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Shott et al.

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[45] **Apr. 1, 1975**

[54] **ELECTRICAL CABLE CONNECTING DEVICE**

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[73] Assignee: **International Business Machines Corporation,** Armonk, N.Y.

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[21] Appl. No.: **355,617**

[52] **U.S. Cl.** ..... **339/91 R,** 339/99 R, 339/185 R, 339/196 R, 339/206 P

[51] **Int. Cl.** **H01r 13/54,** H01r 11/20

[58] **Field of Search** 339/59–61, 339/91, 95, 97–99, 185, 196, 206, 207, 208, 210

[56] **References Cited**

UNITED STATES PATENTS

2,528,971	11/1950	Philips	339/196 A
2,587,239	2/1952	Smith	339/98
3,519,977	7/1970	Swearingen	339/185 R
3,760,338	9/1973	Bruels	339/196 M

FOREIGN PATENTS OR APPLICATIONS

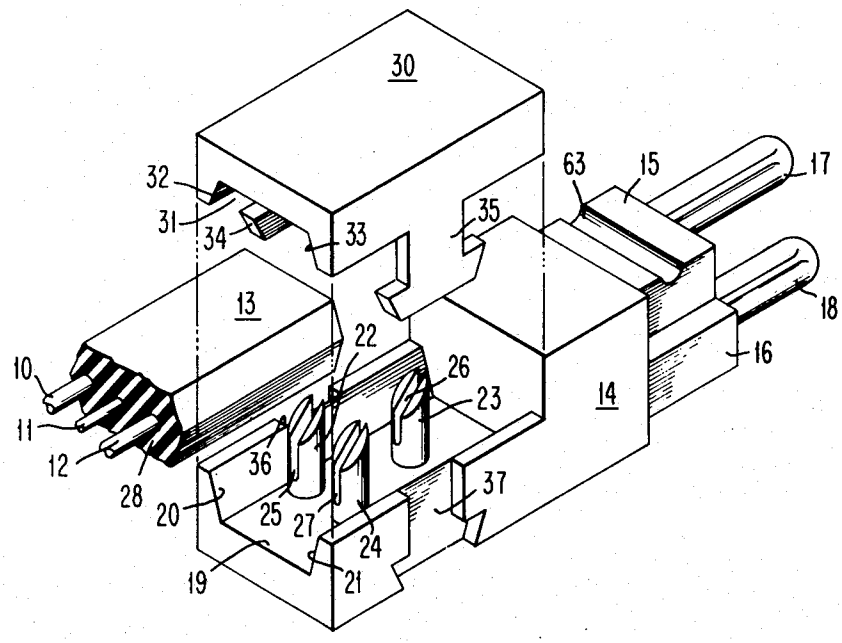
699,856	11/1953	United Kingdom	339/99 R
479,961	11/1969	Switzerland	339/97 R
508,583	2/1952	Belgium	339/99 R

Primary Examiner—Joseph H. McGlynn
Attorney, Agent, or Firm—Charles S. Neave

[57] **ABSTRACT**

An electrical connector plug assembly for terminating the conductor elements of a cable to enable disengageable electrical connection with other terminal means. The plug assembly comprises a molded connector housing having a pair of male type metal pins projecting from one end of the housing while the other end portion of the housing defines a cable-receiving channel. A set of combination insulation strippers and conductor connecting members are mounted in the cable-receiving channel of the housing. The insulation strippers are slotted and tapered in their upper portion and perform a wire insulation piercing and stripping function and make electrical contact with the conductor elements of the cable. Conductive members electrically couple the insulation strippers with the projecting pins. A cable-contacting cap member is adapted to overlie the cable receiving channel and is functionally operable to forceably press a cable into the cable-receiving channel wherein the insulation strippers remove the insulation and make electrical contact with the conducting elements of the cable. An actuator grouper member enables the ganging of the electrical connector plug assemblies thereby enabling multiple plug connecting and disengaging operations.

