wrapping methods.

In fabricating the connector of the invention the terminal pins or sleeves are located for wire wrapping by means of a suitable positioning fixture such as one employing rectangular pins to engage the inner apertures of each of the sleeves. The appropriate interconnections are made, following standard wiring assembly diagrams. Thereafter, the completely wired assembly is encapsulated with a suitable potting compound such as an epoxy resin. The ends of each of the terminal sleeves are arranged to protrude from the encapsulated wiring module and may be connected to an associated electrical component by standard wrapped wire techniques such as shown in for instance U.S. Letters Patent 3,002,045, also having an assignee in common with the present application.

Accordingly, it is an object of the invention to provide a connector assembly formed of a multiplicity of electrically interconnected conductive sleeves.

Another object of the invention is to provide an improved method for interconnecting a multiplicity of electrical terminals of a connector.

A still further object of the invention is to provide an improved method for making a connector.

Another object of the invention is to provide a connector assembly incorporating insulated interterminal wiring which may readily be connected by means of a wire-

2

wrap technique, without the need for stripping the insulation from the wrapped ends of the wires.

These and other objects and advantages of the invention will become apparent and the invention will be fully understood from the following description and drawings in which:

FIG. 1 is an exploded perspective view of the invention in association with several modular electronic assemblies each having a plurality of terminal pins extending outwardly therefrom;

FIG. 2 is an enlarged perspective view of one of the terminal sleeves shown in FIG. 1; and

FIG. 3 is a cross sectional view taken along lines 3—3 of FIG. 2 illustrating the manner in which the wire wrapping operation is effective to electrically connect the conductor to the sleeve at the sharp edges of the sleeve.

Referring to the drawings in particular, the novel connector is shown in exploded fashion in FIG. 1. The connector is designed to electrically interconnect a multiplicity of spaced terminal pins 12, extending from a plurality of electrical units designated generally at 10. The electrical units or modules 10 contain a large number of electrical circuits employing transistors, resistors, etc. (not shown) which terminate in the terminal pins 12. These terminal pins require electrical interconnection with similar pins on adjacent electrical units to effect a completely operational device.

This module interconnection function is provided by a wiring module or connector assembly 14.

The connector assembly 14 includes a plurality of upstanding tubular sleeves, generally designated 16, held in place by the main body portion 17 of the assembly which may be made of a conventional encapsulating compound such as epoxy resin or the like. The sleeves 16 include an encapsulated lower body portion 18 which, in the embodiment shown is of rectangular cross section. It will be understood by those skilled in the art that any polygonal cross section is suitable for the purposes of this invention so long as sharp corners are provided which perform the function described in more detail hereafter. Each tubular sleeve 16 includes an upstanding terminal pin portion 20 which protrudes from the body of the connector assembly 14 and provides the means by which electrical connection is made between the connector assembly 14 and the associated electrical modules 10.

Referring more specifically to the manner in which the upstanding sleeves 16 are electrically interconnected in the desired predetermined manner, a plurality of conductor wires 22 are arranged to extend therebetween. Each of the conductors 22 carries a thin insulated covering 24 which preferably extends to the end of each of the conductors 22. When the end of the conductor 22 is wrapped in tension about the outside of the rectangular portion 18 of the sleeve, the cutting effect created by the sharp corners 26 thereof is adequate to penetrate or sever the insulated covering at that point. This severing of the insulation 24 by the corners 26 is effective to place the conductor 22 in electrical contact with the sleeve 16. Preferably the terminal end of each wire is wrapped about the sleeve for several turns. In the example shown an edge penetration will occur at each of the four corners of the portion 18 for each revolution of wrap. Accordingly, with the four or five turns shown in FIG. 2, 16 to 20 electrical connections will be made between each of the conductors 22 and its respective sleeve 16.

The method of manufacture of the connector assembly 14 includes a jig (not shown) having a plurality of upstanding pins. Each of the sleeves 16 is placed over its respective pin to thereby fixedly locate the pins in position prior to electrical interconnection. Thereafter, the conductors 22 are arranged in predetermined fashion accord-

3

ing to the desired electrical interconnection of the terminal sleeves 16, the ends of each of the conductors being wrapped in the aforementioned manner thereabout. Upon completion of the electrical interconnection of the sleeves 16, the body portion of the assembly, exclusive of the pins 20, is encapsulated in a suitable potting compound. After the hardening thereof, the assembly jig is removed to produce the completed connector assembly 14 as shown. In use, the male terminal pins 12 are inserted through the central aperture of its respective sleeve 16. Thereafter the upstanding terminal portion 20 of each of the sleeves may be electrically connected by means of a non-insulated wire-wrap connection 28 in accordance with the aforementioned U.S. Letters Patent 3,002,045.

Thus it can be seen how the use of the thin insulation covered wire may be used in a conventional wrapped wire technique to effect substantial economies in the production of a connector assembly of the type shown in U.S. Patent No. 3,083,261. The need for physically separating the interconnection wires 22 from adjacent wires 22 prior to encapsulation is completely eliminated due to the fact that they are insulated wires. Furthermore, the novel manner in which electrical connection between the wire and the rectangular cross section sleeve is made, eliminates the need to strip the ends of the insulated wires.

While one specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What I claim is:

1. An electrical connector for equipment having a plurality of substantially parallel terminal elements, comprising a body portion having an outer surface, a plurality of hollow terminal means each having an end portion extending outwardly from said surface of said body portion for substantial parallel alignment with respective ones of the terminal elements to be connected, each of said hollow terminal means having at least two longitudinal surfaces which meet at a sharp edge, connecting means including a plurality of electrically insulated conductor wires for selectively interconnecting said terminal means, each said wire having a plurality of turns wrapped in tension around one of said terminal means with the sharp edge of said terminal means penetrating the

4

insulation of said insulated conductor wire producing a rupture of said insulation at the point of contact with said sharp edge thereby causing said terminal means to make electrical contact with the conductor wire, said hollow terminal means being adapted to receive respectively in the hollow portions thereof said terminal elements for electrical connection of said terminal elements respectively to said hollow terminal means, said body portion including insulating material encapsulating said conductor wires and leaving said end portions of said terminal means exposed for said electrical connection respectively to said terminal elements.

2. An electrical connector according to claim 1, wherein said hollow terminal means are sleeves of rectangular cross-section.

3. The terminal means as recited in claim 2 wherein the number of electrical contact points between each of said sleeves and an associated conductor wire corresponds in number to the number of sharp edges on the respective sleeve multiplied by the number of turns of the wire around said sleeve.

4. The combination as recited in claim 1, including a plurality of electrical modules comprising an insulated surface portion, each of said terminal elements extending substantially perpendicularly through the surface portion and in alignment with said end portion of each of said terminal means of said connector, and means for securing said terminal elements to respective ones of said end portions of said terminal means when in engagement therewith.

5. The combination as recited in claim 4 wherein said last mentioned means comprises; a bare conductor wrapped in tension around each of said terminal elements when in engagement with said respective one of said extended portions of said terminal means.

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