4 Claims, 11 Drawing Figures



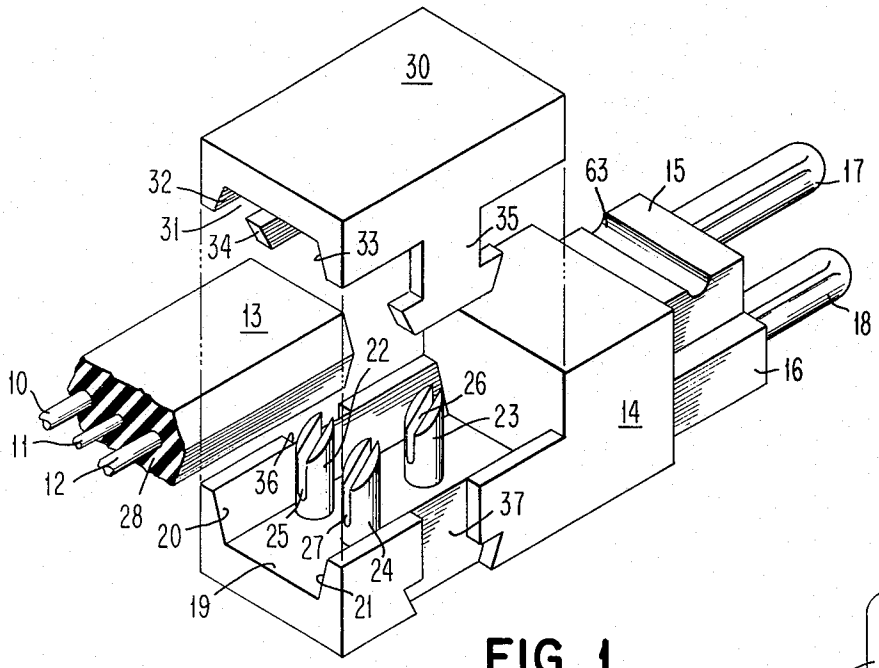


FIG. 1

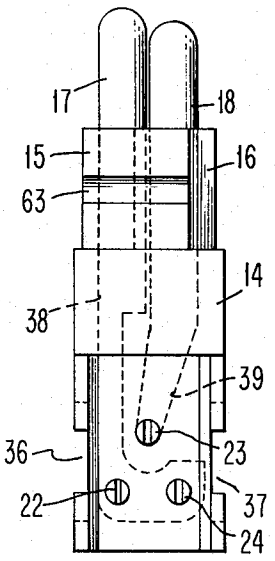


FIG. 2

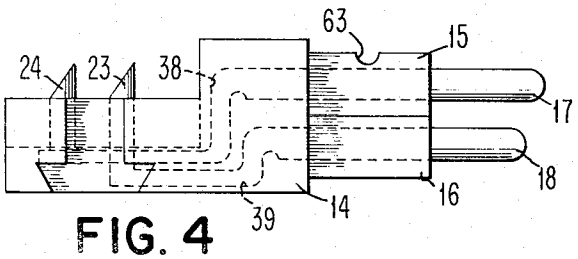


FIG. 4

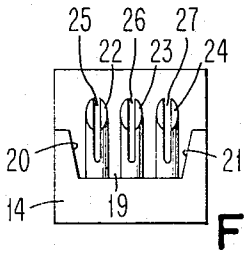


FIG. 3

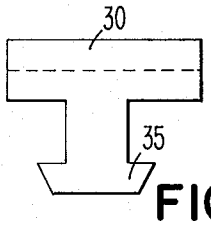


FIG. 6

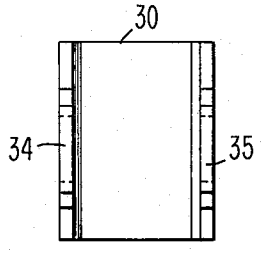


FIG. 7

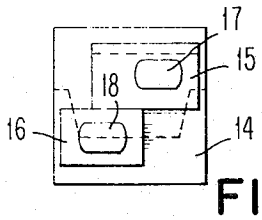


FIG. 5

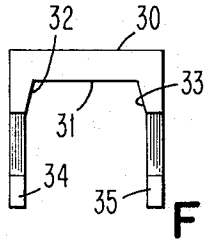


FIG. 8

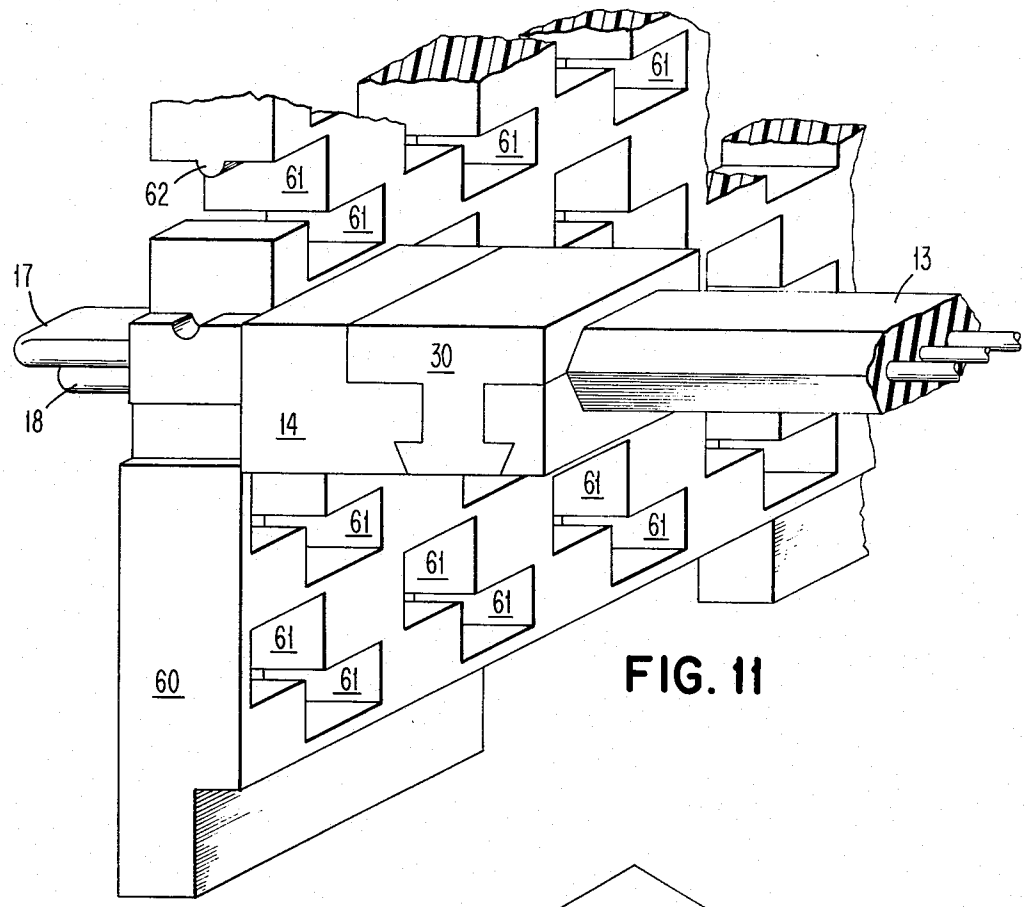


FIG. 11

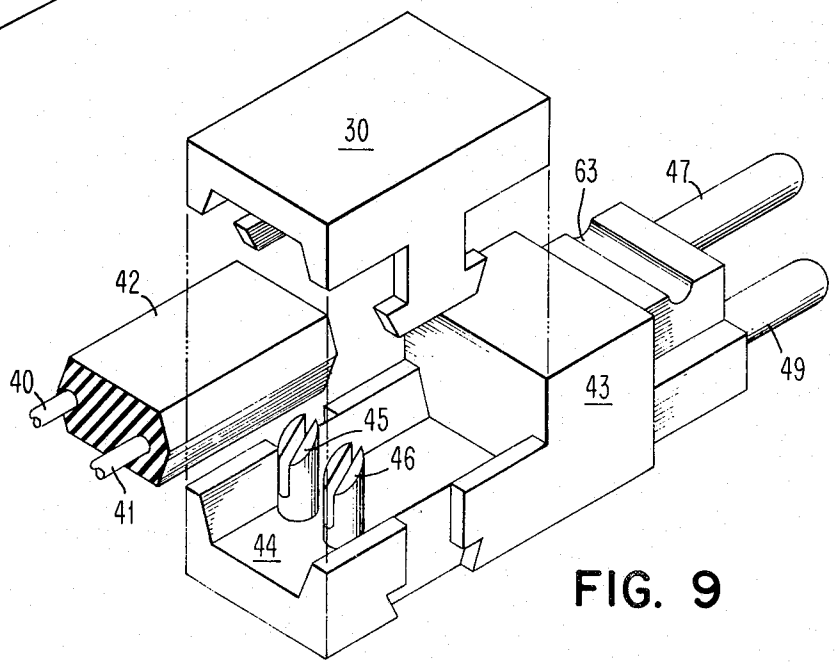


FIG. 9

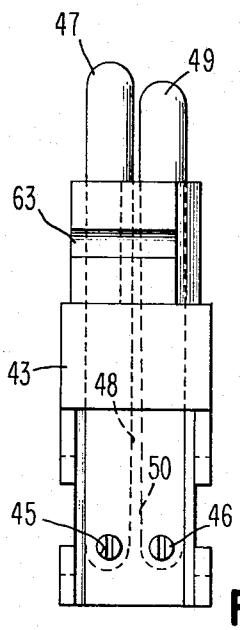


FIG. 10

ELECTRICAL CABLE CONNECTING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to disengageable electrical connector plug assemblies for connecting the cable conductors with other electrical terminal means of a panel board, printed circuit board or the like.

2. Description of the Prior Art

A variety of connectors have been either used or proposed for connecting cables to the panel boards of a data processing system; but a lack of reliability, versatility, economy and ruggedness is a common failing. Modern electronic technology has created new needs in wiring techniques. With the advent of microminiaturization of printed circuit technology, there is a need for a cable connecting assembly which is readily attachable and detachable and adaptable for nesting or ganging to accommodate a plurality of cable connections with a printed circuit board or the like.

Flat cables comprising a plurality of small diameter round wire conductors arranged in spaced parallel side-by-side relation within a flat plastic or insulating strip have many advantages not afforded by single or multiple conductor wires or cables of the conventional constructions. Flat cables of this character under consideration are particularly adapted for use in electronics and data processing systems.

In the prior art, U.S. Pat. No. 3,012,219 discloses a solderless connector for individual insulated small wires wherein no preliminary stripping of insulation is required. The connector penetrates and displaces the insulative covering during application and makes a positive metal-to-metal connection. U.S. Pat. No. 3,189,863 discloses multiple contact connectors for application to multiple conductor insulated cables consisting of a plurality of parallel side-by-side mutually insulated small-diameter copper wires. Means are provided for making electrical contact with the conductors of flat cable without any previous removal of insulation from the cable or conductors. U.S. Pat. No. 3,235,833 discloses another type of improved electrical connector assemblies adapted for use with flat cable.

SUMMARY OF THE INVENTION

The electrical connecting device of the present invention overcomes certain well-known disadvantages of prior constructions such as the utilization of excessive space, labor costs involved in wire stripping, and requirements of individual wire handling to accomplish the connecting of a plurality of wires, and includes the features and advantages of providing a good disengageable electrical connector assembly enabling the quick connecting and disconnecting of wires of a cable with other terminal means of a printed circuit board or the like.

Briefly, the electrical connecting device comprises a molded plastic connector housing including a pair of overlying quadrilateral extensions at one end thereof and with a male type metal pin protruding from each of the quadrilateral extensions. The opposite end portion of the molded connector housing defines an electrical cable-receiving channel in which is mounted a set of insulation strippers, each insulation stripper including a cylindrical member having a U-shaped slot therein with the upper portions being tapered to perform a wire insulation piercing and stripping function.

A cable-contacting cap member is adapted to overlie the cable-receiving channel and functionally operates to forceably press the cable into the cable-receiving channel wherein the insulation strippers remove the insulation from the conductive elements of the cable and the conductive elements are forced into the U-shaped slots and make a reliable electrical connection therewith. An actuator grouper member having a plurality of complementary paired quadrilateral apertures therein can be utilized to receive and hold a plurality of the plastic connector housings to enable multiple cable connecting and detaching operations simultaneously.

A feature of the instant device is that it enables a high performance cable wiring system. It is particularly adapted for the printed circuit board art. It facilitates the connection of multi-conductor wire flat cable, tri-lead cable or twin lead cables and the like. It permits a low-cost method of terminating the cables. It provides a low-cost connector housing. The cable terminating means may be latched into an actuator grouper member for retention therein and for concurrent attachment or detachment of a group of cables.

It is a primary object of the invention to provide an improved electrical cable connecting device for connecting conductors of a cable with other terminal means attached to a printed circuit board.

It is a further object of the invention to provide an improved cable connector assembly structure including means for ensuring the precise positioning and connecting of the connector elements within the connector assembly.

It is still a further object of the invention to provide an improved cable connector construction having unique means for removably attaching a plurality of cable connector assemblies with other terminal connecting devices.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded isometric view of an electrical connector plug assembly for terminating the conductor elements of a tri-lead cable in accordance with the invention.

FIG. **2** is a top view of an electrical connector plug housing.

FIG. **3** is an end view of the cable-receiving channel portion of the electrical connector plug housing.

FIG. **4** is a side view of the electrical connector plug housing.

FIG. **5** is an end view showing the quadrilateral extensions of the electrical connector plug housing.

FIG. **6** is a side view of a cap member adapted to overlie the cable-receiving channel portion of the electrical connector plug housing.

FIG. **7** is a top view of the cap member.

FIG. **8** is an end view of the cap member.

FIG. **9** is an exploded isometric view of an electrical connector plug assembly for terminating the conductor elements of a twin-lead cable in accordance with the invention.

FIG. **10** is a top view of the electrical connector plug housing for the twin-lead cable.

FIG. 11 is an isometric view of a composite electrical connector plug assembly showing a single cable connector housing in place in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 and more particularly to FIGS. 1 through 8, there is shown one embodiment in accordance with the present invention, an electrical connector plug assembly for terminating the conductive elements 10, 11 and 12 of a cable 13 and enabling electrical connection with other electrical terminating means. The connector plug assembly of the present invention is adapted to be disengageably mounted with the other terminal means. The connector plug assembly comprises a molded plastic housing 14 having a pair of overlying quadrilateral extensions 15 and 16 protruding from the forward end of the housing 14. The extensions 15 and 16 may be of equal round, square, or rectangular size. Alternatively, the extensions 15 and 16 may be of unequal round, square or rectangular size for the purpose of polarizing the connector plug electrically. In the preferred embodiment, the extension 15 overlies the extension 16 and is arbitrarily offset to one side, as shown more clearly in FIG. 5. The extensions 15 and 16 could be in a horizontal or vertical alignment without departing from the spirit of the invention.

To establish connection with other electrical terminal devices, there is provided male type metal pins 17 and 18 which protrude from extensions 15 and 16, respectively. These pins 17 and 18 may be round, square, rectangular or flat as the need dictates. Actually, the shape of the mating female connector is controlling for the shape to be used for the male pins 17 and 18.

The after end of the connector housing 14 is provided with a longitudinally extending cable-receiving channel 19. The sides 20 and 21 of the channel 19 are tapered inwardly to the bottom and inner portion of the channel 19. In the channel 19 are located three cylindrical members 22, 23 and 24 of metal material, each with the upper end portion being tapered downwardly and having a U-shaped slot 25, 26 and 27 therein, respectively. The members 22, 23 and 24 function as insulation strippers, with the functions and operation being more particularly described later in this description.

The cylindrical members 22, 23 and 24 are electrically and metallically coupled with the pins 17 and 18 as shown in FIGS. 2 and 4 and wherein the outer stripper members 22 and 24 are coupled together and with the round pin 17 by means of the coupling element 38. The center stripper member 23 is coupled with the signal pin 18 by means of the coupling element 39.

A connector assembly of the instant invention is a pluggable electrical connect and disconnect means for connecting tri-lead cables with other electrical terminal devices. The tri-lead cable 13 comprises three dissimilar parallel conductors 10, 11 and 12 in a predetermined side-by-side space relationship, not necessarily symmetrical, and wherein the outer conductors 10 and 12 are of a larger size functioning as ground wires and the center conductor 11 is of a smaller size functioning as the signal conductor. The conductors 10, 11 and 12 are covered with an insulative material 28.

A molded cap member 30 is a part of the electrical connector plug assembly. It is a longitudinal cap adapted to overlie the cable receiving channel 19 of the housing 14. The cap member 30 has a recess 31 with inwardly tapered sides 32 and 33. A pair of inverted T shaped projections 34 and 35 depend inwardly from the cap member 30 sides.

During an assembly operation for the connector plug an end of cable 13 is placed above the cable-receiving channel 19. The cap member 30 is positioned over the cable end and above the cable-receiving channel 19. The cap member 30 is manually and forceably urged downwardly until its sides contact the connector housing 14 during which operation the insulation material 28 in contact with the cylindrical members 22, 23 and 24 will be pierced and removed from the conductive elements 10, 11 and 12 in the area of contact. The elements 10, 11 and 12 will be forceably urged into the slots 25, 26 and 27, respectively. The sides of the cylindrical members 22, 23 and 24 formed by the U-shaped slots 25, 26 and 27 therein will yield sufficiently to permit the conductive elements 10, 11 and 12 to enter the slots 25, 26 and 27, respectively. Consequently, each of the cylindrical members 25, 26 and 27 will make a firm or positive metal-to-metal contact with its related conductive element.

The cap member 30 being of plastic material provides the "T" shaped projections 34 and 35 with some resiliency wherein they can be moved to the sides of the connector housing 14 during an assembly operation and until the cap member 30 is fully seated whereupon the inverted T-shaped projections 34 and 35 will snap into and latch in the correspondingly shaped slots 36 and 37 in the connector housing 14. This action serves to lock the cap member 30 and cable 13 in position. As a result, an electrical connector plug is assembled to a tri-lead cable and can be readily and easily connected with other terminal means such as might be associated with a printed circuit terminal board or the like.

A connector plug assembly of the instant invention is also adaptable to provide an electrical connect and disconnect means for connecting twin-lead cables comprising a signal and ground conductors with a printed circuit panel board. Referring to FIGS. 9 and 10, there is shown in accordance with the present invention, an embodiment of an electrical connector plug assembly for terminating the conductive elements 40 and 41 of a twin-lead cable 42. In the twin-lead connector plug housing 43 the cable receiving channel 44 is shown to include two cylindrical insulation stripper members 45 and 46 which are identical in structure with the previously disclosed stripper members 22, 23 and 24. The cylindrical member 45 is coupled to the ground pin 47 by means of the coupling element 48 and the stripper member 46 is coupled to the signal pin 49 by means of the coupling element 50. As the result of such electrical connector plug assembly, a twin-lead cable can be readily and easily connected with other terminal means such as the terminal devices associated with a printed circuit terminal board or the like.

Referring now to FIG. 11, there is shown a composite electrical connector plug assembly, according to the present invention, wherein a plurality of individual connector plug assemblies such as is shown in FIGS. 1 and 9 can be releasably or detachably inserted into appropriate apertures in an actuator grouper member 60. The actuator grouper member 60 is a molded plastic material having a lattice like structure including a plurality of paired quadrilateral apertures 61 therein. The

apertures **61** are postioned in an overlying manner and designed to be mateable with the connector plug extensions **15** and **16,** respectively. Accordingly, the paired apertures **61** must have the same shape as the mating extensions **15** and **16** but are slightly larger in size in order to receive the connector plug extensions **15** and **16.** It can be pointed out that one of the paired apertures may be larger in size than the other aperture **61** in order to provide desired electrical polarity characteristics.

The actuator grouper member **60** and the connector housings **14** or **43** may additionally include methods for maintaining the housings within the apertures of the grouper members **60.** In the preferred showings of FIGS. **1, 9** and **11,** in the actuator grouper member **60,** one of each of the paired quadrilateral apertures **61** has been provided with a transverse boss **62** while an extension of the connector housing **14** or **43** has been provided with a mateable transverse indentation **63.** The mating boss **62** and indentation **63** function to retain the housing **14** or **43** within the apertures **61** in the actuator grouper member **60** after being inserted therein. Other detenting or retaining arrangements are conceivable without departing from the spirit of the invention.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

We claim:

1. An electrical connector plug assembly for terminating the conductor elements of a cable and enabling electrical connection with other electrical terminal means, the assembly comprising:

a. a molded plastic connector housing including a pair of overlying transversely offset quadrilateral extensions at one end thereof and provided with T-shaped cap retaining slots therein,

b. a pair of male type metal pins projecting from the pair of overlying transversely offset quardilateral extensions of said connector housing,

c. the other end portion of said connector housing defining a channel for receiving an electrical cable therein,

d. a set of insulation strippers mounted in the channel of said connector housing comprising three stripper elements adapted to accommodate a tri-lead cable in which a center conductor functions as a signal conductor and is flanked by two outer conductors which function as the ground conductors, each insulation stripper including a cylindrical member having a U-shaped slot therein with the upper portions being tapered to perform a wire insulation piercing and stripping function and make electrical contact with a respective conductor element when disposed therebetween,

e. conductive means electrically coupling each metal pin with a respective one of the insulation strippers wherein the center conductor stripper couples with a signal projecting pin and the outer conductor strippers are coupled with a ground projecting pin, and

f. a cable-contacting cap member adapted to overlie the cable and channel and to forceably press the cable into the channel thereby to cause the insulation strippers to remove the insulation from the conductor elements of the cable and cause the conductor elements to enter into the U-shaped slots and make electrical contact with the strippers, said cable-contacting cap member is provided with T-shaped cap retaining projections adapted to cooperate with the T-shaped cap retaining slots in the connector housing for securing the cap to the housing.

2. An electrical connector plug assembly as defined in claim **1** wherein the overlying quadrilateral extensions are of such configuration as to be adapted to be pluggably connected into a respective one of a plurality of lattice-like apertures in an acutator grouper member.

3. An electrical connector plug assembly as defined in claim **2** wherein one of the quarilateral extensions of each connector housing is provided with a retainer means for maintaining said connector housing in locked position within said acutator grouper member.

4. An electrical connector plug assembly as defined in claim **2** wherein one of the quadrilateral extensions of each connector housing and the related quadrilateral apertures in the actuator grouper member are provided with cooperating retainer means for maintaining said connector housings in a releaseably locked position within said actuator grouper member.

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